**Materials**

1. **Casing** – The silencer casing shall be made of 0.7mm thick galvanized steel sheet for attenuator of size up to 450mm width X 450mm height, 1.0mm thick for silencer of size up to 900mm width x 900mm height, and 1.2mm thick for silencer of a size larger. The casing shall be accurately pre-punched with appropriate holes for assembly of splitters, flanges, and adjacent modules. The splitter frame, inlet, and outlet fairings shall be made of the same thickness galvanized steel sheet similar to the casing.
2. **Perforated Lining** – Perforated linings shall be made of 0.5mm thick galvanized steel sheet perforated with 2.5mm diameter holes arranged staggered pattern with 5mm triangular pitch.
3. **Angle Frame** – The angle frame shall have a flange of 40mm wide by 2.5mm in thickness for silencer size up to 1200mm width x 1200mm height, 50mm wide by 2.5mm in thickness for silencer size up to 2400mm width x 1200mm height and 50mm wide by 5mm in thickness for larger silencers. All angle frames shall be cold-formed from a 2.5mm thick pre-hot-dip galvanized steel sheet of Z27 zinc coating. Five mm thick frame shall be constructed with double thickness cold-formed angles.
4. The galvanized steel sheet shall all be hot-dipped galvanized to a minimum zinc coating of Z18 according to JIS Standard and of roll forming quality.
5. **Acoustic Infill** – Acoustic infill shall be of fiberglass of the appropriate density for maximum insertion loss performance. The material shall be non-combustible and meets Class 'O' requirements to BS Standard BS476 Part 6 and Part 7. It shall be inert, vermin- and moisture-proof.
6. **Glass Cloth Fabric** (Optional) – The cloth fabric shall be used with the perforated lining for protection against fiberglass erosion. The material shall be not more than 1.0mm in thickness and shall be non-combustible. The silencer with glass cloth shall have been tested for its sound insertion loss in an accredited laboratory, and the test report shall be submitted for approval.

**Construction**

1. The silencer shall be constructed of a casing, splitters, and connecting flanges. The casing shall have snap-lock corner joints angle-reinforced to give it strength. The joints shall be filled with silicone sealant to prevent air leakage to a minimum pressure of 2000 Pascals.
2. The splitter shall consist of a die-formed bullnose fairing, a steel frame constructed of cold-formed angles, perforated steel linings, and acoustic infilled. The perforated sheet lining shall be riveted to the splitter frame; tack or spot welding shall not be allowed. These parts shall be assembled to form an aerodynamic shape splitter. When assembled within the casing, the splitters form bell mouth entrance and tapered discharge for uni-direction airflow. For bi-direction airflow, the splitter shall be designed with bullnose and taper ends. The aerodynamic splitter design with selected infill and perforated lining shall meet the specified sound attenuation with less airflow resistance and lower generated noise. The acoustic infill shall be packed within the splitter frame to a minimum of 5 percent compression to prevent void forming.
3. Fiberglass cloth fabric (optional) required to prevent erosion of fiberglass infill shall be fastened together with the perforated sheet lining to the splitter frame with aluminium rivets.
4. Splitters shall be fastened to the casing with 4.75mm diameter high-quality aluminum rivets. No tack or spot welding shall be allowed.

**Performance**

The subcontractor shall submit the brand, the manufacturer name, the type of silencer, size, acoustic, and aerodynamic performance for approval. The test report shall be submitted for approval before ordering. The silencer should have been tested in an accredited laboratory for pressure loss, static and dynamic sound insertion loss (SIL and DIL), and generated noise according to ASTM Standard E477-99. For the DIL, the attenuator shall be tested with airflow in the forward and reverse direction in relation to the noise source. Test shall be conducted based on 600mm width by 600mm height silencer with length starting at 600mm and at increments of 600mm to 2400mm in length. For silencers smaller than 600mm width x 600mm height, test shall be carried out on smaller test units to provide accurate aero-acoustic performance for small silencers. Length of small test silencer shall start at 600mm, at increment of 600mm to a maximum of 2400mm.

The pressure loss across the silencer shall not exceed the values, as shown in the silencer schedule.

The fan manufacturer shall submit accurate fan sound power levels for the silencer manufacturer to perform noise analysis to determine the dynamic insertion loss required to achieve the specified noise criteria. Noise analysis and resultant silencer selection and pressure loss shall be submitted for approval before proceeding to manufacture. The fan manufacturer shall adjust the fan static according to the selected silencer pressure loss.

The silencer shall be similar to OLSON Acoustics Model HA40 silencer as manufactured by OLS Manufacturing Co. Pte Ltd or equivalent.