TECHNICAL SPECIFICATIONS

SHEET METAL WORKS AND ACCESSORIES - SPECIFICATIONS

1. SCOPE

1.1 The scope of this section includes supply, fabrication, installation & testing of all sheet metal ducts, supply, installation; testing & balancing of all grills & diffusers as per specifications & drawings.

1.2 Except as otherwise specified all ductwork and related items shall be in accordance with these specifications.

1.3 Duct work shall mean all ducts, casings, dampers, access doors, joints, stiffeners and hangers.

2. DUCT MATERIALS

2.1 The ducts shall be fabricated from galvanized steel sheets class VIII - Light coating of Zinc conforming to ISS:277-1962 (REVISED) and with a galvanising thickness of nominal 120 GM. per SQM surface area.

Only new, fresh, clean (unsoiled) and bright GI sheets/Aluminium shall be used. The Owner / Consultants reserve the right to reject summarily sheets not meeting these requirements. Fabrication of ducts shall be through Lock formers.

2.2 All duct work, sheet metal fabrication unless otherwise directed, shall strictly meet requirements, as described in IS:655-1963 with Amendment-I (1971 Edition)

<table>
<thead>
<tr>
<th>Longer size of Duct</th>
<th>Sheet Thickness GI(MM)</th>
<th>Type of Joints</th>
<th>Bracing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 750</td>
<td>0.63</td>
<td>GI Flange</td>
<td></td>
</tr>
<tr>
<td>751-1000</td>
<td>0.80</td>
<td>25x25x3 mm angle iron frame with 8 mm Dia nuts &amp; bolts</td>
<td>25X25X3 MM @ 1M</td>
</tr>
<tr>
<td>1001-1500</td>
<td>0.80</td>
<td>40x40x5 mm angle iron frame with 8 mm Dia nuts &amp; bolts</td>
<td>40x40x5 MM @1M</td>
</tr>
<tr>
<td>1501-2250</td>
<td>1.00</td>
<td>50x50x5 mm angle iron frame with 10 mm Dia nuts &amp; bolts at 125 mm center</td>
<td>40x40x3 mm @ 1.2m to be braced diagonally.</td>
</tr>
<tr>
<td>2251 &amp; above</td>
<td>1.25</td>
<td>50x50x6 mm angle iron frame with 10 mm Dia nuts &amp; bolts at 125 mm center</td>
<td>40x40x3 mm @ 1.6m diagonally braced</td>
</tr>
</tbody>
</table>

2.3 Ducts larger than 450 mm shall be cross broken, duct sections upto 1200 mm length may be used with bracing angles omitted.

2.4 Changes in section of ductwork shall be affected by tapering the ducts with as long a taper as possible. All branches shall be taken off at not more than 45 Deg. Angle from the axis of the main duct unless otherwise approved by the Engineer-in-Charge.
2.5 All ducts shall be supported from the ceiling/slab by means of M.S. rods of 10 MM Dia with M.S. angle at the bottom of size 40 mm x 40 mm x 6 mm for sizes upto 1500 mm at 3 m intervals. Above size 1500 mm upto 2250, support shall be provided with 10 mm dia. MS rod and MS angle size 50 mm x 50 mm at bottom at 2.5 m intervals. Above size 2250 mm support shall be provided with 12 mm dia MS rod and MS angle size 50 mm x 50 mm at bottom.

3. INSTALLATION

3.1.1. All ducts shall be fabricated and installed in workman like manner, generally conforming to relevant BIS codes. Round exposed ducts shall be die formed for achieving perfect circle configuration.

3.1.2. Ducts so identified on the drawing shall be acoustically lined and thermally insulated as described in the section ‘Insulation’ and as indicated in ‘Schedule of Quantities’. Duct dimensions shown in drawings are overall sheet metal dimensions inclusive of the acoustic lining where required and indicated in ‘Schedule of Quantities’.

3.1.3. Ducts shall be straight and smooth on the inside with neatly finished joints. All joints shall be made air tight.

3.1.4. All exposed ducts upto 60 cm width within conditioned spaces shall have slip joints. The internal ends of the slip joints shall be in the direction of airflow. Ducts and accessories within ceiling spaces visible from air conditioned areas shall be provided with two coats of matt black finish paint.

Change in dimensions and shape of ducts shall be gradual. Air turns shall be installed in all vanes arranged to permit the air to make the turn without appreciable turbulence.

3.1.5. Ducts shall be fabricated as per details shown on drawings. All ducts shall be rigid and shall be adequately supported and braced where required with standing seams, tees of ample size to keep the ducts true to shape and to prevent buckling, vibration or breaking.

3.1.6. All sheets metal connections, partitions and plenums required to confine the flow of air to and through the filters and fans shall be constructed of 18 Gauge GSS thoroughly stiffened with 25mm x 25mm x 3mm angle iron braces and fitted with all necessary inspection doors as required to give access to all parts of the apparatus. Doors shall be not less than 45cm X 45cm in size.

3.1.7. Plenums shall be panel type and assembled at site. Fixing of MS angle iron flanges of duct pieces shall be with rivet heads inside i.e. Towards G.S. sheet and riveting shall be done from outside.

3.1.8. Rubber gasket 3 mm thick shall be used between duct flanges and between duct and duct supports instead of felt in all ducting installation for complete sealings.

3.2.1. During the construction, the Contractor shall temporarily close duct openings with sheet metal covers to prevent debris entering ducts and to maintain opening straight and square, as per direction of Engineer-in-Charge.
3.2.2. Great care should be taken to ensure that the duct work does not extend outside and beyond height limits as noted on the drawings.

3.2.3. All duct work shall be of high quality approved galvanized sheet steel guaranteed not to crack or peel on bending or fabrication of ducts. All joints shall be tight and shall be made in the direction of air flow.

The ducts shall be re-inforced where necessary, and must be secured in place so as to avoid vibration of the duct on its support.

3.2.4. All air turns of 45 degrees or more shall include curved metal blades or vanes arranged so as to permit the air to make the abrupt turns without an appreciable turbulence. Turning vanes shall be securely fastened to prevent noise or vibration. All ducts shall be fabricated and installed in accordance with modern design practice. The sheet metal gauges and fabrication procedures as given in I.S.S. specifications shall be adhered to and shall be considered as an integral part of these specifications.

3.2.5. The duct work shall be varied in shape and position to fit actual conditions at building. All changes shall be in accordance with accepted duct design and subject to the approval of the engineer-in-charge. The Contractor shall verify all measurements at building and shall notify the Engineer-in-Charge of any difficulty in carrying out his work before fabrication.

3.2.6. Sponge rubber or approved equal gaskets shall be installed between all connections of sheet metal ducts to walls. Sheet metal connections shall be made to walls and floors by means of galvanized steel angles anchored to the building structure with anchor bolts and with the sheet bolted to the angles. Sheet metal connections shall be as shown in the drawings or as directed by Engineer-in-Charge.

3.2.7. All ductwork shall be independently supported from building construction. All horizontal ducts shall be rigidly and securely supported, in an approved manner, with trapeze hangers formed of galvanized steel rods and galvanized steel angle/channel under ducts. All vertical ductwork shall be supported by structural members on each floor slab. Duct supports may be through galvanized steel insert plates left in slab at the time of slab casting. Galvanized steel cleat with a hole for passing the hanger rods shall be welded to the plates. Trapeze hanger formed of galvanized steel rods and angles/channel shall be hung through these cleats. Wherever use of metal insert plates is not feasible, duct support shall be through dash/anchor fastener driven into the concrete slab by electrically operated gun. Hanger rods shall then hang through the cleats.

3.2.8. Where ducts pass through brick or masonry openings, it shall be provided with 25 mm thick TF quality thermocole around the duct prior to sealing of the opening.

3.2.9. All ducts shall be totally free from vibration under all conditions of operation. Whenever ductwork is connected to fans, air handling units or blower coil units that may cause vibration in the ducts, ducts shall be provided with a flexible connection, located at the unit discharge. Flexible connections shall be constructed of fire retarding flexible heavy canvas sleeve at least 10 cm long securely but not more than 200 mm bonded and bolted on both sides. Sleeve shall be made smooth and the connecting ductwork rigidly held by independent supports on both sides of the flexible connection. The flexible connection shall be suitable for pressure at the point of installation.
3.2.10. Flanges and supports are to be black, mild steel and are to be primer coated on all surfaces before erection and painted with aluminium thereafter. Accessories such as damper blades and access panels are to be of materials of appropriate thickness and the finish similar to the adjacent ducting, as specified.

3.2.11. The ductwork should be carried out in a manner and at such time as not to hinder or delay the work of the other agencies especially the boxing or false ceiling Contractors.

4. DAMPERS

4.1 At the junction of each branch duct with main duct and split of main duct, volume control dampers must be provided. Damper shall be rigid in construction to the passage of air.

4.2 The volume dampers shall be of an approved type, lever operated and complete with suitable level links & quadrants, locking devices which will permit the dampers to be adjusted and locked in any position.

4.3 The dampers shall be of opposed blade or louver type. The damper blade shall not be less than 1.25 mm (18) gauge and shall not be over 225 mm wide. Automatic and manual volume opposed blade dampers shall be complete with frames and bronze bearings as per drawings. Damper frames shall be constructed of 16 gauge steel

4.4 After completion of the duct work, dampers are to be adjusted and set to deliver the required amount of air as specified in the drawings.

5. MISCELLANEOUS

5.1 Sponge rubber gaskets also to be provided behind the flange of all grills.

5.2 Each shoot from the duct, leading to a grille, shall be provided with an air deflector to divert the air into the grille through the shoot.

5.3 Inspection doors measuring at least 450 mm x 450 mm are to be provided in each system at an appropriate location, as directed by Engineer-in-Charge.

5.4 Diverting vanes must be provided at the bends exceeding 600 mm and at branches connected into the main duct without a neck.

5.5 Proper hangers and supports should be provided to hold the duct rigidly, to keep them straight and to avoid vibrations. Additional supports are to be provided where required for rigidity or as directed by Engineer-In-Charge.

5.6 All duct supports, flanges, hangers and damper boxes etc. Shall be given 2 coats of red oxide paint before installation and one coat of aluminium paint after the erection, at no extra cost.

5.7 All angle iron flanges are to be welded electrically and holes to be drilled.

5.8 All the angle iron flanges are to be connected to the GSS ducts by rivets at 100 mm centres.
6. **GRILLS / DIFFUSERS**

6.1 **SUPPLY AND RETURN AIR DIFFUSERS**

Supply and return air diffusers shall be made of extruded aluminium section as specified in BOQ. The diffusers shall be powder coated in finish. Supply air diffusers shall be provided with screw operated opposed blade volume control devices of extruded aluminium in black anodised finish. The diffusers shall be suitable for concealed fixing arrangement and as approved by Architect/Consultant.

The diffusers shall be provided with removable central core.

All diffusers shall be selected as per selection curves and in consultation with Architect / Consultant. All diffusers shall have soft continuous rubber/foam gasket between the periphery of the diffusers and the surface on which it has to be mounted.

6.2 **LINEAR GRILLS:**

Linear continuous supply or return air grills shall be extruded aluminium construction with fixed horizontal bars at 15 - 30° inclination with flanges on both sides. The thickness of fixed bar louvers shall be 5 mm in front and the flange shall be 20mm wide with round edges. The grille shall be suitable for concealed fixing and horizontal bars of the grille shall be mechanically crimped from the back to hold them.

Volume control device of extruded aluminium construction in black anodised finish shall be provided in S.A. duct collars.

6.3 **DOUBLE ADJUSTABLE LOUVERED SUPPLY / RETURN AIR GRILLS WITH HORIZONTAL/VERTICAL OR VERTICAL/ HORIZONTAL LOUVER ARRANGEMENT:**

The grille shall be adjustable as each louver shall be pivoted to provide pattern with 00 to plus or minus 150 ARC up to 300 deflection down towards. The louvers shall hold deflection settings under all conditions of velocity and pressure. The rear louver of the register shall be in black shade.

Volume control device of extruded aluminium construction with black anodised finish shall be provided in S.A. grills.

6.4 **EXHAUST AIR REGISTER:**

Exhaust air register shall be made of extruded aluminium with fixed horizontal louvers at 40 degree angle setting on a 20 mm louvers pitch. The register shall have 20 mm wide flange with round edges all around. The register shall be suitable for front screw fixing.

Volume control device of extruded aluminium construction with black anodised finish shall be provided.

6.5 **MULTI SLOT CEILING DIFFUSERS:**
Multi slot ceiling diffuser shall be made of extruded aluminium with various slot width and air pattern deflectors. Deflectors in each slot provide an adjustable air pattern of 180 degrees full. A special plenum shall be provided for each supply air diffuser. The linear diffuser shall have alignment strips to give straight look while installation.

Hit & miss type volume control damper of extruded aluminium construction with mill finish shall be with multislot supply air diffuser.

6.6 LINEAR CEILING MOUNTED DIFFUSERS:

Linear ceiling mounted air terminals shall be made of extruded aluminium surface mounted one way or two way pattern. The linear terminal shall have alignment strips to give straight look while installation.

Volume control device of extruded aluminium construction in mill finish shall be provided in S.A. diffuser.

6.7 FRESH AIR INTAKE LOUVERS:

Fresh air intake louvers 50 mm deep (minimum) wherever required as per shop drawing will be made of extruded aluminium construction duly anodized or powder coated. Bird/insect screen will be provided with the intake louvers. The blades are inclined at 45° on a 40 mm blade pitch to minimise water ingress. The lowest blade of the assembly shall extended out slightly to facilitate disposal of rainwater without falling in door/wall on which it is mounted.

Wherever specified, the intake louvers shall be provided with factory fitted all aluminium construction volume control dampers in black anodised finish.

8. PAINTING

8.1 All grilles, and diffusers shall be powder coated in colour as approved by Architect/Consultant before installation.

8.2 All ducts immediately behind the grilles/diffusers etc. Are to be given two coats of black paint in Matt finish.

9. TESTING

9.1 After completion, all duct system shall be tested for air leakage.

9.2 The entire air distribution system shall be balanced to supply the air quantity as required in various areas and the final balance of air quantity through each outlet shall be submitted to the engineer-in-charge for approval. Measured air quantities at fan discharge and at various outlets shall be identical to or less than 5% in excess of those specified and quoted. Branch duct adjustments shall be permanently marked after air balancing is completed so that these can be restored to their correct position if disturbed at any time.
3. DUCT ACOUSTIC LINING

The ducts so identified and marked on drawings and in 'Schedule of Quantities' shall be provided with acoustic lining of thermal insulation material as follows:

3.1 MATERIAL FOR DUCT LINING

The material to be used for duct lining shall be 12/25 mm thick resin bonded glass wool having a density of 32 kg/cu.mt and covered with 26 gauge thick perforated aluminum sheet with atleast 20% perforation. The value at 32°c shall not be less than 0.034 KCAL/HR/MTR/ Deg C.

3.2 APPLICATION

a) Clean inside surface of the duct
b) Apply a coat of CPRX compound
c) Fix the board inside the duct provided with GI channel 25 x 25 mm screwed on duct surface with self tapping screws to make grid of 600 x 600 mm.
d) The inner surface should now be covered with fibreglass RP tissue.
e) Cover the insulation boards with 26 G perforated aluminium sheet with atleast 20% perforation
f) Secure the insulation board and aluminium sheet with cadmium plated bolts and washers
g) Seal the ends completely so that no insulation material is exposed.
<table>
<thead>
<tr>
<th></th>
<th>APPROVED MAKES OF EQUIPMENT &amp; MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Air Distribution/Ducting GI Sheets</td>
</tr>
<tr>
<td>2.</td>
<td>Extruded Aluminium Grills/Diffusers</td>
</tr>
<tr>
<td>3.</td>
<td>GI Volume Control damper</td>
</tr>
<tr>
<td>4.</td>
<td>Glass wool</td>
</tr>
</tbody>
</table>

Note: For any other item required for successful completion, but not included in the above list the Contractor shall take prior written approval from the Consultant.