

### **1.15 UL 891 Generator Main Circuit Breaker Switchboard**

An insulated case, 4000 amp circuit breaker shall be provided on each genset. It shall be 100% rated and UL approved. Provide the circuit breaker with a 3200 amp rating trip plug. It shall have adjustments for long, short, and instantaneous trip settings. It shall include ground fault indication with two sets of normally open and closed relay contacts for remote indication. It shall be mounted in a UL 891 Switchboard Freestanding Cabinet adjacent to the generator set, and accommodate bottom entry feeders. The breakers shall be provided with buss detail allowing for connection of the feeders as per the one line diagram. Connection to the buss shall be via two hole long barrel compression lugs, to be supplied by the generator set supplier. All buss rating and breakers supplied shall be per the UL 891 requirements. The generator set supplier shall also be responsible for providing drawings for submission detailing the UL 891 listing and labeling for approval. Any changes or modifications to the circuit breaker or buss detail are required to comply with the UL 891 listing and these requirements will be the responsibility of the generator set supplying dealer.

### **1.16. Sound Attenuated Enclosure**

The emergency generator set and related equipment shall be housed in an UL Classified factory fabricated outdoor weatherproof enclosure. The unit will have all required UL Classified labeling associated for this listing. The manufacturer must supply confirmation of the ability to provide this listing. The design and placement shall be such that the generator will function properly without overheating in the ambient conditions specified. Enclosure shall be walk-in type and sound attenuated (maximum 85 dBA at 5 feet from any side, top and bottom to no more than 75 dBA when measured at 50 feet horizontally from any part of the enclosure or appendage on the enclosure. This rating will be based on full load condition of engine/generator in a single unit operation condition. Overall assembled dimensions of the assembled package are to be approximately 50' L x 12'W x 15' H. Airflow configuration of the unit will be intake through rear of unit and discharge air vertically up. The unit will require 12' - 15' unobstructed air on sides and intake end of unit.

#### Design Criteria:

- a) Weather resistant, walk-in type enclosure.
- b) Rigidity wind test equal to 120 mph. Certification of this rating and design must be supplied by the manufacturers independent P.E.
- c) Roof load equal to 40 lbs. per sq. ft.
- d) Floor loading 200 lbs. per sq. ft. of equally distributed load.  
Non distributed loading as required.
- e) UL Classification Packaging and products designed to comply with the following codes and standards:
  - 1.) International Building Code - 2000 Edition
  - 2.) National Electrical Code - 2002 Edition
  - 3.) NFPA 30
  - 4.) NFPA 37
  - 5.) NFPA 110
  - 6.) U.L. 142 - for sub-base fuel tanks
  - 7.) UL 891 - for generator main switchboard

Enclosure will consist of a roof, sub base; two (2) side walls, and two (2) end walls, of A- 36 HR steel panels that bolt together.

The enclosure shall be constructed as follows:

1. The exterior finish shall be guaranteed for a period of 10 years to be free from any defects when properly maintained.
2. Enclosure shall be of sufficient size allowing for code clearances and proper servicing isles without removal or opening of enclosure panels. Final size and arrangement shall be as approved on the shop drawings by the Architect/Engineer.
3. Radiator exhaust outlet shall be ducted through the end of the enclosure in an approved manner.
4. All exterior surfaces shall be factory painted with industrial enamel in a color selected by the Architect.
5. Unit shall have sufficient guards to prevent entrance by small animals.
6. Batteries to fit inside enclosure and along side the engine provide protective shield. (Batteries under the generator are not acceptable.)

#### 7. Roof:

Roof seams shall have continuous seal welds preventing the entrance of water. All welded roof seams shall be tested with weld penetrate to insure integrity and weatherability. All welds will be performed by AWS D1.1 certified welders. Documentation of certification will be provided upon request. The roof shall have properly flashed openings for the engine exhaust pipe penetration, radiator coolant fill, ventilation fans and tank vent openings where required. The roof shall have a minimum 4" center peak transgressing lengthwise to the enclosure. No cambered riveted roofs will be allowed. No exposed fasteners will be allowed where the roof attaches to the enclosure wall panels. The roof shall be designed for evenly distributed loading of 40 lbs./sq.ft. The roof shall also be designed to support the largest commercially available silencer in addition to two 250-lb men during normal maintenance procedures. Additional support added for project specific requirements when required. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

#### 8. Side and End Walls:

Side and end walls shall be modular in construction and minimum 4" inches deep, to meet project thermal and acoustical requirements. Material will be A-36 HR steel with double-formed wall seams for rigidity. Wall panels must be connected via interior, non-exposed, ¼-20 cadium plated fasteners with hole centers on maximum 12" for mechanical connections. Welded walls seams are not allowed. Panel cores will be 100% filled with semi-rigid mineral fiber thermal/acoustic insulation having a flame spread of 10 or less with fuel contributed as 0 and smoke developed as 0. The mineral fiber insulation will

be mechanically held into place with 22 gauge galvanized perforated liner, first run quality, 3/32ed – 3/16stg. Perforated liner will be secured with removable screw fasteners for panel core inspection required by local code issues. All interior corners and openings shall be trimmed with formed 22 gauge solid galvanized angles. The corners and openings shall be neat in appearance representing quality workmanship. No sharp edges on the enclosure interior shall be exposed to personnel. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

#### 9. Personnel Doors:

The enclosure shall have thermal/acoustic insulated pre-hung doors for personnel access to engine room and any other service area required. Door depth must match enclosure wall depth. Door hardware shall include minimum 2 heavy duty strap hinges and 1 handle per door. All door handles shall be chrome plated and shall be rated heavy-duty industrial type for severe service. Doors jamps shall be fully double gasketed on 4 sides for sound and weather integrity. Interior door latch shall have a positive acting, interior push plunger release handle that will allow door to be opened from the interior when exterior is locked. Exterior door handles will be heavy duty cooler style slam latch type, single point latching. Exterior hinges will be stainless steel and finish painted to match exterior enclosure color. Aluminum J-Drip rain gutters to be installed over doors, gutters will extend 6" beyond each side door opening as required and as permitted by roofline. Enclosure will be equipped with 2 – personnel on each side of side walls. One of the access doors must line up with the unit mounted circuit breaker and allow full service access to this breaker. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

#### 10. Removable Side and End Wall Panel:

All side, front and rear panels are removable to facilitate installation or removal of equipment. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

#### 11. Interior Lighting:

A.C. interior lights shall be installed within the enclosure assembly. The A.C. lights must be recommended by manufacturer for use in vibration, dust, corrosive vapors, moisture and high temperature application per the project environmental requirements. The fixture-mounting base must be a corrosion resistant die cast aluminum housing. The system shall include 6-100W/120VAC incandescent bulbs with 2-on/off switches and 2-GFI duplex receptacles located at enclosure entrance doors. All wiring shall be in EMT rigid conduit and fittings.

#### 12. Emergency Lighting

Within the enclosure shall be minimum 2 – dual head emergency lights with battery back up power supply. The lights shall have a polycarbonate housing which meets U.L. flame rating 94 V-0. The lamp heads must have high

temperature acrylic lens. Lamp heads must also have full range track and swivel design for adjustment. The emergency light must have a seal, maintenance-free, lead calcium battery that provides 90 minutes of emergency power with a fully automatic solid state battery charger. Emergency lights must meet U.L. 924, NFPA 101-1991 NEC and OSHA illumination standards.

### 13. Emergency Breakglass Stations

7. Enclosure will be equipped with exterior emergency breakglass stations to shut down generator. Minimum 2 required, one per side. Breakglass stations must have multiple contacts for customer use. Provide nameplate to read "EMERGENCY STOP OF GENERATOR."

### 14. Auxiliary Breaker Box:

The enclosure shall be equipped with an auxiliary circuit breaker panel as a single entry point for commercial power supply conduits and wiring by the Electrical Contractor. All the accessories shall be pre-wired to the auxiliary circuit breaker box; i.e., battery charger, jacket water heater(s), lighting, receptacles, space heater, etc. The breaker panel shall be mounted within the enclosure and allow for site conduit entry and NEC code clearances. Commercial power supplied to the enclosure auxiliary circuit breaker panel will be 480V/30KV - 120/208VAC 3-phase, 4 wire Mini Power Zone. Panel to have 100 amp main breaker and all branch breakers sized for proper voltages required by the accessories. The placement of this breaker panel shall be shown on the submittal drawings. All internal wiring and conduit runs to the various auxiliary equipment supplied with the package shall be pre-wired at the factory by the enclosure manufacturer in accordance with NEC codes pursuant to this application. Enclosure shall contain summer ventilation fan (with necessary louvers) and thermostat, two (2) 5 kW (or as required) space heaters complete with thermostat; two (2) battery two-head lights, six (6) interior vapor proof incandescent type lights with associated 3-way toggle switches at enclosure doors; two (2) GFI duplex receptacles; two (2) exterior weatherproof incandescent type lights above door with photoelectric cells, mounted on the exterior of the enclosure, all installed and wired to the local 3 phase, 4 wire, 120/208 volt, 100 ampere panel. Panel shall have a 3P-100A main circuit breaker. All exterior wiring devices and fixtures shall be weatherproof. All generator enclosure devices (lights, heaters, receptacles, etc.) shall be completely wired and piped in EMT rigid thinwall conduit to panel. Design, material, and construction must comply with UL Classification.

### 15. Space Heater

Qty. 2 - 5kW – 208V Space Heaters per unit shall be provided with built-in, adjustable thermostatic controls and engine cutout relay to maintain interior enclosure temperature above freezing. The heaters will be supported from interior roof with severe service aluminum brackets and threaded rods. The heaters will be wired to the auxiliary breaker panel.

#### 16. Oil and Water Drains:

All necessary fittings, hoses, shut-off valves, etc. shall be provided by to facilitate lube oil and water drain at the exterior of the enclosure. Valves shall be ¾" minimum and rated industrial service. These ports shall be labeled on exterior of enclosure for their identification. In addition, engines equipped with a crankcase breather tube shall have this tube terminate at the exterior of the directly under the radiator air discharge louver. The engine cooling system will be provided with a 50% mixture of engine manufacturer approved glycol solution. Jacket water heater isolation valves will be installed for service isolation of heaters.

#### 17. Exhaust System:

The silencer shall be critical grade, mounted and thermally insulated inside the enclosure. For heat rejection reduction and personnel protection, insulation must be provided for the silencer, flex and all discharge piping. The weight of the silencer shall not be supported by engine. An integral square tube frame support stand must be provided to support the weight of the silencer. This stand must also protect the silencer from movement during shipping and rigging. The exhaust pipe size shall be sufficient to insure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer. The exhaust silencer outlet roof penetration shall be adequately sealed to prevent the entrance of rain, snow and sleet. A stainless steel bellowed flex shall be provided. Nut, bolt, and gasket kits will be provided for all exhaust connections. Exhaust silencer shall be space conserving, low-profile size "pancake style muffler" suitable for horizontal mounting within the enclosure and supported by interior exhaust silencer stand. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

#### 18. Louvers:

8. Intake louvers shall be motorized 240 VAC, parallel blade, spring open motor close, for fail-safe operation. Discharge louvers to be gravity actuated. Gravity discharge louver frames to be aluminum frame construction with aluminum blades with felt seals. Motorized intake louvers shall be aluminum frame and blade construction with blade seals installed within the frames. Motorized louvers must be provided with louver control wiring j-box which must incorporate time delay relays and ventilation fan controls. Provide an access hatch to allow for inspection and maintenance of each louver motor and spring mechanism where required.

#### 19. Ventilation Exhaust Fan:

Enclosure shall be provided with an appropriately sized ventilation fan. Fan shall be roof mounted. Fan shall be provided with an adjustable thermostat wired to louver control circuitry. Fresh air intake for fan shall utilize one of the enclosures motorized intake louvers. Fan shall be equipped with a discharge hood directed downward and a gravity draw louver at fan. Framed opening in roof shall be provided with appropriate framing for support and flashing for prevention of weather ingress. No wall mount fans will be allowed.

## 21. Sound Baffles:

22 gauge formed galvanized construction. 25% compression on internal insulation. All joints and seams to be mechanically riveted. No spot welding will be allowed. Internal insulation must be covered with 22 gauge galvanized perforated liner. Galvanized rodent intake screening must be supplied and mount on the intake sound baffles. Baffles to be located on intake and discharge ends of enclosure with appropriate mounting supports and flashing to maintain physical integrity of units.

## 22. Engine Generator isolation:

The prime mover will be mounted to the fuel tank base structure via spring loaded isolators. Isolators must be installed on weld-pads that will be solid welded to under-frame base structure. No steel tapping plates on top of light duty floor plate with OSB wood underlayment board will be allowed. No top mount, side to side span, light duty beams that rely on outboard weight transfer of engine load will be allowed. 4" square tube with 1/2" wall shipping blocks must be provided to secure prime mover for transportation with removable bolts and shims for field adjustment.

## 23. Base and Under Frame

Two wide flange structural I Beam or channel iron main runners, spanning the full length of the enclosure must be used. Formed sheet metal or plate bases will not be allowed. Cross members will must be fabricated of structural carbon steel and placed on centers to carry floor loads as required. Under no circumstance will OSB plywood be allowed as any part of sub-base structure. Floor will be 3/16" diamond deck floor plate. Base will be equipped with threaded ground bosses for customer site grounding connections. Base must be able to carry internal loads applied without relying on site structures to provide additional support. Base must be designed to support internal loads on cross beams. No light duty, top mounted cross beams that rely on transferring load to exterior edge of frame or base will be allowed. Base must be designed to be perimeter supported only. Provide adequately sized conduit stub-up areas with removable cover plates for customer site use in floor and/or roof of enclosure for generator power cable, engine-generator control wiring and enclosure auxiliary 120/208 volt load center.

## 24. Base lifting Eyes

Furnish plate steel lifting eyes rated for the combined enclosure and unit weight less fuel. Four or six point lifting as required by total package weight. Lifting plates must be removable for shipment. Supporting data must be available to verify design when requested.

25. Sub-base Tank **Please review Tank section for conformance to Project requirements, always check with local code requirements**

A **7,300** gallon capacity fuel tank base with a **110%** gallon rupture basin. Tank shall be furnished with low and high level and rupture basin alarms. **(Tank shall also be supplied with contacts for starting and stopping a remote pump to replenish the fuel in the base tank. Provide supply and overflow return port for connection to the main tank. Ports are to be piped to the side of the enclosure and labeled.)** All alarms and switches shall be pre-wired to the unit mounted control panel and for remote indication. The manual fuel fill connection shall internally accessed from enclosure personnel door. Fuel fill port shall be 2" diameter and be provided with a 6-inch riser and screw on cap. Remote pump tank supply and overflow connection will be supplied at exterior enclosure wall. Connections to be a minimum 3/4" NPFT.

A mechanical fuel level gauge shall be provided near fuel fill port and provided with a protective kick guard. Normal tank and rupture venting shall be provided, 2" minimum, and extended to exterior of enclosure at roofline. Tank and rupture basins shall be closed-top design. Tank and rupture basins are equipped with 2-inch drain ports. Tank will be supplied with 1/2" engine pick-up and return ports. Conduit stub-up sleeves will be provided for generator load and control wiring and cabling. Sleeve will also be provided for AC distribution panel. 2-2" spare couplings will be provided in tank and rupture basin for customer use. Tank must have 3/16" diamond deck top plate and 7 ga bottom sheeting. Emergency vents must be extended to exterior roof line. Design, material, support bracing and construction must comply with UL Classification and UL wind loading design parameters.

a) **Tank shall be UL 142 listed** with the following construction features and procedures:

1. Fuel tank bases shall be constructed with a combination of formed and structural steel, ASTM A-36. The beams and cross members shall be designed to withstand four times (4X) rated load.
2. Tank plates will be a minimum of 3/16" thick for proof of design pressure of 25psi.
3. Tank to be equipped with industry standard emergency relief vents per UL wetted surface area guidelines.
4. Welds shall be of the AWS D1.1 GMAW type and be performed by Industry certified welders.
5. Bottom plates shall be welded to the underside of the fuel base using continuous AWS D1.1 GMAW fillet type welds. No plug welds will be allowed. All cross beams are to be seamed and all welds shall be leak tested.
6. Once the underside of the fuel tank is welded, the fuel base will be turned over so the inside of the bottom tank plates can be welded to the inside of beams. Holes for fittings are to be placed into the top plates prior to attachment to tank to prevent torch slag and debris from entering the tank.

7. A pressure test of 5 psi shall be performed on tank to conform to UL 142 listing.
8. A leak test shall then be performed.
9. The fuel tank base shall next be cleaned and degreased prior to painting.