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6 DUCTWORK AND AIR-SIDE EQUIPMENT

6.1 GENERAL

6.1.1 Scope

- 1 This Part details the requirements for the construction and installation of the ductwork and air side equipment.
- 2 Related Sections and Parts are as follows:
Section 1 General

6.1.2 References

- 1 The following standards are referred to in this Part:
BS 476.....Fire tests on building materials and structures
BS 1449Steel plate, sheet and strip
BS 1470.....Wrought aluminium and aluminium alloys for general engineering purposes (EN 573)
BS 1474.....Wrought aluminium and aluminium alloys for general engineering purposes; bars extruded round tubes and sections (EN 755)
BS CP 352.....Mechanical ventilation and air conditioning in buildings

NFPA 90AInstallation of Air Conditioning and Ventilating Facilities
NFPA 96.....Ventilation Control and Fire Protection of Commercial Cooking Operation

SMACNADuctwork design and installation

UL 555 SSmoke Dampers

6.1.3 Submissions

- 1 Technical Submissions. After award, the Contractor shall check design calculations and shall advise the Engineer of any discrepancies found.
- 2 The Contractor will also prepare an air balance for supply, return, exhaust, make-up, exfiltration etc.
- 3 The Contractor will prepare full shop drawings, including sections, of distribution systems and equipment.
- 4 Hardware Submissions. The Contractor will submit catalogue information for all distribution equipment including, but not limited to:-
 - (a) ductwork, duct sealants, gaskets and tapes
 - (b) flexible ductwork
 - (c) flexible connections
 - (d) access panels
 - (e) balancing dampers

- (f) motorised dampers
 - (g) backdraft dampers
 - (h) splitter dampers
 - (i) fire dampers
 - (j) silencers
 - (k) vibration isolators
 - (l) diffusers, grilles and registers
 - (m) louvres, sand louvres
 - (n) filters.
- 5 The Contractor will submit samples for any or all of the above as requested by the Engineer after receipt of the catalogues.
- 6 Samples will definitely be required of these items which are exposed, such as diffusers, grilles, louvres. The samples must be of size, specification and finish as relevant to the project.
- 7 Where a country of origin is given, this refers to the head office in the case of international corporations. However, for each product not manufactured in that country separate approval must be obtained from the Engineer.

6.2 DUCTWORK

6.2.1 Ductwork Material

- 1 All ductwork except in laboratories, kitchens and laundry extract systems shall be manufactured from strip mill, cold reduced sheet, continuously hot dip galvanized in accordance with BS 2989 grade Z2. Unless specified elsewhere in the Project Documentation
- 2 All flanges and stiffeners used in the construction of galvanized mild steel ductwork shall be galvanized steel section.
- 3 Where flexible ductwork is used, it shall conform to ductwork of the type manufactured in accordance with BS 1470 aluminium strip corrugated and spirally wound with double lock seam.
- 4 The length of flexible ductwork shall not exceed 2 m per section and shall be supported as recommended by the manufacturer.
- 5 Kitchen extract ductwork shall be air and watertight welded construction manufactured from 16 g black steel sheets in accordance with BS 1449, Part 1 Grade CR4 GP. Ductwork shall be painted on the outside with two coats of heat resistant galvanic paint after manufacture.
- 6 Laundry extract ductwork shall be air and water tight construction manufactured from aluminium sheets in accordance with BS 1470.
- 7 Laboratory ductwork or systems carrying corrosive gases shall be manufactured of PVC or FRP. However before installation of such system the QGEWC shall be approached for written approval.

6.2.2 Ductwork Specification

- 1 Ductwork fabrication and hanging methods shall be as described in the "Equipment" Volume of the American Society of Heating, Refrigerating and Air Conditioning Engineers Guide and Data Book, latest edition, and/or current edition of applicable manuals published by the Sheet Metal and Air Conditioning Contractors National Association Inc., where methods described in these volumes are not at variance with the requirements of any authority having jurisdiction, or do not conflict with methods described hereafter. Ductwork shall not be ship fabricated until work has been job measured and interference situations co-ordinated.
- 2 Any Contractor who is very familiar with British Standards may refer to BS CP 352 and DW 144. Any discrepancy will be clarified by the Engineer on request.
- 3 In any event, the standard of work required is the best available, and the specifications are to be so interpreted.

6.2.3 Ductwork General

- 1 All dimensions shall be checked on site before ductwork manufacture is commenced.
- 2 The whole of the ductwork installation shall be carried out by an approved specialist in ductwork manufacture and installation. No ductwork shall touch the building structure or building finishes direct, but shall be isolated with insulating spacer.
- 3 The fabrication shall be carried out in a neat and workmanlike manner with all ductwork true in size and cross-section, braced and stiffened as specified and with all internal and external surfaces free from projections and sharp edges.
- 4 At each main branch in ductwork and at each fan discharge or suction, provide sufficient number of Pitot tube holes for balancing systems. Also, provide test holes for traverse fan discharge and at all equipment. Test holes shall be located within easy reach of catwalks or ladder. Each test hole shall have 20 mm clear opening, provided with a metal ring plate with a threaded hole in the boss, and matching screwed head plug. Where these plugs are installed in insulated ductwork, provide an extension collar against which the insulation can be finished.
- 5 Reinforced holes shall be provided where thermometers, manometers, thermostats, gauges, damper rods etc., occur in ductwork. Extended collars shall be provided for the reinforced holes where these occur on insulated ductwork. Where copper tubing passes through ductwork, or casing, provide a rubber grommet to prevent damage to copper tubing.
- 6 Ductwork shall be rigidly suspended or supported from building structure. Expansion type concrete inserts shall be placed so that the fastener is in shear rather than tension. Powder actuated fasteners placed by an explosive charge will not be accepted. Angle type trapeze hangers with rod supports space at 2 m maximum shall be used. "C" type beam clamps will not be accepted. Provide necessary steel angle iron required for bracing of ductwork or equipment, and for supporting ductwork from building structure.
- 7 A layer of felts strip 12.5 mm compressed thickness shall be provided between any support member which is designed to clamp or grip the duct (e.g. circular duct band clip) or on which the duct is to rest. All supports shall be hot dip galvanized.
- 8 Increase in duct size shall be gradual. Where width or largest dimension of a duct is over 450 mm, duct shall be stiffened by bending in a break across corners in both directions. Ducts shall be self-supporting and complete in themselves. Single thickness partition between ducts will not be accepted. Visible internal portions of duct outlets to grilles and registers shall be painted in dull black.

- 9 All necessary allowances and provisions shall be made in the installation of the ducts for the structural framing of the building and when changes or offsets are necessary, the required cross-sectional areas shall be maintained. All of these changes however, shall be approved, and installed as directed at the time.
- 10 During installation, the open ends of ducts shall be protected with blank, flanged sheet metal baffles, securely attached to prevent debris and dirt from entering.
- 11 Where ducts are shown connecting to masonry openings and/or along the edges of all plenums at floors, walls, etc., provide a continuous 30 x 30 x 4 mm galvanized angle iron which shall be bolted to the structure and made airtight to same by applying caulking compound on the angles before they are drawn down tight. The sheet metal at these locations shall be bolted to the angle iron framing.
- 12 All air ducts, casings, plenums etc., shall be constructed of lock forming quality prime galvanized steel sheets, which are free from blisters, slivers, pits, imperfectly coated spots etc. No second quality sheet metal allowed.
- 13 Where damage (or rusting) has occurred on galvanized ductwork, the affected section shall be made good by painting with two coats of zinc-rich paint and approved finishing paint, or where the damage in the Engineer's opinion cannot be made good, then a new section of ductwork shall be provided at no cost to the contract.
- 14 Duct shall be constructed using double or Pittsburgh lock corner seams. All seams shall be hammered down and made airtight by applying sealant before hammering down. For transverse joints, refer to the current ASHRAE guide for low pressure ductwork.
- 15 Support the vertical ducts installed in the various shafts at each floor level with galvanized supporting irons of approved size.
- 16 Install these angles across the width of the shaft, with their ends attached to angle irons securely anchored into the masonry walls of the shaft, or attached to the framing of the floor openings. The ducts shall be bolted to these supporting angle irons.
- 17 Ensure that all openings required through floors, walls, partitions etc., for the duct system are provide in the exact location required.
- 18 Each piece of ductwork shall be wiped inside and out before installation and all open ends shall be capped and sealed to prevent entrance of dirt during construction. Ensure that ductwork systems are clean and free from dirt, dust, grime, debris etc., before initial operation of fans. Fans shall not be operated until the filters are installed and approved from the Engineer has been obtained.
- 19 The bottom joint and 150 mm of vertical joint on outside air intake ducts and mixing chamber ducts shall be soldered and made watertight. Provide drain connection and run copper drain pipe to nearest floor drain.
- 20 All fixing devices including nuts, bolts, washers etc., used in the construction or support of galvanized ductwork shall be sheradised, or cadmium-plated.
- 21 Final connections to diffusers shall be carried out using flexible ductwork or solid spigots as detailed in the Project Documentation.
- 22 Sealants, gaskets and tapes shall comply with DW 144 Part 7 section 27 or DW 151 section 12 as appropriate.

6.2.4 Low Pressure Ductwork

- 1 This applies to ductwork with mean velocities less than 10 m/s and static pressures of 500 Pa or less.

- 2 Rectangular low pressure ductwork shall be fabricated from prime quality, re-squared, tight coat galvanized steel sheets as specified in the relevant standard.
- 3 Reinforcing and joints shall be in accordance with ASHRAE Guide and Data Book, Equipment Volume, 1988 Chapter 1 or in accordance with DW 144.
- 4 Low pressure suction and discharge plenum chambers shall be fabricated from 1.3 mm galvanized steel with galvanized angle iron framework and bracing.
- 5 In square elbows and in elbows where the radius is less than 1.5 times the width of duct, sheet metal deflector vanes shall be installed the full height of the duct, being securely riveted in place. All vanes shall be double thickness vanes of two gauges heavier than the duct in which they are installed, and shall be factory made, not site fabricated. Vanes shall be tack welded to vane rail. For vane lengths over 1000 mm, tack weld vanes to 10 mm tie-rod at mid-span.

6.2.5 Medium Pressure Ductwork

- 1 This clause applies to ductwork subject to pressures up to 1000 Pa.
- 2 Rectangular medium pressure ductwork shall be fabricated from prime quality, re-squared tight coated galvanized steel sheet as specified in the DW 144.
- 3 Reinforcement and joints shall be as detailed in DW 144.

6.2.6 High Pressure Ductwork

- 1 This applies to ductwork subject to pressures up to 2000 and 25000 Pa.
- 2 Rectangular medium pressure ductwork shall be fabricated from prime quality, re-squared tight coated galvanized steel sheet as specified in the relevant standard.
- 3 Reinforcement and joints shall be as detailed in the DW 144.
- 4 All high pressure ductwork shall be pressure tested in accordance with the DW 144.

6.2.7 Low Pressure Flexible Ductwork

- 1 Flexible ductwork shall be manufactured with a two ply aluminium inner core, surrounded by 25 mm thickness of 24 kg/m³ density fibre glass, all wrapped in a reinforced aluminium outer jacket. Ductwork shall meet the standards of NFPA 90A, and be UL listed or to meet BS 476 and BS 413.
- 2 Flexible ducts installed in an externally insulated duct system shall be factory insulated with glass fibre insulation not less than 25 mm thick and a density not less than 24 kg/m³, re-covered with an acceptable vapour seal.
- 3 Flexible ducts installed in internally (acoustic) insulated duct system, shall be factory insulated with glass fibre insulation not less than 20 mm thick and a density not less than 24 kg/m³, faced on air side with PVC coated glass cloth having an open area not more than 25 %, and on room side with material specified above.
- 4 Flexible duct installation shall be in accordance with manufacture's instruction. Joints between factory insulated flexible ducts and field insulated ductwork shall be sealed and taped under this section.
- 5 Pre-insulated flexible ducts shall be subject to QGEWC approval.

6.2.8 Flexible Connections

- 1 Flexible connectors at inlet and discharge to air handling equipment shall be pre-assembled 0.7 mm galvanized steel with minimum of 100 mm width (exposed) fabric. For higher pressure applications 25 mm of width of fabric shall be used for each 25 mm of static pressure.

- 2 Flexible connectors attached to acoustically treated ductwork shall be insulated with 25 mm Fibre glass insulation packed between flexible connector and 16 gauge (1.5 mm) galvanized steel housing. Housing shall be fastened to duct with sheet metal screws. At equipment collar caulk between collar and flange on housing with 10 mm thick permanently flexible sealant. Care shall be taken to ensure that ducts on both sides of the connection are independently supported and that no "bridging" occurs.
- 3 All flexible connection will be an approved manufacturer, with ratings of fire spread, strength etc., listed by a recognised Testing Authority.
- 4 The fabric shall be rated for use up to 93 °C working temperature with a tensile strength of not less than 690 kPa.
- 5 The material shall also be impervious to moisture, dimensionally stable, and shall not rot.

6.2.9 Access Panels

- 1 Duct access doors shall be minimum 450 x 300 mm. All access panels shall be constructed from double thickness galvanized steel sheets, thickness to suit the duct insulation with necessary reinforcing inside for rigidity with space filled with glass fibre insulation. Panels shall be made airtight with a continuous neoprene rubber gasket.
- 2 Openings in ductwork shall be provided with continuous galvanized reinforcing bars, which on insulated ductwork, shall be extended to the face of the insulation. Small panels shall be provided with at least two brass window sash fasteners. All panels shall have brass drawer type handle.
- 3 Apparatus access doors shall be minimum 600 x 1500 mm with angle or channel frame. Provide two 75 mm strap hinges with brass pins; and two handles minimum, operate from inside and outside.
- 4 Provide access panels where shown, required and directed and in the following locations:
 - (a) bottom of all duct risers
 - (b) next to outside intakes and outlets
 - (c) at each fire damper
 - (d) into apparatus casings to facilitate maintenance and cleaning of all components
- 5 The duct access doors shall be fitted with CAM type to locks spaced to minimise leakage and drawer type handles.

6.3 BALANCING

6.3.1 Balancing Dampers

- 1 Install volume dampers in accessible locations at all branch connections and wherever necessary to adjust the flow of air to secure correct distribution. They shall be made of galvanized sheet metal, and be equipped with an approved device for fastening in any desired position. This device shall be such that the damper cannot move or rattle and pointer shall indicate the position of the damper from the outside of the finished duct insulation and shall be clearly marked with words 'Open and Shut'.
- 2 Dampers shall be multi-leaf opposed blade with blade height not more than 1.80 mm. PVC or similar blade seals shall be incorporated to the end of all blades. The blades shall be of an aerofoil design.
- 3 All blades shall be operated by a single operating quadrant with gears and links as necessary.

- 4 Spindles shall be non-corrodible, passing through non-ferrous bushings or ball bearing supports with seals.
- 5 The whole damper assembly shall be mounted in a galvanized frame with flanges.
- 6 Seal material shall be rated up to 93°C with low water absorption and excellent chemical resistance to acids, alkalis and oils.

6.3.2 Flow Control Dampers

- 1 These dampers shall be installed in ductwork to maintain a constant air flow regardless of changes of pressure conditions. The damper shall be suitable for duct velocities ranging between 2 m/s to 8 m/s and shall operate from a minimum pressure of 20 Pa up to a maximum of 200 Pa. These dampers shall be installed in branch ducts fitted with high efficiency particle (HEPA) filters.

6.3.3 Motorised Dampers

- 1 The Contractor shall furnish and install, control dampers as required for the proper functioning of the system.
- 2 All control dampers shall be opposed blade.
- 3 Dampers frames shall be formed channels of not less than 1.8 mm galvanized steel with mounting holes for enclosed duct mounting.
- 4 Damper blades shall be of not less than 1.5 mm form galvanized steel. Blades on multi-blade dampers shall not exceed 200 mm in width and 1200 mm in length. Blade shaft bearings shall be provided at the ends of each blade. Blade side edges shall seal off against spring stainless steel seals.
- 5 Dampers shall be supplied in standard sizes, in 50 mm even increments, with transition as necessary to mating duct sections.
- 6 Dampers shall be suitable for operation within the temperature limit of – 40 °C to 93 °C. Horizontal dampers shall have a rated face velocity of 2 m/s at 1500 Pa static pressure differential.
- 7 Dampers used for shut off function shall be of the low leakage type.
- 8 Damper blades shall have neoprene or PVC edging on all outside air dampers.

6.3.4 Backdraft Dampers

- 1 Backdraft dampers shall be low leakage with parallel blades and neoprene edge seals.
- 2 Damper frames shall be constructed from galvanized sheet steel with aluminium blades. Bearing shafts shall be stainless steel, in brass bearings.
- 3 All blades shall be coupled at the blade centres and shall be in width of not more than 1000 mm, with maximum blade size of 200 mm.
- 4 Leakage shall not exceed 10 m³/h per m² at 1000 Pa pressure differential.
- 5 Pressure relief dampers shall be multi-parallel blade with weighted arm closing assist. The frame shall be anodised aluminium channel sections with formed aluminium blades. Maximum blade length shall be 100 mm, and polyester foam seating strips shall be incorporated on blade edges. Bearing shall be in PVC with non-corrodible shafts.

6.3.5 Splitter Dampers

- 1 In each low pressure system take off where opposed blade duct dampers are not specified, splitter dampers shall be provided. The only justification for not providing splitters is in a system which can be demonstrated to be sized by a static regain programme and which is run in high pressure fittings. Otherwise splitter dampers shall be installed at all take offs.
- 2 Splitters shall consist of hollow blades in a vane rail assembly, made from galvanized steel by a recognised manufacturer.
- 3 A lockable quadrant adjustment level shall be located outside the insulation, and marked clearly to show vane position.

6.3.6 Fire Dampers

- 1 Provide, where required by ordinances or codes, for dampers made to BS 476 or North American Standards or NFPA 90A, and complete with angle iron frame of 3 mm thickness, 70 °C fusible link, pivot rods, and spring catches. Fire damper housings shall be galvanized steel duct sections around the fire dampers, and shall allow 100% unrestricted duct area while in the open position. Provide approved type access doors, with airtight gaskets, for inspection and servicing of fire dampers. Fire dampers shall be 2 hour rated and shall be labelled by manufacturer. The fire damper blades shall be out of the air stream.
- 2 Provide fire dampers in all duct over 125 cm² in area, in the following locations, whether or not specifically required by ordinances and codes and as indicated the contract drawing:-
 - (a) duct entering and leaving fire shafts (duct shafts)
 - (b) ducts passing through designated fire walls
 - (c) ducts through floors, and not encased in fire shaft
 - (d) ducts leaving and entering plant area
 - (e) ducts entering and leaving storage areas.
- 3 Where fire dampers are located remote from fire partition, duct between fire damper and partition shall be encased in double metal lathe and plaster or other fireproofing acceptable to Authorities having jurisdiction. This shall be arranged and paid for by this trade.
- 4 Dampers shall be operated by two stainless steel springs with the blades being held in the open position by a fusible link and stranded stainless steel strap. Blades shall be made from galvanized steel.
- 5 Fire dampers shall not be installed in kitchen exhaust ductwork. This shall comply in all respects with NFPA 96.

6.3.7 Smoke Dampers

- 1 Smoke dampers shall be the low leakage type, rated under UL 555 S as leakage Class I.
- 2 Frame shall be of formed channel of not less than 1.6 mm galvanized steel. Blades shall be 1.6 mm, airfoil shaped, double skin construction, opposed blade type.
- 3 Blade edge seals shall be silicon rubber and jamb seal shall be flexible metal compression type.
- 4 Bearings shall be stainless steel sleeve type pressed into frame.
- 5 Damper actuators shall be factory furnished suitable for either 240 volt or 24 volt application. Complete unit shall be factory tested in compliance with UL 555 S.
- 6 Damper and actuator shall be qualified under UL 555 S to an elevated temperature 120 °C.

- 7 The damper unit shall be supplied with a two position indicator switch linked directly to the damper to provide the capability of remotely indicating damper blade position.

6.4 SILENCERS

6.4.1 General

- 1 Silencers shall be installed when required to achieve the specified noise levels.
- 2 At shop drawing stage, the contractor will undertake calculation for every unit and every area and determine the insertion loss required to meet the stated noise criterion.
- 3 Supply and return duct noise must be considered as well as duct breakout noise.
- 4 Materials of construction shall be galvanized sheet metal and mineral fibre acoustic fill which is inorganic, inert, moisture and vermin resistant. Silencers shall be so constructed as to prevent erosion and pregnability of the acoustic fill.
- 5 The silencers shall incorporate a removable panel which provides complete access to all internal surfaces for cleaning and also permits removal and replacement of acoustic fill.
- 6 Silencers shall be factory made, and shall have available certified test data concerning insertion loss. This must be available when required, in advance of ordering units. Where a silencers is made under licence, or part assembled locally, then tests must also be made after assembly and witnessed by and independent authority.
- 7 The static pressure loss of any required silencer must be considered in air handling equipment original selection.
- 8 Silencers shall be installed in locations as indicated on the contract drawings.
- 9 Silencers shall be flanged to exactly match the adjacent ductwork in which they are to be installed.

6.5 DIFFUSERS AND REGISTERS

6.5.1 General

- 1 Diffusers, registers and grilles shall be arranged for flush mounting in lay-in type ceilings and over lap mounting in plaster, mineral tile and similar ceilings, with concealed fixings unless otherwise directed
- 2 Grilles, register and diffuser locations shall be adjusted to suit reflected ceiling drawings, or Engineer's site instructions. All grilles, registers, diffusers, louvres shall be from one manufacturer.
- 3 Provide plaster frame for grilles, and diffusers installed in plaster ceilings,
- 4 All diffusers, grilles and registers shall be supplied completely factory powder coated. Finish colour shall be to the approval of the Architect. The interior of all grilles and diffusers is to be factory painted matt black.
- 5 All supply grilles and diffusers will have opposed blade balancing dampers. All will have foam rubber sealing band around the edge to seal to the structure. All pivots will be round section, not of formed sheet, and not relying on a spring steel locking wire.
- 6 Basic grilles and diffuser materials shall be aluminium extruded sections. Sections in the air stream shall be carefully selected to minimise turbulence.
- 7 All grilles and diffusers supplied on this project shall be tested and rated in accordance with ASHRAE Standard 70-72, ADC Test Code 1062-GRD and ISO 3741 or have ARI certification.

- 8 Linear bar grilles shall be fabricated from aluminium, with 6.4 mm wide bars on 12.5 mm centres pressed into a notched steel retaining bar. The core can be either welded into the outer frame, or where the grille is used in a sill application, held in the outer frame by spring clips fixed to the core retaining bar. The outer frame shall be 35 mm deep and shall have a visible flange 25.4 mm wide, milled end caps shall be welded to give a near invisible joint. The grill shall be complete with an opposed blade damper painted matt black, and shall be fixed with universal mounting brackets. Both the damper and the fixing brackets shall be accessible through the face of the grille. Continuous grilles shall be provided with positive alignment strips, which fit into special keyways extruded into the frame of the grille to ensure clean unbroken lines.
- 9 Ceiling Diffusers shall be multi-core giving 4 way horizontal discharge. The three centre cores of the diffuser shall be manufactured from pressed aluminium, with the remaining cores and the outer frame fabricated from extruded aluminium welded at the corners to give near invisible joints. One, two and three way pattern cores shall be used as indicated on schedules. All cores shall be interchangeable. The core shall be removable without the use of special tools, but for safety, shall be fixed to the outer frame by a small length of chain. The diffuser shall be complete with an opposed blade damper painted matt black." The damper shall be adjustable through the face of the diffuser".
- 10 Wall registers shall be double deflection fabricated from aluminium, the front vanes being horizontal, the rear vanes vertical. This grille shall be complete with an opposed blade damper painted matt black and adjustable from the face of the diffuser. Both sets of vanes shall be fully adjustable without the use of special tools.
- 11 Eggcrate return or extract grille shall be provided with 12.7 mm x 12.7 mm openings, giving a free area of 90 %. The core shall be fixed into an extruded aluminium frame, with welded corners and a 25 mm face flange. The grille is complete with an opposed blade damper painted matt black and adjustable through the face of the diffuser.
- 12 Circular ceiling diffuser shall be of aluminium construction with two concentric inner spinings. The diffuser core shall be fully adjustable for vertical or horizontal air discharge, and shall be removable without the use of special tools. An iris damper shall be provided in the neck of the diffuser which is adjustable from the diffuser face.
- 13 Vision proof door transfer grilles shall consist of an aluminium core with inverted-vee type blades, and an extruded aluminium frame with matching rear flange. The frame shall be adjustable from 28 mm to 60 mm to suit the door width. Transfer grilles for 'LIGHT TIGHT' applications such as dark rooms shall be with two vision proof cores back to back.
- 14 Linear slot diffusers shall provide an unobtrusive continuous air diffusion with a pleasing aesthetic appearance. Hairline butt joints shall ensure clean unbroken linear runs for active and dummy sections. The diffusers shall be complete with pattern control blades, fully adjustable from face of diffuser through 180 degrees and shall be fitted with end caps at each end. The diffuser members shall be constructed from high quality aluminium extrusions to BS 1474 while the pattern control blades shall be of black rigid PVC or aluminium extrusions.

6.6 LOUVRES

6.6.1 Outside Louvres

- 1 Outside louvres shall be supplied with sleeves for the appropriate openings, and with full installation instructions.

- 2 Louvres shall be extruded aluminium frame with aluminium blades of not less than 2 mm thickness, and shall be firmly fixed so as not to vibrate. Unsupported blade width shall not exceed 1800 mm.
- 3 Behind each louvre shall be an insect mesh screen 6 x 6 mm made from 2 mm diameter wire. The screen will be clamped by a 20 mm frame and will be firmly fixed to the outer edges of the louvre. The screen and frame shall be hot dip galvanized after fabrication.
- 4 The connection to the louvre shall be flexible and shall ensure no duct load is transmitted to the louvre.
- 5 Louvres shall be provided with powder coated finish to the approval of the Architect.

6.6.2 Sand Louvre

- 1 Sand louvres shall have a double deflection inlet passage to separate sand from incoming air by means of centrifugal forces.
- 2 Separation efficiency shall not be less than 80 % on 20 to 200 micron test dust, and 50 % on 1 to 70 micron test dust.
- 3 Sand louvre shall be mill finished aluminium sections with casing 2 mm thick and blades 1.5 mm thick. The base of the louvre shall have self-emptying sand holes.
- 4 Pressure drop at 2 m/s average face velocity shall not exceed 85 Pa.
- 5 Insect mesh shall be included.
- 6 Sand louvres shall be provided with powder coated finish to the approval of the Engineer.

END OF PART