1. GENERAL

1.01 SECTION INCLUDES

.1 HVAC ducts and casings.

.2 Acoustic duct lining material.

.3 Special systems ductwork.

.4 Dampers.

.5 Louvres.

.6 Other duct work accessories.

1.02 SUBMITTALS

.1 Submit shop drawings/product data sheets for all products specified in this section except shop fabricated ductwork and fittings.

.2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

.3 With shop drawing/product data sheet submission, supply evidence that fire rated duct manufacturer is ULC listed to size requirements shows on drawings.

.4 Submit duct leakage test data prior to ductwork being covered from view.

.5 Submit manufacturer's colour chart(s) for all items for which a finish colour is to be selected.

1.03 CLOSEOUT SUBMITTALS

.1 Submit proper installation certification from fire rated duct manufacturer as specified in Part 3 of this section.

.2 Submit a site inspection and start-up report from fan filter diffuser manufacturer's representative as specified in Part 3 of this section.

1.04 MAINTENANCE MATERIAL SUBMITTALS

.1 Supply and hand to Owner at Substantial Performance of the Work, a minimum of 10 identified (with tags) grille/diffuser volume control damper adjustment keys.

1.05 COORDINATION

.1 Supply reviewed copies of ventilator/curb assembly shop drawings or product data sheets to trade who will cut roof openings for ventilators, and ensure openings are properly sized and located.

1.06 QUALITY ASSURANCE

.1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2. PRODUCTS

2.01 GALVANIZED STEEL DUCTWORK

.1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.

.2 Rectangular

.1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

.3 Round

.1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.

.4 Flat Oval

.1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

2.02 GALVANIZED STEEL ROUND PVC COATED DUCTWORK

.1 Factory made G90 galvanized steel, ASTM A653, spiral seam smooth wall round duct and fittings with metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible for a 2.5 kPa (0.36 psi) pressure, with a 4 mm thick PVC coating permanently fused to both sides of the duct, fittings and sleeve joint pieces, and type 316 stainless steel sheet metal screws and support hardware.

2.03 RECTANGULAR ALUMINUM DUCTWORK

.1 Alloy 3003 Temper H14 aluminum, ASTM B209, shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to

suit the duct working pressure classification, and type 316 stainless steel support hardware.

2.04 ROUND ALUMINUM DUCTWORK

.1 Alloy 3003 Temper H14 aluminum, ASTM B209, factory fabricated, water-tight, smooth interior, single wall duct, and fittings of spiral lockseam construction with site sealed beaded sleeve (slip type) joints, all in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct working pressure classification, and type 316 stainless steel sheet metal screws and support hardware.

2.05 RECTANGULAR STAINLESS STEEL DUCTWORK

.1 300 Series stainless steel, type 304 or type 316 as specified in Part 3 of this Section, ASTM A167 and ASTM A480, with a #4 finish where bare (uncovered) and exposed in finished areas and a #2B finish elsewhere, with, unless otherwise specified, metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct location and working pressure classification, and stainless steel support hardware to match duct material.

2.06 ROUND STAINLESS STEEL DUCTWORK

.1 Factory made, spiral, mechanically locked flat seam, single wall duct fabricated from type 316 stainless steel to ASTM A240 with metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible for 2.5 kPa (0.36 psi) pressure. Type 316 stainless steel fittings equipped with leak-proof stainless steel couplings secured to connecting duct by means of stainless steel sheet metal screws and duct sealer. Duct system performance is to meet SMACNA's Leakage Class 3 requirements at system design static pressure. Stainless steel finish is to be a #2B mill finish where concealed or exposed in unfinished areas and a #4 finish where exposed in finished areas.

2.07 ROUND STAINLESS STEEL LINED DUCTWORK

.1 Double wall self-sealing duct system constructed from type 316 stainless steel to ASTM A240 and consisting of 24 kg/m3 (1.5 lb/ft³) density, 25 mm (1") thick glass fibre insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102 and wrapped in a thick non-woven polyester fabric, sandwiched between double wall duct and fittings. Spiral, mechanically locked, flat seam outer casing, and perforated inner liner with 3.2 mm (⅛") perforations on 6.4 mm (¼") staggered centres. Fittings and couplings constructed as for ducts and air-tight to SMACNA Leakage Class 3 requirements. Concealed duct and exposed duct in unfinished areas is to have a #2B mill finish. Exposed duct in finished areas is to have a #4 finish.

2.08 FIBERGLASS REINFORCED PLASTIC DUCT – RECTANGULAR AND ROUND

.1 Factory fabricated duct and fittings in accordance with ASTM C582, ASTM D3982, ASTM D2996, SMACNA manual entitled "Thermoset FRP Duct Construction Manual", and with resin conforming to 25/50 flame spread/smoke developed rating when tested in accordance with CAN/ULC-S102, pigment coloured as selected from manufacturer's standard colours, with thixotropic resin paste sealed and fibreglass cloth and resin overwrapped bell and spigot joints for round ducts, air-tight gasketed flanged joints with type 316 stainless steel bolts, lock washers and nuts for rectangular ducts, and type 316 stainless steel support hardware.

2.09 FLEXIBLE METALLIC DUCTWORK

.1 Bare

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.

.2 Insulated

.1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", CAN/ULC-S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m3 (0.75 lb/ft³) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC-S102.

2.10 FLEXIBLE FABRIC DUCTWORK

.1 Equal to DuctSox Corp. round fabric air duct, 25/50 flame spread/smoke developed rated when tested in accordance with CAN/ULC-S102, white or coloured (to manufacturer's standards), and complete with 3 x 1 tension cable suspension system.

2.11 FLEXIBLE FABRIC DUCTWORK

.1 Bare

.1 Equal to Flexmaster Canada Ltd. "Fabriflex" Type 4 ULC listed and labelled Class 1 flexible fabric duct consisting of vinyl coated

fibreglass cloth mechanically bonded to a corrosion resistant galvanized steel helix.

.2 Insulated

.1 Equal to Flexmaster Canada Ltd. "Fabriflex" Type 4T ULC listed and labelled Class 1 flexible fabric duct consisting of vinyl coated fibreglass cloth mechanically bonded to a corrosion resistant galvanized steel helix and factory insulated with 25 mm (1") thick glass fibre insulation with a polyethylene vapour barrier jacket.

2.12 FLEXIBLE CONNECTION MATERIAL

.1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber.

.2 Manufacturers:

.1 Duro Dyne Canada Inc. "DUROLON";

.2 Dyn Air Inc. "HYPALON".

.3 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber.

.4 Manufacturers:

.1 Duro-Dyne Canada Inc. "THERMAFAB";

.2 Dyn Air Inc. "SILICON HI-T".

2.13 METAL DUCT SYSTEM JOINT SEALANT

.1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.

.2 Manufacturers:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.14 ACOUSTIC LINING

.1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.

.2 Manufacturers:

.1 Johns Manville;

.2 Manson Insulation;

.3 Knauf Insulation.

2.15 FACTORY INSULATED FIRE RATED DUCTWORK

.1 Equal to DuraSystems Barriers Inc. "DuraDuct HP" or "DuraDuct GNX" duct, 2 hour fire rated, constructed, ULC listed and labelled for fire rated ventilation applications. Duct is constructed of a galvanized steel inner liner, a galvanized steel outer jacket, and all required fittings and accessories, including support hardware.

2.16 IN-SLAB EXHAUST DUCTWORK

.1 Equal to ECCO Manufacturing "ECCODUCT" spiral wound, galvanized steel, 300 mm x 45 mm (12" x 1-¾") rectangular duct supplied in 3 m (10') lengths complete with factory supplied galvanized steel connection couplers, fittings, exterior discharges with back draft dampers, and support brackets. Concrete encased duct and fittings are 3 hour fire rated in accordance with tests conducted by Intertek/Warnock Hersey in accordance with ULC S115 and ASTM E814, are to have an impact loading rating of 200 kg (440 lb) from 1.5 m (5') with no permanent deformations in accordance with CAN3-A23, and are to have a point loading rating with 1 mm (1/32") permanent deformation when tested to CSA S269.1.

2.17 CASING AND PLENUM MATERIAL AND ACCESSORIES

.1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.

.2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.18 ACOUSTIC PLENUM PANELS

.1 Vibro-Acoustics Ltd. type "AP", 100 mm (4") thick panels with acoustic media meeting NFPA 90A requirements sandwiched between minimum #24 gauge galvanized sheet steel, with airside face perforated, access doors where shown, and with acoustic performance as follows:

Octave Bands, (Hz)	125	250	500	1000	2000	4000
Transmission Loss	21	28	39	50	53	56
Absorption Coefficient	0.7	0.9	0.99	0.99	0.9	0.9

.2 Acoustic plenum media factory encapsulated in sealed DuPont "Tedlar" polyvinyl fluoride film to ensure no media enters the airstream.

.3 Manufacturers:

.1 Vibro-Acoustics Ltd.;

.2 Kinetics Noise Control Inc.;

.3 Carrier Corp. – Racan;

.4 Haakon Industries;

.5 Price Industries Inc;

.6 Alumavent.

2.19 PLENUM ACCESS DOORS

.1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.20 ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.21 SPLITTER DAMPERS

.1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.22 AIR TURNING VANES

.1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.23 MANUAL BALANCING (VOLUME) DAMPERS

.1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:

.1 hexagonal or square shaft extension through frame;

.2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;

.3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;

.4 linkage for multiple blade dampers;

.5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.

.2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.

.3 Round Dampers: Nailor Industries Inc. model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.

.4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.

.5 Manufacturers:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 Greenheck Fan Corp.;

.4 Ruskin Co.

2.24 BACKDRAFT DAMPERS

.1 Nailor Industries Model 1370CB counterbalanced backdraft dampers, vertical or horizontal mounting, 50 mm (2") wide, sized as shown and complete with:

.1 extruded 6063-T5 aluminum frame, 2.3 mm (0.090") nominal wall thickness, with mitred corners;

.2 extruded 6063-T5 aluminum blades, 1.3 mm (0.050") nominal wall thickness on 92 mm (3-5/8") centres, and with extruded PVC blade seals;

.3 corrosion-resistant synthetic bearings;

.4 adjustable plated steel counterweights mounted internally in the airstream;

.5 concealed blade linkage located out of the airstream.

.2 Manufacturers:

.1 Nailor Industries Inc.;

.2 T.A. Morrison & Co. Inc. "TAMCO";

.3 Greenheck Fan Corp.;

.4 Ruskin Co.

2.25 FUSIBLE LINK DAMPERS

.1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.

.2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.

.3 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.4 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H. Price).

2.26 COMBINATION FIRE/SMOKE DAMPERS

.1 Nailor Industries Series 1221, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.

.2 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.

.3 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.

.4 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.5 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H. Price).

2.27 SMOKE DAMPERS

.1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each

complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.

.2 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.

.3 Manufacturers:

.1 Nailor Industries Inc.;

.2 Greenheck Fan Corp.;

.3 Ruskin Co.;

.4 Price Industries (E.H Price).

2.28 ROOF DUCT SUPPORTS

.1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

2.29 PRESSURE RELIEF DOORS

.1 Greenheck model PRAD (positive) or VRAD (negative) pressure relief doors constructed of same material as duct or plenum they are associated with, each complete with a sealing gasket, special latches, cable assembly with spring to limit door opening to maximum 80° and factory set, field adjustable pressure relief magnet assembly.

.2 Size access doors to match requirements of system so pressure drop through open blow-out door at required flow rate will not exceed rated pressure of duct system.

.3 Manufacturers:

.1 Greenheck Fan Corp.;

.2 United Enertech.

2.30 DUCT ACCESS DOORS

.1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.31 DUCTWORK DRAIN POINTS

.1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut, and cap.

2.32 INSTRUMENT TEST PORTS

.1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.33 WIRE MESH (BIRDSCREEN)

.1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.34 LOUVRES

.1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.

.2 Acoustical Louvres: Price Industries Inc. Model QA1245 300 mm (12") deep, welded, extruded alloy 3003-H14 aluminum, storm-proof, stationary, drainable acoustical louvers, AMCA water penetration and air performance certified, with high density mineral wool acoustic media secured to blades and protected by perforated aluminum, sound ratings in accordance with ASTM E90 and ASTM E413, and mounting and securing facilities as required.

.3 Louvres are to be factory finished with a finish equal to PPG Industries "Duranar" fluoropolymer powder coating over primer with colour as selected from manufacturer's standard colour range.

.4 Manufacturers:

.1 Price Industries Inc.;

.2 The Airolite Co. LLC;

.3 Construction Specialities;

.4 Nailor Industries Inc.;

.5 Kinetics Noise Control Inc.

.6 Greenheck Fan Corp.

.7 Ventex.

2.35 LOUVRE BLANK-OFF PANELS

.1 Insulated, framed, sandwich construction panels consisting of 40 mm (1-½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.36 BRICK AND BLOCK VENTS

.1 Equal to Price Industries Inc. vents constructed of 6063-T5 alloy extruded aluminum, sized as shown, complete with stainless steel fasteners, aluminum rod vertical supports on minimum 300 mm (12") centres, #2 mesh fixed aluminum screen, and all required accessories to suit the application.

.2 Vent(s) to be factory finished with a finish equal to a baked "Kynar 500-XL" colour coat and a clear coat over cleaned and primed metal with colour as selected from manufacturer's standard colour range.

2.37 FIRE STOP FLAPS AND THERMAL BLANKET MATERIAL

.1 Rectangular or round, ULC listed and labelled, blade type galvanized steel fire stop flaps in accordance with CAN/ULC S112, Standard Methods of Fire Test of Fire-Damper Assemblies and CAN/ULC S112.2, Standard Method of Fire Test of Ceiling Firestop Flap Assemblies, each complete with #22 gauge G60 galvanized steel blade(s) and frame, a 74°C (165°F) fusible link, and, for dampers 300 mm (12") and larger, ceramic fibre insulation on both sides of the blades.

.2 Ceramic fibre material in accordance with 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102 and of a thickness to suit required fire rating.

2.38 GRILLES AND DIFFUSERS

.1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.

.2 Manufacturers:

.1 Price Industries Inc.;

.2 Anemostat;

.3 Krueger Division of Air System Components Inc.;

.4 Titus;

.5 Nailor Industries Inc.;

.6 Tuttle & Bailey.

2.39 FAN FILTER DIFFUSERS

.1 Factory assembled and leakage tested, suspended ceiling mount, modular assemblies, each ULC and CSA or ETL certified and labelled, consisting of a fan-motor and HEPA filter enclosed in a metal plenum, designed for unidirectional vertical flow of filtered air over a cleanroom space. Sound performance of each is not to exceed 50 dBA measured 765 mm (30") from filter face at 0.5 m/s (90 FPM). Units are to be in accordance with the Institute of Environmental Services and Technology Recommended Practices IEST RP CCOO1, HEPA and ULPA Filters, and IEST RP CCOO2, Unidirectional-Flow, Clean-Air Devices. Each unit is to be equipped with:

.1 plenum and face frame: airtight low profile design, constructed of type 304 stainless steel with aluminum interior parts including an extruded aluminum filter frame with air by-pass seal, an inlet duct connection collar, sound insulation meeting 25/50 flame spread/smoke developed ratings when tested to CAN/ULC S102, a static pressure port, eyebolts at each corner;

.2 fan and motor: removable, consisting of a blower wheel encased in a strategically shaped enclosure a direct connected to a vibration isolated ⅓ HP ECM brushless DC motor with permanent built-in inverter programmed for constant volume airflow and equipped with a 2.4 m (8') length of power cord with plug;

.3 filter: HEPA ultra low penetration air (ULPA) filters, 99.9995% efficient on 0.12 µm micron particles, latched into fan plenum and protected by a perforated screen attached with quarter-turn thumb-wheel fasteners, and room side replaceable;

.4 diffuser face: perforated, laminar flow face constructed of aluminum with quarter-turn fasteners for removal and access to fan-motor and filter;

.5 mounting gasket: roll type gasket material supplied with units for site installation on T-bar ceiling members;

.6 factory secured seismic restraint connection hardware.

2.40 ROUND LOW SILHOUETTE ROOF MOUNTED VENTILATORS

.1 Spun aluminium, round, gravity roof mounting hoods in accordance with drawing schedule, each complete with:

.1 wind band with a rolled bead, and curb cap with one-piece, spun, deep venturi inlet, and pre-punched holes for mounting;

.2 galvanized steel bird screen;

.3 minimum 300 mm (12") high welded aluminium, insulated roof mounting curb with damper tray;

.4 aluminium backdraft damper supplied loose, for site installation in roof curb damper tray;

.5 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit control voltage requirements;

.6 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 PennBarry;

.3 Twin City Fan and Blower.

2.41 LOUVRED PENTHOUSE TYPE VENTILATORS

.1 Low silhouette, rectangular, roof mounting louvred penthouse type hoods in accordance with drawing schedule, each constructed of aluminium, supplied in knock-down form for site assembly, and each complete with:

.1 extruded aluminium, welded storm-proof louver blades with mitred corners and stainless steel securing screws;

.2 removable cover for internal access, lined with glass fibre insulation material and equipped with stainless steel fasteners;

.3 12 mm x 12 mm (½" x ½") aluminium mesh birdscreen;

.4 welded aluminium, minimum 300 mm (12") high insulated roof mounting curb with damper tray and curb seal;

.5 aluminium backdraft damper supplied loose, for site installation in roof curb damper tray;

.6 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit site control voltage requirements;

.7 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 Twin City Fan and Blower;

.3 PennBarry.

.4 Ventex.

2.42 HOODED TYPE VENTILATORS

.1 Low silhouette, rectangular, roof mounting hooded penthouse type ventilators in accordance with drawing schedule, each constructed of aluminium, supplied in knock-down form for site assembly, and each complete with:

.1 full 360° perimeter hood opening;

.2 12 mm x 12 mm (½" x ½") aluminium mesh bird screen;

.3 welded aluminium, minimum 300 mm (12") high insulated roof mounting curb with damper tray and curb seal;

.4 aluminium backdraft damper supplied loose for site installation in roof curb damper tray;

.5 non-corrosive motorized damper supplied loose for site installation in roof curb damper tray, equal to T. A. Morrison TAMCO Series 9000 insulated damper with linkage, end switch, and a Belimo or equal motor with voltage to suit site control voltage requirements;

.6 factory secured seismic restraint connection hardware.

.2 Manufacturers:

.1 Greenheck Fan Corp.;

.2 Twin City Fan and Blower;

.3 PennBarry.

2.43 INTAKE WALL BOX

.1 Equal to Reversomatic SWBL-INTAKE wall boxes leakproof seamless construction, extruded aluminum grille, sized as shown, complete with stainless steel fasteners, and all required accessories to suit the application. Contractor to coordinate colour and finish with colour as selected from manufacturer's standard colour range as noted in schedule.

2.44 EXHAUST WALL BOX

.1 Equal to Reversomatic SWBL wall boxes leakproof seamless construction, extruded aluminum grille, sized as shown, complete with stainless steel fasteners, neoprene backdraft damper, and all required accessories to suit the application. Contractor to coordinate colour and finish with colour as selected from manufacturer's standard colour range as noted in schedule.

3. EXECUTION

3.01 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

.1 Handle and install ductwork in accordance with CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities and SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

.2 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.02 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

.1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.

.2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.

.3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken or beaded per SMACNA standards. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

.4 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-

off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.

.5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by the Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.

.6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.

.7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.

.8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.

.9 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.

.10 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.

.11 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by the Consultant.

.12 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise

specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.

.13 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

.14 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:

.1 ductwork outside building or otherwise exposed to the elements;

.2 dishwasher exhaust;

.3 shower exhaust ducts from grilles to duct main or riser;

.4 minimum of 3 m (10') upstream and downstream of duct mounted humidifiers or humidifier manifolds;

.5 fresh air intakes;

.6 wherever else shown.

.15 Leakage Testing:

.1 Ductwork leakage is not to exceed following:

.1 ductwork to 2" W.C. Class, 1% of total air quantity handled by respective fans;

.2 ductwork exceeding 2" W.C. Class, 2% of total air quantity handled by respective fans.

.2 Leakage testing is to be performed by the Testing, Adjusting and Balancing (TAB) agency in accordance with SMACNA HVAC Air Duct Leakage Test Manual and is to be witnessed by the Consultant.

.3 Leakage test following ductwork:

.1 [ ];

.2 [ ].

.4 Be responsible for following:

.1 preparing duct systems for leakage testing prior to installation of external insulation including capping duct runouts and provision of final tap-in for test equipment;

.2 schedule testing with TAB agency in advance, be present for all testing and ensure notice is given to the Consultant so they may witness testing;

.3 resealing and/or replacement of defective ductwork;

.4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.

.16 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.17 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.

.18 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.

.19 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.

.20 Round exposed ductwork in Gymnasium is to be 2 metal gauges heavier than standard metal gauge for same size duct, and duct hangers are to be pairs of 9.5 mm (⅜") diameter hanger rods secured to 40 mm (1-½") wide #12 gauge galvanized steel split clamps around full circumference of duct at maximum 1.8 m (72") centres. Provide double nuts and lock washers on each hanger rod above and below each clamp.

.21 Equip ducts with a dimension of 600 mm (24") and larger and located in mechanical equipment rooms of any kind with hanger rods equipped with double deflection neoprene rod isolation hangers properly sized for associated load. Also refer to Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.22 In addition to SMACNA duct construction standards specified above, ductwork is to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.03 INSTALLATION OF ALUMINUM DUCTWORK

.1 Provide aluminum ductwork, rectangular or round.

.2 Provide aluminium ductwork for:

.1 [ ];

.2 [ ].

.3 Wherever bare aluminum ductwork comes in contact with ferrous metal or copper, paint ferrous metal or copper surface with a heavy, 100% covering coat of zinc chromate paint, asphalt paint or otherwise isolate direct contact with the bare aluminum.

.4 Refer to "Commentary on Aluminum Ducts" in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, do not use drive and S cleats for joining waterproof aluminum ductwork. Use following SMACNA joining methods:

.1 T-21 - welded flange;

.2 T-22 - companion angle and gasket;

.3 T-24A - flanged.

.5 Keep longitudinal joints at top surface of horizontal runs. Provide proper transverse supports to prevent deflection. Ensure duct is rigid.

.6 When mastic is used for sealing such as sealing longitudinal joints, apply mastic to both surfaces before they are mated. When dry, apply mastic again for a water-tight seal.

3.04 INSTALLATION OF STAINLESS STEEL DUCTWORK

.1 Provide stainless steel ductwork, round or rectangular.

.2 Provide stainless steel ductwork as follows:

.1 [ ];

.2 [ ].

.3 Exposed stainless steel kitchen exhaust duct is to be minimum #16 gauge and of welded construction with pickled and passivated welds which are ground to a finish to match duct finish.

3.05 INSTALLATION OF FIBREGLASS REINFORCED PLASTIC (FRP) DUCTWORK

.1 Provide rectangular fibreglass reinforced plastic ductwork.

.2 Provide FRP ductwork for:

.1 [ ];

.2 [ ].

.3 Generally, install duct in accordance with duct manufacturer's instructions and requirements of SMACNA publication entitled "Thermoset FRP Duct Construction Manual".

.4 Secure duct in place with type 316 stainless steel angles, straps, hanger rods, and accessories. Provide strips of felt or neoprene material between duct and hanging and support hardware.

3.06 INSTALLATION OF ROUND PVC COATED GALVANIZED STEEL DUCTWORK

.1 Provide round PVC coated galvanized steel ductwork.

.2 Provide round PVC coated galvanized steel ductwork for:

.1 [ ];

.2 [ ].

.3 Underground ductwork is to be constructed to SMACNA Positive Pressure Class 10" w.c. with minimum metal gauges as follows:

.1 150 mm (6") through 350 mm (14") dia. - #28 gauge;

.2 400 mm (15") through 660 mm (26") dia. - #26 gauge;

.3 685 mm (27") through 915 mm (36") dia. - # 24 gauge;

.4 940 mm (37") through 1.27 m (50") dia. - #20 gauge.

.4 Install underground ductwork in accordance with requirements and details for underslab duct in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.07 INSTALLATION OF FABRIC DUCTWORK

.1 Provide fabric ductwork.

.2 Secure duct from structure by means of tension cable and suspension components supplied with ductwork.

.3 Install tension cable and suspension components in accordance with duct manufacturer's instructions.

.4 Provide metal duct connection collars as required.

.5 Start-up fabric duct system in accordance with manufacturer's instructions.

.6 Do not penetrate fire barriers with fabric duct.

3.08 INSTALLATION OF FLEXIBLE DUCTWORK

.1 For supply air ductwork, provide maximum 1.8 m fully stretched, long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.

.2 For return air ductwork, provide maximum 1.0 m fully stretched, long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles. Do not install flexible ductwork through walls, even if shown on drawings.

.3 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.

.4 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.

.5 Do not penetrate fire barriers with flexible duct.

3.09 INSTALLATION OF ACOUSTIC LINING

.1 Provide acoustic lining in ductwork in locations as follows:

.1 wherever shown and/or specified on drawings;

.2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;

.3 all transfer air ducts.

.2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.10 INSTALLATION OF FIRE RATED DUCTWORK

.1 Provide 2 hour fire rated ductwork.

.2 Install ductwork in strict accordance with duct manufacturer's instructions using support hardware supplied with duct.

.3 When installation is complete, arrange, and pay for duct manufacturer to visit site and examine duct installation. Make any revisions requested by manufacturer, and when manufacturer is satisfied with installation, obtain and submit a letter certifying proper installation in accordance with ULC requirements.

3.11 INSTALLATION OF SHEET STEEL KITCHEN GREASE EXHAUST DUCTWORK

.1 Provide welded sheet steel kitchen grease exhaust ductwork from exhaust hood(s) to roof mounted exhaust fans, all in accordance with requirements of NFPA 96. Construct ductwork watertight with continuous externally welded seams and joints, cleanouts, duct expansion provisions, riser residue traps, etc.

.2 Clean and prime coat ground welds in black steel ducts.

.3 Support ductwork at not greater than 1.5 m (5') intervals and ensure fasteners at hangers do not penetrate duct. Install without forming dips, sags, or traps where grease reside might collect, and locate access door/cleanouts for ease of maintenance.

.4 Slope horizontal ductwork 25 mm per 300 mm (1" per foot) back to exhaust hood.

3.12 INSTALLATION OF IN-SLAB DUCTWORK

.1 Provide in-slab concrete encased ductwork, complete with required fittings and accessories.

.2 Install duct with support brackets supplied with duct and coordinated with location of reinforcing steel, post tensioning cables, and any other structural slab component. Install duct in strict accordance with manufacturer's installation instructions and requirements of the Consultant. Ensure all joints are water-tight.

.3 Confirm finish of exterior discharge fittings with the Consultant prior to ordering.

3.13 INSTALLATION OF CASINGS AND PLENUMS

.1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.

.2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.

.3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.

.4 In addition to SMACNA duct construction standards specified above, casings and plenums are to be constructed and installed to meet seismic requirements of British Columbia Building Code and ANSI/SMACNA - The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.14 INSTALLATION OF ACOUSTIC PANELS

.1 Provide acoustic panels for plenums. Integrate acoustic plenums with standard casings and plenums. Install acoustic panels in strict accordance with manufacturer's instructions. Seal panels with acoustic caulking where pipes, ducts or conduit penetrate and make air and watertight.

.2 Provide floor to ceiling high acoustic plenums where shown, each complete with required framing, including framing for access doors and other openings, each structurally designed to resist excessive deflection or bowing, constructed to be air-tight when subjected to a pressure differential of 2.48 kPa (0.36 psi), and designed so any one panel can be removed without dismantling entire plenum.

.3 Provide acoustic type access doors where shown, and provide acoustic caulking at all locations where acoustic plenums abut building walls or slabs, and at all points where pipe, ducts or conduit penetrate acoustic panels.

.4 In addition to SMACNA duct construction standards specified above, acoustic plenums are to be constructed and installed to meet seismic requirements of [British Columbia Building Code] and ANSI/SMACNA, The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.15 INSTALLATION OF CASING AND PLENUM ACCESS DOORS

.1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.

.2 Construct access doors to open in or out to suit positive and negative pressures of system.

.3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.

.4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.16 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

.1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.17 INSTALLATION OF SPLITTER DAMPERS

.1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.18 INSTALLATION OF TURNING VANES

.1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.19 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

.1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.

.2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.

.3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

.4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.20 INSTALLATION OF BACKDRAFT DAMPERS

.1 Provide backdraft dampers.

.2 Install and secure dampers so they cannot move or rattle.

3.21 INSTALLATION OF FUSIBLE LINK DAMPERS

.1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr) is suitable for fire barrier it is associated with.

.2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.

.4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.22 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

.1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.23 INSTALLATION OF SMOKE DAMPERS

.1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.

.2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

.3 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple smoke dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.24 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

.1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.

.2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

.3 For system [_____] use high temperature flameproof flexible connection material.

3.25 INSTALLATION OF ROOF MOUNTED DUCT SUPPORTS

.1 Supply supports for roof mounted ductwork.

.2 Hand adjustable structural supports to roofing trade on roof for installation and flashing into roof construction as part of roofing work. Accurately mark exact locations and spacing of structural supports and supervise installation. Provide properly sized hot dip galvanized structural steel angles between structural supports and secure in place on support studs. Support ductwork on the angles and provide galvanized steel banding to secure ducts to the angles.

.3 Accurately mark location and spacing of roof support assemblies. At each plastic base location, carefully scrape away loose roof ballast (gravel) and all other debris and dirt. Prime existing membrane with a primer which is compatible with existing roofing components. Set bases in adhesive in accordance with manufacturer's installation instructions. Scrape loose ballast back around and on bases. Install framing, and install ductwork on the cross-members. Secure ductwork to cross-members with galvanized steel banding.

3.26 INSTALLATION OF PRESSURE RELIEF DOORS

.1 Provide pressure release access doors to prevent duct system explosion or implosion as a result of a duct obstruction, i.e. closed fire damper, which prevents normal air flow through the system. Size access doors in accordance with requirements of Part 2 of this section.

.2 Where pressure release doors are shown in suction ducts or plenums, mount access door assembly so door swings in and latch mechanism is on the inside of duct or plenum. If latch mechanism is not accessible, provide a standard access door at latch side of the pressure release access door for maintenance purposes.

.3 Adjust each latch mechanism by means of the adjusting pin to suit static pressure of the particular system in accordance with latch mechanism manufacturer's instructions.

3.27 INSTALLATION OF DUCT ACCESS DOORS

.1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

.2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.

.3 When requested, submit a sample of proposed duct access doors for review.

.4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.28 INSTALLATION OF INSTRUMENTS TEST PORTS

.1 Provide instrument test ports in all main ducts at connections to fans, plenums, or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.

.2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.29 INSTALLATION OF WIRE MESH (BIRDSCREEN)

.1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.

.2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.30 INSTALLATION OF LOUVRES

.1 Provide louvres for wall openings.

.2 Install louvre assemblies and secure in place in accordance with manufacturer's instructions and details.

.3 Confirm exact louvre sizes and finish prior to ordering.

3.31 INSTALLATION OF LOUVRE BLANK-OFF PANELS

.1 Provide blank-off panels for inactive portions of exterior wall louvres.

.2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.

.3 Confirm exact finish of panels prior to fabrication.

3.32 INSTALLATION OF BRICK AND BLOCK VENTS

.1 Supply brick or block vents for installation in exterior walls.

.2 Hand assemblies to masonry trade for installation.

.3 Accurately mark exact locations and coordinate installation.

3.33 INSTALLATION OF FIRE STOP FLAPS AND THERMAL BLANKETS

.1 Provide fire stop flaps in duct connection necks of grilles and diffusers installed in ULC fire rated suspended ceiling systems where shown on drawings.

.2 Provide thermal blanket material to completely cover grille and/or diffuser pans above suspended ULC fire rated ceilings. Cut, install, and secure in place in accordance with manufacturer's instructions and ULC requirements.

3.34 INSTALLATION OF GRILLES AND DIFFUSERS

.1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.

.2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

.3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.

.4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

.5 Attach troffer type diffusers associated with typical ceiling mounted fluorescent lighting fixtures to the fixtures on floor prior to fixture installation in ceiling. When fixtures are installed, connect diffuser boots with flexible ductwork.

.6 Provide sheet metal plenums, constructed of same material as connecting duct, for linear grilles and/or diffusers where shown. Construct and install plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip duct connection collar(s) with volume control device(s).

.7 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip diffusers/grilles in place using clip supplied by diffuser/grille manufacturer.

.8 Confirm grille and diffuser finishes prior to ordering.

3.35 INSTALLATION OF FAN FILTER DIFFUSERS

.1 Provide fan filter diffusers.

.2 Exactly locate fan filter diffusers to conform to final architectural reflected ceiling plans, and to conform to final lighting arrangement and locations of ceiling equipment.

.3 Install in strict accordance with manufacturer's instructions, including gasket tape on T-bar ceiling members at unit locations. Plug each unit into an adjacent ceiling receptacle.

.4 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.5 For equipment/system manufacturer certification requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.6 For equipment/system start-up requirements, refer to Section 20 05 00 – Common Work Results for Mechanical.

.7 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration.

3.36 SUPPLY OF DOOR GRILLES

.1 Supply door grilles as shown and scheduled.

.2 Hand grilles to appropriate trade at site for installation.

3.37 INSTALLATION OF ROOF MOUNTED GRAVITY VENTILATORS

.1 Provide roof mounted gravity ventilators.

.2 Supply a roof mounting curb with each ventilator and hand curbs to roofing trade on roof for mounting and flashing into roof construction as part of the roofing work. Site assemble gravity ventilators as required, and secure in place on curbs.

.3 Brace and secure each unit in accordance with requirements specified in Section 20 05 48.16 – Seismic Controls for Mechanical Systems.

.4 Install dampers in curb damper tray and secure in place.

3.38 INSTALLATION OF INTAKE AND EXHAUST WALL BOXES

.1 Supply brick or block vents for installation in exterior walls.

.2 Hand assemblies to masonry trade for installation.

.3 Accurately mark exact locations and coordinate installation.

3.39 DUCT SYSTEM PROTECTION, CLEANING AND START-UP

.1 Temporarily cover all open ends of ducts during construction.

.2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.

.3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.

.4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.

.5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted, and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

End of Section