



Design by Initiative LLC

Engineering Document - High Acoustic attenuation - Steel or Aluminum (>0.100") Enclosure specification

Introduction

Panel derived high density steel using (typical subject to required attenuation 6lbft² mineral wool insulation or 0.100" aluminum with 8lbft² insulation enclosure system providing high impact resistance to satisfy specifications or preferences requiring high grade enclosures. Essential to achieve low noise levels while maintaining low static pressure drops. *Note: Matching of enclosure stiffness and insulation density/absorption provide for superior sound performance than 4 inch thick, 0.040 / 0.080' aluminium skinned derivatives filled with fiberglass.* 150 mph wind rating with ease. The 2 inch enclosure thickness provides greater volume (ref static pressure drop) and increased floor space for a given package foot print.

Typical definitions used within the industry.

Level 1 - Weather resistant un-attenuated option. No air intake or discharge ducts

Level 2 - Sound attenuation- air discharge duct/splitter attenuator. (typ 600fpm/1000fpm)

Level 3 - Level 2 plus air intake hood or splitter attenuator (typ 1000fpm).

In all cases however dB(i) prefer to design to a given acoustic target and are capable / willing to quote actual anticipated noise external to enclosure or at specified boundary based upon accurate engine data.

1.0 Weather Ingress Protection (IP Code) and Testing

- 1.1 Weather protection shall be IP12 as defined in BS EN 60529. (IP code)
- 1.2 Intake air velocity shall be no greater than 1000 ft/min (5.08 mtrs/sec) at any first point of entry or air into the enclosure.
- 1.3 Wet area's (e.g. air discharge plenum if fitted) shall have a continuous fall to permanent open water run off drains.
- 1.4 Exhaust silencer shall be internally mounted.
- 1.5 Exhaust tail pipe if vertical gas discharge (preferred) shall be fitted with rain flap.
- 1.6 Exhaust tail pipe if horizontal shall be 45^o mitered and fitted with ingress protection IP2X per BS EN 60529.
- 1.7 The exhaust tailpipe when transiting the roof shall have an air gap between the exhaust pipe and roof panel with a minimum 1 inch up-stand and weather guard attached to the pipe. The weather guard lower edge shall have a minimum of 1/2" clearance above the roof. Exhaust tailpipe shall not make contact with any part of the roof so not to provide a heat transfer path to protect the integrity of the painted steel.
- 1.8 Hinged doors shall be fitted with a continuous bubble door seal of 0.625" diameter.
- 1.9 Bolted access covers to dry areas shall be neoprene gasketed at a minimum dimension of 2 .000' x 0.125 thick.
- 1.10 In the event that the enclosure is to be attached to a supporting fabrication the supporting fabrication shall have a anti capillary ingress barrier attached and sealed to the periphery of enclosure mating face inboard of the enclosure internal edge at a minimum height of 1.500'. This to prevent water entering the dry area via the enclosure to supporting fabrication joint.
- 1.11 Enclosure shall be nitrile rubber gasketed at a minimum dimension of 0.250" thick x width of the enclosure flange between the enclosure and the supporting fabrication.
- 1.12 If the enclosure is to be affixed to a concrete foundation pad; the concrete pad flatness variance is to be within 0.375" across the mating surfaces. An anti capillary system similar to that outlined in 1.9 shall be provided by installer. Gasketing as described in 1.10 should be used to aide corrosion resistance (abrasion avoidance) by installer.

- 1.13 The completed enclosure shall be leak tested prior to shipment per practicable application of pertinent procedure outlined in the IP code

2.0 Construction

- 2.0 **Panel material:** 12 or 14 ga (dependant on size and noise level) gauge sheet steel to ASTM A569 or 0.100" 5052 in respect of Aluminum.
Note. Panel depth 2" down to 85 @ 3,3 ft noise level when used with mineral wool insulation of correct weight and perforated sheet facing. Depth to increase below this noise level
- 2.1 **Enclosures greater** in height than 120 inches, horizontal header rails no less than 6 inches in height manufactured from 12 gauge ASTM A569.
- 2.2 **Excepting enclosure extremities** ends of header and footer rails shall not align with vertical panel joints.
- 2.3 **Roof panels** shall be of interlocking panel type, sloped by and will incorporate a water run off fall rate of 0.1"/ft.
Maximum deflection at panel joint with weight across two joints to be 0.0000108 inch/lb/foot.
- 2.4 **Sufficient** internal bracing shall be provided to prevent undue racking integrity for prevailing wind loading (typical wind loading 150 mph) and or structural integrity for installed components.
- 2.5 **Corners / Return** flanges of folded Panels / Doors to be fully welded. Welds associated with any mating surfaces are to be ground flush and finished to grit grade 60.
- 2.6 **Any externally** visible welds shall be finished ground to 240 grit grade.
- 2.7 **Appropriate additional structure** shall be incorporated where necessary for mounting of internally or externally mounted equipment or project wind rating.
- 2.8 **Panels shall** be bolted using flanged lock nuts at 12-inch centers.
- 2.9 **Roof panels** shall be flange lock nut bolted on 6 inch centers using 0.250" thk x 1.750" diameter load spread washers on both sides of joint.
- 2.10 **Roof panels** shall have two formed 7 gauge ASTM A569 sheet steel C section stringers running the length exhaust for silencer support. Stringers shall be flange lock nut bolted to each roof panel joint.
- 2.11 **Lateral anti racking** beams shall be manufactured from 7 gauge ASTM A569 and shall have a minimum depth of 10".
- 2.12 **Bonding** - Panels shall be full mating face continuously bonded at assembly, following finish coating, using 3M clear adhesive/sealant rated 260 psi tensile strength, (ASTM D 412). Sealant shall have a 12.5% movement accommodation factor, and a continuous temperature service rating of -40° F to $+195^{\circ}$ F (-40° + 90° C). Sealant 1 Hour rating shall be 285° F.
- 2.13 **Access doors** shall be suitably braced to prevent excessive torque twisting for both resistance to fatigue stress and maintenance of door seal integrity.
- 2.14 **Lifting points** to lift enclosure complete with exhaust silencer or other installed on enclosure equipment shall be provided.
- 2.15 **Supporting structure.** Where the enclosure is to be mounted on a supporting e.g. skid or tank, max deflection when supported at C of G (one pivot point per side) of the supporting fabrication shall be 0.016 inch/ft, or 0.600" total deflection along the length if longer than 30 feet.
- 2.16 **Enclosure height** shall be minimized fro transportation reasons.
- 2.17 **Insulation.** Subject to noise specification. Light attenuation - Foam or perforated galvanized 18 ga steel (Perf) faced fiberglass varying between 2 to 4 inch in depth. Moderate attenuation: Perf faced Mineral wool at $6\text{lb}/\text{ft}^3$ from at 2 - 4 inches in depth. Heavy attenuation: Perf steel faced Mineral wool at $8\text{lb}/\text{ft}^3$ varying in depth from 2 to 4inches. $8\text{lb}/\text{ft}^2$ standard on aluminum.

3.0 Ventilation / temp rise from ambient to radiator core. Exhaust Connection.

- 3.1 (Typ) Heat rejection (kWt) from the internally mounted exhaust silencer shall not exceed 0.01% of generator kW_e electrical output. Exhaust silencer shall be internally insulated to achieve above.
- 3.2 Double element stainless steel low spring rate exhaust flex shall be used to connect engine to the silencer.
- 3.3 Internally positioned connecting pipe-work / flex bellows to and from the silencer shall be lagged with exhaust blankets.
- 3.4 (Typ) Static pressure within the enclosure shall not exceed 0.5"WC.

- 3.5 Irrespective of 3.5 total static pressure shall not exceed max fan capability of radiator fan (Typ 0.75")
- 3.6 Care should be taken on high air volume applications (Typ 2 mWe and above) to ensure that cross sectional area of the enclosure is not overly occupied thereby adversely increasing velocity pressure.
- 3.7 Note in view of 4.7 unless special attention proves otherwise (e.g. additional fan capability above 0.75") items such as switchgear cabinets should not be installed in an enclosure having a max width of 10'.
- 3.8 The radiator shall be connected to the enclosure using a flexible duct of sufficient temperature and pressure rating. No recirculation of air is permitted.

4.0 Corrosion Protection

- 4.1 Panels that are exposed to wet areas such as the discharge duct shall incorporate drain holes.
- 4.2 All O&P steel panel surfaces shall powder coated at a minimum DFT of 2 Mil. Galvanized panels are coated on external surfaces.
- 4.3 Powder coat shall be standard polyester with a gloss rating loss of 50% between 12 and 24 months of south Florida weathering.
- 4.4 Enclosure shall be bonded to generator ground potential.
- 4.5 Installer must inspect surface coating on completion of start up and make coating repairs per enclosure maintenance document to be supplied by **dB(i)**.
- 4.6 Supporting fabrication to be prepared and painted.
- 4.7 Any enclosure penetrations shall be sealed using bonding material as specified in 2.12.

5.0 Access and hardware

- 5.1 Walk-in Enclosures. 24 inches of access shall be maintained to the key areas e.g. side of engine, controls and or electrical distribution. 36 inches of clearance shall be provided from the front of any control panel or distribution board, per NFPA 70.
- 5.2 Walkways shall be furnished with diamond plate with kick plates where appropriate if a supporting fabrication is involved.
- 5.3 Skin Tight Enclosures. Access doors shall be provided / positioned such that routine maintenance activities may be carried out and that access to control or electrical distribution shall meet NFPA 70 with doors in the open position.
- 5.4 All door access shall be provided for adequate access. Minimum of 2 doors, 1 each side plus that needed for special equipment access.
- 5.5 Powder coated hinges appropriate to door weight shall be used. Doors locks shall be of the stainless steel recessed type.
- 5.6 One half of double doors shall utilize a two point latch mechanism.