Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 02 41 99 - Demolition for Minor Works.

.2 Section 04 05 00 - Common Work Results for Masonry.

.3 Section 06 10 00 - Rough Carpentry.

.4 Section 06 15 00 - Wood Decking.

.5 Section 07 26 00 - Vapour Retarders.

.6 Section 07 62 00 - Sheet Metal Flashing and Trim.

.7 Section 07 92 00 - Joints Sealants.

.8 Section 26 41 13 - Lightning Protection for Structures.

.9 Section 26 41 13.01 - Early Streamer Emission Lightning Protection System.

1.2 REFERENCES

.1 ASTM International

.1 ASTM A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

.2 ASTM A606/606M, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.

.3 ASTM A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM B32, Standard Specification for Solder Metal.

.5 ASTM B370, Standard Specification for Copper Sheet and Strip for Building Construction.

.6 ASTM D523, Standard Test Method for Specular Gloss.

.7 ASTM D822, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-51.32, Sheathing, Membrane, Breather Type.

.3 Department of Justice Canada

.1 Canadian Environmental Protection Act (CEPA), 1999.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Research Council Canada (NRC)/Institute for Research in Construction (IRC) - Canadian Construction Materials Centre (CCMC)

.1 CCMC-2015, Registry of Product Evaluations.

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act (TDGA), 1992.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Proof of manufacturer's CCMC listing and listing number.

.3 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

.3 Shop Drawings:

.1 Shop drawings are not required. However, the Contractor will have to conduct a pre-installation meeting one month prior to commencing work of this Section, in presence of the sheet metal roofer supervisor and the Departmental Representative, to:

.1 The heritage context of the project.

.2 Verify project requirements, including mock-up requirements.

.3 Verify substrate conditions.

.4 Co-ordinate products, installation methods and techniques.

.5 Sequence work of related sections.

.6 Co-ordinate with other building subtrades.

.7 Review manufacturer's installation instructions.

.4 Samples:

.1 Submit duplicate 300 x 300 mm samples of each sheet metal material.

.2 Submit one sample of snow guards.

1.4 QUALITY ASSURANCE

.1 Mock-ups:

.1 Submit mock-ups in accordance with Section 01 45 00 - Quality Control.

.2 Prepare surface mock-ups of roofing and roofing components, from existing decking to sheet metal, 2440 mm x 2440 mm using materials and methods planned for the roofing to be installed; these surface mock-ups will have to show the following typical assemblies:

.1 Lower portion of the roof, including the eave, a section of type 1 gutter, with all brackets, straps, reinforcing planks, as well as a full-height downspout with hangers;

.2 Lower portion of the roof, including the eave and a section of type 2 gutter;

.3 Higher portion of the roof, including ridge and hips;

.4 Base of chimney stalk (minimum one short face and one long face), including junction with the ridge;

.5 Valley, including junctions with existing roofing kept-in-place;

.6 Edges of a roof hatch and sheet metal on roof hatch cover;

.7 Fans, including junctions with adjacent sheet metal pans;

.8 Vent cap, including junctions with adjacent sheet metal pans;

.9 Type 3 gutter (on a minimum length of 2440 mm), including all brackets and straps.

.10 Complete covering of a chimney stalk coping, including all junctions with smoke shafts and chimney pots.

.3 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application.

.4 Locate where directed.

.5 Allow 48hours for inspection of mock-up by Departmental Representative before proceeding with sheet metal flashing work.

.6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

.7 Approved mock-up may remain as part of finished Work.

1.5 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 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

.4 Packaging Waste Management: remove in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.6 WARRANTY

.1 For Work in this Section 07 61 00 - Sheet Metal Roofing, the 5 years warranty **period is extended to 10 years**.

Part 2 Products

2.1 SHEET METAL MATERIALS

.1 Copper sheet: to ASTM B370, H00 temper designation, 2% yield strength for roofing.

.1 Minimum weight of 20 oz./sq. ft., 0.68 mm thick for general roofing surface, flashings, counter flashings, valleys, eaves, fans, vent cap and others. Metal sheets: 762 x 2440 mm maximum.

.2 Plain stainless steel sheet (water will flow on the copper roofing below): to ASTM A240/A240M, Type 316L (austenitic) with matte finish (two faces), of the following minimal thickness of:

.1 0.50 mm for covering the chimney stalk copings.

.2 1.0 mm for the sleeves holding the chimney pots to the concrete copings.

.3 Metal sheets: 1000 x 2000 mm.

2.2 ACCESSORIES

.1 Battens: white pine, clear of knots, NLGA grade "B and BETTER", cut in a triangular profile, dimensions as indicated on plan.

.2 Ridges and hips: white pine, clear of knots, NLGA grade "B and BETTER", cut in a triangular profile, dimensions as indicated on plan.

.3 Isolation coating: alkali resistant bituminous paint.

.4 Underlay: self-adhering membrane for high temperature applications composed of two waterproof materials (a high density, cross laminated polyethylene film coated on one side with a layer of butyl rubber adhesive). Refer to 07 26 00 - Vapour Retarders.

.5 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer. See Section 07 92 00 - Joint Sealants for caulking.

.6 Primer: compatible with sealant and adhering to copper.

.7 Cleats: of same material, and temper as sheet metal: 50 mm minimum wide.

.1 Thickness same as sheet metal being secured.

.8 Neoprene: in self-adhesive strips of width and length required x minimum thickness of 1.5 mm.

.9 Fasteners: Fasteners: concealed throughout except where copper sheet is secured to masonry or impossible to use cleats or welds.

.10 Washers: of same material as sheet metal, 1 mm thick with rubber packings.

.11 Hangers for downspouts: cast stainless steel.

.12 Snow guards: copper, fan-shaped, with pre-drilled rectangular base for fastening with a minimum of two stainless steel screws of a minimum length of 62.5 mm.

.13 Bug screen: CUI-36 copper, 18 x 14 x .011.

.14 Blind rivets: copper, with backing washer, appropriate length and 4.0 minimum diameter.

.15 Rivets: peening copper, rod 4.0 mm diameter minimum x appropriate length, 12 mm penetration minimum.

.16 Nails: copper, flat head, appropriate length.

.17 Screws: No. 8 copper, appropriate length.

.18 Lead shims: for masonry joints.

.19 Solder (copper): to ASTM B32, alloy composition 50% tin / 50 % lead.

.20 Solder (stainless steel): to ASTM B32, alloy composition over 95 % tin / less than 5% silver.

.21 Flux: rosin, cut muriatic acid, or commercial preparation suitable for materials to be soldered.

.22 Reinforcing planks to support gutters: mahogany left natural, in accordance with dimensions indicated on architectural drawings. Refer to Section 06 10 00 - Carpentry.

.23 Separation net between the reinforcing planks and the copper gutters: high density polyethylene resin, having the following properties:

.1 Thickness (ASTM D 5199): 220±20 mil.

.2 Carbon black (ASTM D 4218) : 2 à 3 %.

.3 Tensile strength (ASTM D 5035): 45 lb/po minimum.

.4 Melt flow (ASTM D 1238): 1 g/10 min. maximum.

.5 Density (ASTM D 1505): 0.94 g/cm^3 minimum.

.6 Transmissivity (ASTM D 4716): 2x10^{-3} m^2/sec.

2.3 FABRICATION

.1 Form individual pieces in 2400 mm maximum lengths. Make allowances for expansion at joints.

.2 Hem exposed edges on underside 12 mm, mitre and seal.

.3 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.4 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

.5 Protect stainless steel against oxidization by backpainting with isolation coating where indicated.

.6 Tin edges of copper sheets to be soldered for width of 40 mm both sides with solder.

2.4 SHOP FABRICATION

.1 Shop fabricate components according to plans for each ornamental copper component.

.2 Fabricate each component to prevent water infiltration on site.

.3 Design components to enable assembly on site without exposed cleats or fasteners.

.4 Make allowances for expansion at joints.

.5 Form sections square, true and accurate to size, free form distortion and other defects detrimental to appearance or performance.

.6 Apply minimum 0.2 mm dry film thickness coat of plastic cement to both faces of dissimilar metals in contact.

.7 Protect stainless steel sheets against oxidation with protective coating applied to the back, as indicated.

.8 Tin edges of copper sheets to be soldered for width of 40 mm both sides with solder.

.9 Protect components from damage until installation on site.

Part 3 Execution

3.1 WORKING DOCUMENTS

.1 Prior to construction, check all documents relevant to installation of sheet metal and adjacent elements to build.

.2 Coordinate sheet metal work with adjacent work.

.3 Refer to demolition documents to locate roof elements to remove and reproduce. Take necessary measures and photograph roof elements to reproduce.

.4 Refer to plans for bending, fastening and forming metal sheets.

3.2 PROHIBITED COMPONENTS

.1 Use of cedar or treated wood is prohibited for use on copper surfaces, even if separating film is used between wood and copper.

.2 Fasteners and materials not compatible with copper, for metal on metal installations: zinc, aluminum, galvanized steel and untreated steel.

3.3 EXAMINATION

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

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.4 INSTALLATION

.1 Use concealed fastenings except where approved in writing by Departmental Representative before installation.

.2 Include underlay for high temperatures applications under sheet metal roofing and components (ex.: roof hatches), vertical planes (ex.: base of chimney stalks) and others (ex.: coping of chimney stalks).

.1 Secure in place and lap joints in accordance with the manufacturer's recommendations.

.3 During progression of roof work, install wood components to receive copper, including battens, hips, ridges, frames, and other.

.4 Make sure that the repairs to the existing roof penetrations and cutting new openings for fans and all other roof component related to the attic have been executed as indicated on the architectural drawings, prior to the installation of the metal sheets or according to work progress.

.5 Before installing battens, pans or metal sheets, install metal anchor sheet at eaves and valleys, with dimensions as indicated on the architectural drawings; use these anchor sheets to create a 10 mm space to allow for movement due to temperature variations.

.6 Install battens with copper screws of adequate length (do not penetrate back of decking) fastened at 300 mm maximum.

.7 Install sheet metal roof panels using cleats spaced at 660 mm maximum on centre, as indicated on the architectural drawings. In some locations, spacing may be shorter in order to create a vertical riser at the edge of a wall or a downward fold at lateral edges.

.8 Install sheet metal roofing using cleats of adequate dimensions (50 mm wide x 75 mm long minimum) and spaced at a maximum of 300 mm on centre, as indicated on the architectural drawings.

.9 Secure cleats with 2 fasteners (copper nails) each and cover with cleat tabs.

.10 Stagger transverse seams in adjacent panels at mid length of sheets.

.11 Flash roof penetrations with material matching roof panels, and make watertight with continuous soldering. For batten roofs, use copper sheets of a minimum weight of 20 oz/sq. ft.), 0.68 mm thick. Transverse seams may be prefabricated or fabricated on site, and sealed on site.

.12 Form seams in direction of water-flow and make watertight.

.13 Soldering

.1 Clean and flux metals before soldering.

.2 Perform soldering with well heated coppers, heat seam thoroughly and sweat solder through its full width.

.3 Follow sheet metal manufacturer's recommendations for soldering procedures.

.4 As work progresses, neutralize excess flux with 5% to 10% washing soda solution, and thoroughly rinse. Leave work clean and free of stains.

.14 Lightning Protection

.1 Install lightning rods and conductive cables with the required clips, in accordance with Section 26 41 13- Lightning Protection for Structures.

.2 Conceal mechanical fasteners (screws) and their junction with the roofing by covering with solder.

.15 To prevent buckling of metal sheets and displacement of clips, allow for movement due to temperature variations (10 mm at transverse seams and edges, 5 mm at batten edges, hips and ridges, and 10 mm at valleys and flashing).

3.5 BATTEN SEAM ROOFING

« Main roof surface »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Use 20 oz/sq. ft. copper, 0.68 mm thick and 2440 mm long sheets to make batten seam roofing.

.3 Fasten the wood battens, cut to a triangular profile, with copper screws spaced at 300 mm on centre maximum (no screw closer to 150 mm from the batten's ends), of adequate length not to protrude at the back of the decking.

.1 Install to allow a 5 mm movement on each side of the battens.

.2 Along the battens, install copper cleats, 50 mm wide x required length to perform the following bending (required width to fasten cleat to decking, including the bend to cover the nail heads and the bend at the top of the batten to clip the two pans).

.3 Fasten cleats with two copper nails, with a maximum spacing between cleats of 300 mm.

.4 Prior to locking seams, seal all seams with sealing compound, as indicated on the architectural drawings. Refer also to Section 07 92 00 - Joint Sealants.

.5 Form with metal sheets a pan of the same width as the space between two battens. Turn the edges of the sheet to the right of the batten to extend 15 mm above top of the batten. Turn the edges of the sheet to the left of the batten to extend 30 mm above the top of the batten

.1 Pinch back together the edge of the sheet to the left and the ends of the cleats 15 mm around the edge of the sheet to the right.

.2 Then bend together 15 mm to lock the seam flat onto the batten.

.6 For transverse seams, fold back the lower edge of each sheet 19 mm, and fold up the upper edge 19 mm.

.1 Lock together the 19 mm fold at the bottom of each sheet into the 19 mm fold at the top of the last sheet to be installed.

.7 Install the metal sheets of the roofing on top of the anchor sheets (eaves flashing), starting at the eaves.

.8 Lock sheets to 20 oz/sq. ft. cooper eaves flashing Extend eaves flashing 150 mm under the roofing sheets and fasten with nails spaced 100 mm on centre, 25 mm from upper edge. Extend eaves flashing down into the gutters, as indicated on the architectural drawings.

3.6 RIDGE AND HIPS

« Meeting line between two roof slopes, at their highest elevation, and meeting line shaped as a ridge but between two slopes of a hip roof »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Prior to the installation of the ridge and hips wood components, notch the sides of planks following the spacing of the battens, centre to centre, on the required depth.

.4 Cover ridge and hips wood components with copper sheets in accordance with indications on the architectural drawings.

.5 Fit the battens into the notches made into the planks forming the ridge and hips.

3.7 EDGES

« Meeting line between roofing and chimney stalks »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Install the wall edges against a plywood panel, in accordance with indications on the architectural drawings.

.4 Lock the flashing, of a minimum weight of 20 oz/sq. ft. and minimum height of 200 mm, at the top with a continuous copper cleat, fastened at 300 mm on centre.

.5 Lock the lower edge of the counter-flashing to a continuous soldered copper cleat, and secure the upper edge with 25 mm wide lead wedges, spaced at 100 mm on centre. On a joint backing rod (compressible), finish the joint into the masonry with a sealant compound recommended by the copper sheet manufacturer, clean surfaces and apply primer on copper counter-flashing (if required).

3.8 VALLEYS

« Meeting line shaped as a depression between two roof slopes »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Shape valleys using sheets of a maximum length of 3000 mm and width of 915 mm. Form staggered seams on 150 mm in the direction of water runoff. These seams must be entirely soldered.

.1 Extend valley sheets on a minimum width of 150 mm under the roofing sheets.

.2 Along the valley axis, form a double lock seam in the valley and roofing sheets.

.3 Lock with 50 mm wide and 75 mm long cleats all seams of valley sheets parallel to the valley, all seams of roofing sheets and all valley transverse seams.

.4 Always shape seams between valley sheets to maintain a sufficient 10 mm space allowing for movement following seasonal temperature variations.

3.9 GUTTERS AND DONSPOUTS

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Roll the outside edge of the gutters on a copper rod to shape a lip of an approximate diameter of 25 mm.

.4 Gutters will be 140 mm wide with a 190 mm high back side and a 150 mm high front side.

.5 Use sheets 3000 mm long to make gutter sections.

.6 Longitudinal seams are forbidden.

.7 Gutters will be placed on reinforcing mahogany planks, but separated from the planks with a high density polyethylene resin net.

.8 Place the back side of the gutter behind the portion of the eaves flashing descending into the gutter, and fasten together with rivets spaced 1200 mm maximum on centre.

.9 Install the male sleeves, cut into flanges fastened to the bottom of the gutter with waterproof blind rivets and full surface soldering, with a 95 mm diameter and 200 mm length.

.10 Install the 100 mm diameter downspouts, fasten to gutter sleeves, shape the downspouts in order for the seam to face the wall, attach downspouts with cast stainless steel hangers, 125 mm long minimum and with a section of 6.4 x 6.4 mm, isolated from the downspout with a neoprene strip. Install hangers at 1200 mm maximum on centre.

.11 Shape downspouts with all the required elbows and leaders to carry water from the gutters down to 100 mm above finished ground level.

.12 Fabricate and install the perforated and removable protection grilles (leaf guards) in accordance with indications on the architectural drawings.

3.10 FANS

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Shape the new fans in accordance with indications on the architectural drawings.

3.11 PLUMBING VENT CAPS (folded and fully soldered seams)

« Exterior cover of gaz and air vent pipes »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Cooper sheets used for this work must have a minimum weight of 20 oz/sq. ft.

.3 Shape each vent pipe cover sleeves with one copper sheet coiled in the shape of a cylinder, the end cap of the cylinder must be finished with flat seams and a continuous solder, shape the sleeve with a diameter 25 mm wider than the plumbing vent pipe. Following measurement of the vent pipe and roof slope angle, cut the base of the cylinder, which must be 50 mm longer than the cylinder itself, into 19 mm wide flanges and bend to match the roof slope angle.

.4 Shape a base plate (or apron) by cutting a central opening having the same diameter as the cylinder, fasten together with waterproof blind rivets and solder the entire perimeter of the cylinder to the apron.

.5 Shape a continuous 150 mm collar (or cap), free from open angles, to cover the top end of the plumbing vent pipe and the sleeve, in accordance with indications on the architectural drawings

.5 The vent caps (collar, sleeve and apron) must be installed at a transverse seam between two roofing sheets, the upper half under the upstream roofing sheet and the lower half above the downstream roofing sheet.

3.12 SNOW GUARDS

« Component forming an obstacle and attached to roof to prevent snow and ice from sliding easily »

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 Use cast copper snow guards, fan shaped, with a pre-drilled rectangular base for fastening with stainless steel screws.

.3 Noyer les percements dans la couverture à l'aide de scellant, souder le dessus des vis à la base des arrêts de neige, souder et le pourtour de la base des arrêts de neige à la couverture pour assurer l'étanchéité.

.4 Fill in the holes made into the roofing with sealant compound, screw snow guards to the roof, solder the top of the screws to the base of the snow guards, and solder the entire snow guards' base perimeter to the roof to ensure waterproofing.

.4 Install the snow guards at the designated location (portion of the eastern roof slope only), in accordance with the pattern indicated on the architectural drawings.

3.13 COPING CLADDING OF THE CHIMNEY STALKS

.1 Follow the general instructions provided in item 3.4 INSTALLATION of this section.

.2 The stainless steel sheets used for this work will have to be Type 316L (austenitic), mate finish (two faces), and 0.50 mm thick.

.3 Prior to installation, inspect the chimney stalks' copings to make sure that the wood backing is securely fastened, that the membrane is waterproof, and that drainage slopes are sufficient on all horizontal surfaces,

.4 Consult plans to confirm the location of the only smoke shaft still in use.

.5 Install metal sheets by locking cleats into seams and flattening surfaces in the direction of water runoff. Fully solder all seams.

3.14 FINISH

.1 Let copper roof weather through 2 heavy rains minimum after final cleaning.

.2 Rub exposed surfaces with clean rags soaked in boiled linseed oil until desirable shade of brown is obtained.

.3 Touch up solder with copper bronze.

3.15 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

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

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

.3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal

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

3.16 PROTECTION

.1 Protect installed products and components from damage during construction.

.2 Repair damage to adjacent materials caused by sheet metal roofing installation.

END OF SECTION