



PURCHASING SECTION
13450 – 104 Avenue, Surrey BC V3T 1V8
Tel: 604-590-7274
E-mail: purchasing@surrey.ca
ADDENDUM #4

REQUEST FOR QUOTATIONS (RFQ) NO.: 1220-040-2016-096
TITLE: MECHANICAL ROOM ADDITION AND GALLERY
HVAC UPGRADE – SURREY ARTS CENTRE
ADDENDUM ISSUE DATE: October 11, 2016
REVISED CLOSING DATE: prefer to receive Quotations on or before:
Wednesday, October 12, 2016

INFORMATION FOR CONTRACTORS

This Addendum is issued to provide additional information to the RFQ for the above named project, to the extent referenced and shall become a part thereof. No consideration will be allowed for extras due to the Contractor not being familiar with this Addendum. This Addendum No. 4 contains 13 pages in total.

MECHANICAL SPECIFICATIONS:

Metal Ductwork Specifications dated October 11, 2016 by The AME Consulting Group Ltd. is hereby added to the detailed scope of work as listed in Schedule B – Appendix 2 – Supplementary Specifications (Project). Refer to Attachment #1 of this Addendum #4 for the Metal Ductwork Specifications.

QUESTIONS AND ANSWERS:

Q1: I see that on drawing M- 401 detail 2 there is a service platform shown in the mechanical drawings but there is no indication of this in the structural drawings showing the specific requirements, such as load ratings and attachments details and so on. Can you provide any clarification in respect to this?

A1: The structural platform was indicated as a future allowance and not to be part of this project. As such, there will not be structural allowances as part of the Quotation for this platform.

END OF ADDENDUM #4

All Addenda will become part of the RFQ Documents.



ATTACHMENT #1

to

ADDENDUM #4

METAL DUCTWORK SPECIFICATIONS

1. GENERAL

1.1 Summary

- .1 Section Includes:
 - .1 Materials and installation of low-pressure and high pressure metallic ductwork, joints and accessories.
 - .2 Specialty exhaust systems including: Kitchen Exhaust (grease hood, condensate hood), welding exhaust, dust collection exhaust.
- .2 Related Sections:
 - .1 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 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 90B-02, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
 - .3 NFPA 91, Standard for Exhaust Systems for Air Conveying of Vapors, Mists, and Non-combustible Particulate Solids.
 - .4 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.

1.3 Submittals

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 35 43 - Hazardous Materials for the following:
 - .1 Sealants.
 - .2 Tape.

.3 Proprietary Joints

1.4 Delivery, Storage and Handling

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store all ductwork elevated off the ground and covered to prevent moisture & dirt migration. Ductwork MUST be protected at all times.
- .3 Shield ductwork from dust and construction material during construction. Clean any ductwork found to be dirty at no extra cost to the Contract.
- .4 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 47 19 - Construction Waste Management and Disposal.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.5 General

- .1 Duct sizes on drawings indicate clear inside dimensions and acoustically lined or internally insulated ducts must maintain inside duct dimensions.
- .2 Proper sized openings shall be arranged for in the correct locations through all slabs and walls. Openings shall be planned to include for the installation of fire dampers at all rated fire separations.
- .3 Where ducts penetrate roofs, provide roof curbs with flashing and counterflashing.
- .4 The project drawings are diagrammatic and although efforts have been made to provide information regarding the number of offsets and transitions, not all are necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. All required adjustments shall be established when coordinating and field measuring the work prior to fabrication and must be provided as part of the contract and all associated costs must be considered and included.
- .5 Ductwork used on this project shall be clean and free from scale, corrosion and deposits. All ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation. (Refer to LEED Requirements)
- .6 All ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.
- .7 Where welded ductwork is indicated, the welding shall be continuous. Tack welding is unacceptable except as specifically noted. Paint damaged areas with zinc coating after welding.
- .8 In exposed ductwork installations, the contractor shall have a consistent ductwork fabrication methodology. Longitudinal seam ducts shall not be intermixed with spiral seamed ductwork. Slip joint seams shall not be intermixed with flanged type seams where practical. Shop drawing submittals shall also indicate the duct fabrication type - spiral seam versus longitudinal seam, and duct joining method etc.
- .9 The contractor shall allow for the design, supply, and installation of all transition fittings required to connect ductwork to all mechanical equipment (both inlet and outlet connections). Where feasible, the fittings shall be fabricated per SMACNA standards in terms of maximum angles of convergence and divergence. Flexible connections shall be provided for all equipment / duct connections.

2. PRODUCTS

2.1 Seal Classification

- .1 Seal classification:
 - .1 Class C: transverse joints and connections made air tight with gaskets or sealant or combination thereof.

2.2 Sealant

- .1 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 HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition [1995] and Addendum No. 1, [1997].
- .2 RADIUSSED ELBOWS:
 - .1 Rectangular: standard radius with single thickness turning vanes Centreline radius: 1.5 times width of duct.
 - .2 Round: smooth radius 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 and 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 Short radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.

2.6 Fire Stopping

- .1 Retaining angles around duct, on both sides of fire separation in accordance with Section 23 33 16 – Dampers: Fire and Smoke.

- .2 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 construction.

2.8 Ductwork - Aluminum

- .1 The following ductwork shall be fabricated from aluminum:
 - .1 Exhaust ductwork from showers/baths, to the extent noted on the drawings.
 - .2 Discharge ductwork through the roof, where noted on the drawings.
- .2 Low Pressure Aluminum ductwork shall be constructed in accordance with Clause 2.2 "Ductwork - 500 Pa [2"] Static Pressure".
- .3 For round and rectangular aluminum ductwork, use four gauges heavier than that scheduled in Table 1-5 or Tables 1-14, 1-15, 1-16 of the SMACNA Duct Standards for galvanized ductwork.
- .4 Aluminum shall be utility grade.
- .5 Support aluminum ductwork using aluminum straps, cadmium plated threaded rods, aluminum flat bar or aluminum angle hangers. Support shall be similar to that specified for galvanized iron ductwork.

2.9 Hangers and Supports

- .1 Hangers and Supports: in accordance with Section 23 05 29 - 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 mm.
 - .2 Hanger configuration: to SMACNA.
 - .3 Hangers: galvanized steel angle with galvanized steel rods to SMACNA per the following table:

| Duct Size (mm) | Angle Size (mm) | Rod Size (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.

2.10 Ductwork and Plenum Pressures

- .1 Provide ductwork and plenums fabricated from galvanized steel for the static pressure categories listed below.

- .1 2500 Pa [10" W.G.] static pressure.
 - .1 Built-up supply air plenums between inlet automatic control dampers and discharge automatic control dampers:
- .2 1500 Pa [6" W.G.] static pressure.
 - .1 Stair, vestibule and elevator pressurization ducts.
 - .2 Smoke evacuation ducts.
 - .3 Supply ductwork and plenums downstream from the discharge automatic control dampers listed below, up to the furthest smoke/fire dampers at the ends of supply duct risers (emerging from duct shafts) or to supply duct smoke dampers, in the walls of mechanical rooms.
- .3 1000 Pa [4" W.G.] static pressure.
 - .1 All supply air ductwork downstream from supply air handling units discharge, to the upstream side of mixing boxes/air valves.
 - .2 All exhaust and return air ductwork downstream from return/exhaust air valves to the return/exhaust fans and downstream from the return/exhaust fans to the air handling units and/or outdoor relief.
 - .3 All outdoor intake plenums in mechanical room(s).
- .4 500 Pa [2" W.G.] static pressure
 - .1 All supply ductwork downstream from mixing boxes/air valves to terminal air outlets.
 - .2 All supply ductwork and plenums on systems without mixing boxes/air valves.
 - .3 All return air ductwork and plenums, except where otherwise specified.
 - .4 All exhaust and relief air ductwork and plenums, except where otherwise specified (welding/sawdust exhaust).
 - .5 All outdoor air ductwork and plenums, except as otherwise specified.

2.11 Ductwork - 500 Pa [2" W.G.] Static Pressure

- .1 Provide galvanized iron ductwork for system operating pressures 500 Pa [2" W.G.] and less. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times the working static pressure.
- .2 Construct rectangular ductwork in accordance with Section I including Tables 1-5, 1-10, 1-11, 1-12, 1-13 and Figs. 1-4 through 1-18 of the SMACNA Duct Standards.
- .3 Nomasco "Ductmate System, Lockformer TDC " or Exanno "Nexus System" may be used for rectangular duct joints.
- .4 At least two opposite faces of all rectangular ductwork must be joined together using a type of joint, which cannot pull apart.
- .5 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 to 2-11 and Figs. 2-16 to 2-18 of the SMACNA Duct Standards.
- .6 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards, but excluding beaded crimp joints and snaplock seams.
- .7 Construct flat oval ductwork in accordance with Section III including Table 3-4 and Fig. 3-6 of the SMACNA Duct Standards. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.

- .8 Construct round and flat oval duct fittings in accordance with Section III including Table 3-1 and Figs. 3-3 through 3-6 of the SMACNA Duct Standards. Round elbows shall have a centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

2.12 Plenums - 500 Pa [2"] Static Pressure

- .1 Provide galvanized steel low pressure plenums suitable for 500 Pa [2" W.G.] positive or negative pressure, for central plant ventilating and air conditioning equipment.
- .2 Construct plenums in accordance with Section VI including Figs. 6-1 through 6-3 of the SMACNA Duct Standards.
- .3 Where the building structure does not form the bottom surface of a walk-in plenum, fabricate plenum floor panels of 1.78 mm (14 ga.) galvanized steel, with angle iron reinforcing such as to limit deflection of the floor panels to a maximum of 6.4 mm [1/4"] under a concentrated load of 115 kg [250 lbs] at mid span.
- .4 Where plenum floors are internally lined, install a 1.47 mm [16 ga.] thick galvanized steel panel on top of the insulation.
- .5 Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.
- .6 Reinforce all openings in plenum walls with 40 mm x 40 mm x 4.8 mm [1-1/2" x 1-1/2" x 3/16"] angle iron, secured to the main vertical and horizontal reinforcing angles.
- .7 Construct access door and casing around door as per SMACNA, casing access doors, Fig. 6-12. Section C-C with angle iron frame sized to suit plenum wall. Doors constructed of 16 gauge metal.
- .8 Arrange access doors so that they open against the airflow and static pressure.
- .9 Weld all joints on condensate drain pans. Construct the pans from 1.45 mm [16 ga.] thick stainless steel type #302 or #304. Install a minimum of 32 mm [1-1/4"] piping connection, complete with water seal at least 100 mm [4"] deep, from the pan drain connection to the nearest building drain. Install drain connections so that they shall completely drain the pans.
- .10 Seal piping penetrations through plenum walls, with gland seals as detailed in Fig. 6-10 of the SMACNA Duct Standards.
- .11 Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.13 Ductwork - Stainless Steel - Rectangular

- .1 The following ductwork shall be fabricated from stainless steel:
 - .1 All exhaust ducts carrying moisture such as Dishwasher, Washer/Sanitizer. Exhaust duct from unit to the discharge point.
 - .2 Duct sections containing duct mounted humidifiers.
 - .3 Where indicated on the drawings.
- .2 Low pressure stainless steel ductwork shall be suitable for system operating pressures 500 Pa or less.
- .3 Material: 1.14 mm [18 ga.], #304 stainless steel, with No. 2B finish where concealed and No. 4 finish where exposed. (Exposed areas shall include finished occupied areas of the building but not mechanical rooms).
- .4 Do not cross break duct panels. Grade to drain as indicated.

- .5 Weld all longitudinal seams and lateral joints and finish all exposed seams and lateral joints by grinding smooth and buffing to finish of the sheet. Do not penetrate stainless steel with screws, bolts or rivets.
- .6 Provide gasketed companion flange connections where necessary to connect to equipment. Flanged connections shall be made up by slipping a formed 1.8 mm [14 ga.] thick matching stainless steel welded angle frame over the end of the duct, leaving space for continuously welding the frame to the duct on the inside.
- .7 Provide escutcheon trim bands around all duct ceiling penetrations.
- .8 Provide gasketed cleanouts (not smaller than 450 mm x 300 mm [18" x 12"], with formed 1.8 mm [14 ga.] thick matching stainless steel welded angle reinforcing frames, in the side of the ductwork at not more than 6 m [20 ft.] intervals, changes in direction and base of risers. Cleanouts shall be fastened with wing nuts at 150 mm [6"] centres. Cleanouts openings shall terminate not less than 40 mm [1-1/2"] from the bottom of the duct.
- .9 Gaskets shall be 3 mm [1/8"] thick teflon or an approved alternate.
- .10 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] matching stainless steel (No. 4 finish) U-strap hangers on 2.4 m [8 ft.] centres.

2.14 Ductwork - Acoustically Lined

- .1 Where rectangular ductwork is indicated to be acoustically insulated with flexible acoustic duct liner, liner shall be installed in accordance with instructions and Figures 2-22 through 2-25, SMACNA Duct Standards. Duct sizes shown are inside the duct liner.
- .2 Where round ductwork is indicated to be acoustically insulated, it shall consist of two concentric round ducts with 25 mm [1"] thick flexible fibrous glass duct liner between the two ducts. The inner duct shall be perforated and correspond to the duct diameter noted on the drawings. The outer duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.15 Ductwork – Outdoors

- .1 The internally or externally insulated supply, return and exhaust ducts (down stream of heat recovery coils) including silencers, located outdoors on the roof, shall be constructed watertight.
- .2 All joints shall be caulked with a water impervious sealant. TDC clips should be continuous on the top and sides of the ducts.
- .3 The top of the finished product (waterproof membrane) should be pitched to avoid pooling of water.
- .4 After pressure testing, the exterior of the ducts and the duct silencers shall be wrapped with a waterproof membrane. The details of this membrane need to be researched but could be as follows:
 - .1 Membrane consisting of a SBS rubberized asphalt compound, integrally laminated to a reinforced aluminum foil, providing a waterproof membrane. Product similar to Bakor Foilskin.

2.16 Plenum Insulation Covering

- .1 Sheet Metal
 - .1 Provide 0.76 mm [22 ga] galvanized sheet metal covering on acoustically lined plenum walls for a distance of 1.2 m [4 ft] downstream from cooling coils.
- .2 Perforated Metal

- .1 Provide 0.76mm [22ga] thick perforated galvanized sheet metal covering on all acoustically lined plenum walls (except immediately adjacent to down stream side of cooling coils).

2.17 Counter flashings

- .1 Counter flashings - galvanized sheet steel of 0.8 mm [22 gauge] minimum thickness.
- .2 Counter flashings are attached to mechanical equipment and lap the base flashings on the roof curbs.
- .3 All joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.
- .4 Vertical flange section of roof jacks shall be screwed to face of curb.

3. EXECUTION

3.1 General

- .1 Do work SMACNA HVAC Duct Construction Standards.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
 - .1 Insulate strap hangers 100 mm beyond insulated duct.
- .3 Support risers SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.
- .5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining.
- .6 Where a duct contains a fire or smoke damper, construct the duct so that the free area of the duct is maintained through the fire or smoke damper.
- .7 Where a duct is to be internally insulated, enlarge the duct so as not to reduce the duct free area.
- .8 Make the taper of diverging transitions less than 20 deg. and the taper of converging transitions less than 30 deg., in accordance with Fig. 2-9 of the SMACNA Duct Standards. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.
- .9 Make the inside radius of any rectangular duct elbow at least equal to the duct width, measured in the direction of the radius. If space conditions do not permit a full radius elbow to be installed, use square elbows with multi-blade turning vanes.
- .10 Turning vanes shall be single wall type. Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.76 mm [22 ga]. Vanes shall be spaced at 40 mm [1-1/2"] centres and shall turn through 90 deg., with a radius of 50 mm [2"]. Vanes shall not include a straight trailing edge. Refer to Figs. 2-3 and 2-4 of the SMACNA Duct Standards. Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 0.86 mm thick [18 ga].
- .11 For 500 Pa [2"] pressure systems, install tie rods to limit the maximum unsupported vane length to 914 mm [36"]. Refer to Fig. 2-4 of the SMACNA Duct Standards.
- .12 For 750 Pa [3"] and greater pressure systems, install tie rods to limit the maximum unsupported vane length to 460 mm [18"]. Refer to 2-4 of the SMACNA Duct Standards.
- .13 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs as required to suit site conditions.

- .14 Where indicated, install adjustable air turning devices, where full radius take-off fittings cannot be installed, in accordance with Fig. 2-16 of the SMACNA Duct Standards. Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.
- .15 Cross-break or bead all metal duct panels unless otherwise noted.
- .16 Do not cross-break duct panels on 750 Pa [3"] and greater static pressure systems.
- .17 Do not cross-break bottom duct panels when ductwork is handling moisture.
- .18 Roof mounted ducts shall have standing seams and shall be sealed weather tight.
- .19 Grade all ductwork handling moisture, a minimum of 1:120 [1" in 10 ft] back to the source or at low points in the ductwork, provide a 150 mm [6"] deep drain sump and 32 mm [1-1/4"] dia. drain connection with deep seal trap and pipe to drain.
- .20 Construct ductwork handling moisture with three sided bottom sections and a separate top panel. Install the three sided bottom sections and internally seal the transverse joints with CGE Silicone Sealant "Silpruf". Then install the top panels and seal the top panel seams and joints.
- .21 Provide floor drains in outside air and humidifier sections with deep seal traps.
- .22 Provide moisture collection sections inside all louvres for outside air and exhaust air.
- .23 Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork. Install ductwork hangers in accordance with Section IV including Tables 4-1 through 4-3 and Figs. 4-1 through 4-9 of the SMACNA Duct Standards.
- .24 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.
- .25 Prior to the fabrication of ductwork, co-ordinate and field measure all ductwork to ensure a complete installation respecting all other services. Provide all necessary fittings, offsets, and alternate construction methods to facilitate the installation.
- .26 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.
- .27 Arrange access doors so that they open against the airflow and static pressure.
- .28 Provide necessary baffling in manufactured or built-up mixed air plenums to ensure good mixed air temperature with variations of not more than \pm minus 5°C [23°F] under all operating conditions.
- .29 Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound. (U.L.C. approved fire stop sealant is not a requirement). Where ducts are insulated provide a 0.61 mm [24 ga] thick galvanized steel band tightly fitted around insulation and then caulk to band.
- .30 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.
- .31 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.
- .32 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with fibreglass insulation.

- .33 Provide drip pans under piping and shields for protection of electrical panels and equipment.
- .34 Unless noted otherwise, line all builder's shafts and air plenums used as ducts and plenums with sheet metal.

3.2 Hangers

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE as follows:

| Duct Size (mm) | Spacing (mm) |
|-------------------|-----------------|
| to 1500 | 3000 |
| 1501 and over | 2500 |

3.3 Watertight Duct

- .1 Provide watertight duct for:
 - .1 Fresh air intake.
- .2 Form bottom of horizontal duct without longitudinal seams.
 - .1 Seal other joints with duct sealer.

3.4 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 manufacturers recommendations.

3.5 Ductwork Leakage Test

- .1 Leakage test all 750 Pa [3"] and greater static pressure supply ductwork installed under this contract, as recommended in the SMACNA H.V.A.C. Air Duct Leakage Test Manual, 1985 Standards, to a static pressure 500 Pa [2" W.G.] in excess of the specified ductwork design static pressure.
- .2 Use equipment capable of demonstrating leakage.
- .3 Test the first 30 m [100 ft] of installed ductwork in the presence of the Consultant.
- .4 Test a 30m [100ft] section of 500 Pa [2"] static pressure ductwork, where complete systems over 30m [100 ft] long are installed under this contract to a static pressure of 500 Pa [2" W.G.].
- .5 The total allowable leakage for the entire system shall be not greater than [5] percent of the total system capacity.
- .6 Submit test reports for all ducts tested.

3.6 Ductwork and Plenum Cleaning

- .1 All ductwork and equipment installed shall be free of scale, debris and dirt.
- .2 Maintain all duct and equipment openings covered with poly or equivalent to prevent the entry of dirt.
- .3 Clean all plenums and buried supply ductwork with an industrial vacuum cleaner on completion of the duct and plenum installation.

- .4 Install air filters of the specified performance.
- .5 Blow out all supply ductwork, (by means of the supply fan) on completion of the duct and plenum installation and prior to installation of air terminals.
- .6 Ductwork shall be considered clean when all foreign material visible to the naked eye has been removed. A random sampling review by the Consultant will be conducted to check for cleanliness. Any system deemed to require re-cleaning shall be re-cleaned in its entirety.

3.7 Ductwork - Kitchen Exhaust

- .1 Protect ductwork exposed to outside elements by painting or coating with suitable weather/heat resistant material.
- .2 Install a residue trap with cleanout at base of vertical risers and at each trapped point.
- .3 Provide minimum 150 mm [6"] clearance on all sides of kitchen exhaust ductwork in accordance with NFPA 96.
- .4 Where U.L. listed "Ecology Units" are used and where approved by the local authorities, the ductwork from the discharge of the ecology filter unit to the duct discharge to be constructed to high pressure standards. Locate access doors and traps as required for kitchen exhaust ductwork.
- .5 Kitchen grease exhaust ductwork downstream of UV hoods or Ecology units need not be sloped to BCBC or NFPA 96 Standards per code equivalency report (verify with most recent copy of report). All other non-protected by fire suppression sprinklers Kitchen grease exhaust ductwork must be sloped a minimum of 2% (if horizontal run is less than 22 m) or 8% (if horizontal run is over 22 m) and protected by fire sprinklers per NFPA.

END OF SECTION