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## **GENERATOR SET ENCLOSURE**

### **(PPPI STD Walk-in)**

#### **PART 1 - GENERAL**

##### **1.01 INTENT**

- A. The intent of this specification is to provide the owner with a generator set enclosure complete in every detail and requiring no additional in-field modifications or assembly, except where specifically allowed by these specifications. The enclosure is to be accurately dimensioned so as to be in compliance with the National Electrical Code (NEC), and the National Fire Protection Association (NFPA) for clearance of all specified items included therein, and all applicable fire codes for a structure and application of this type.
  
- B. Construction drawings, engineering blueprints, or other bid documents accompanying these specifications which show switchgear, transfer switch(es), motor controller(s) and/or other service or distribution equipment within the generator set enclosure must be considered complimentary to and not in lieu of this written specification. Drawings submitted for approval shall reflect this fact clearly and any contradiction or omission shall be brought to the attention of the designing engineer prior to order.

#### **PART 2 – PACKAGED GENERATOR SET ENCLOSURE**

##### **2.01 WALL PANELS**

- A. The weatherproof enclosure shall be of formed G90 galvanized steel panel construction as designed and manufactured by Professional Power Products. The enclosure shall contain a galvanized perforated lining on the interior of the wall panels to cover the insulation and sound absorption materials. The enclosure is to be rated for a wind load of 120 MPH (150 MPH optional) and 50lbs./sq ft roof load. The basic structure meets all seismic requirements of Zone 4 or equivalent. The design and construction shall be modular in that the panels shall not exceed 36" in width and shall be minimum thickness of 0.1046", 12 GA. Bolt together wall panels shall be powder coated (spray coat not accepted) and shall have gasketing between each vertical seam. All exterior components of the enclosure shall be assembled utilizing corrosion resistant steel bolts, nuts and lock washers. All seams shall be sealed to prevent leaks. The roof shall be bolt together in construction so as to allow no more than two men to remove individual sections to facilitate large component removal from above if needed.

##### **2.02 ROOF**

- A. Rain test equal to 4 inches/hour.
  
- B. The roof of the enclosure shall match the minimum gauge requirements specified for the walls previously but, in addition, shall be strengthened in such a manner as to support the largest commercially available exhaust silencer recommended by the engine manufacturer for this application.

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- C. The roof shall be bolt together in construction so as to allow no more than two men to remove individual sections to facilitate large component removal from above if needed. Bolt together design and construction shall utilize an external perimeter gutter to direct rainwater way to both ends of the enclosure and away from all doors and louvers.

## 2.03 DOORS

- A. Doors shall not exceed 36" in width and door skin shall be a minimum of 12 gauge construction.
- B. All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance on the generator set and allow sufficient access to and visibility of instruments, controls, engine gauges, etc. The doors shall be fitted with a heavy duty, full height, continuous gear hinge concealed between the door leaf and door frame. No exterior hinges will be allowed. The hinge shall be made of corrosion resistant aluminum and shall utilize Nylon bearings for longevity.
- A. The door shall have a 3 point latching mechanism for maximum sealing to frame gasketing. Each door shall be fitted with pad lockable Stainless Steel handles. The handle hardware shall allow escape from within when locked externally by use of an emergency egress lever. Door hold open hardware shall be provided to secure the door to the enclosure wall, when fully open, during installation and maintenance. If exterior wall mounted components can be damaged from full open door swing, door restraint chains shall be provided to limit the door rotation to 110 degrees. All doors shall be fully gasketed to prevent leaks. Rain guards/gutters shall be provided above each door and extend 6" beyond the door opening on each side. Rain guards/gutters will be shipped loose for onsite installation to prevent possible shipping damage during transit.

## 2.04 SOUND ATTENUATION

- A. Adhered Foam insulation shall not be used in any situation. If a specific sound attenuation level is required, enclosure manufacture must provide sound level calculations that the overall sound level can be met (by Octave band if required). The calculations should include certified sound test reports of wall panel and sound baffling construction.

## 2.05 THERMAL INSULATION

- A. The enclosure is to be thermally insulated with gasketed doors. Insulation material is to be fiberglass held in place with a galvanized perforated metal liner. Insulation shall have no less than a R19 rating.

## 2.06 AIR INTAKE

- A. All louvers shall be designed to help prevent the entrance of driving rainwater, but shall have sufficient free area to allow for engine-generator cooling air requirements.

## 2.07 MOTORIZED LOUVERS

- A. Air intake and exhaust louvers shall be of aluminum or galvanized construction. The louvers shall open automatically upon diesel generator start and close upon diesel

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generator shutdown. Heavy-duty screens over the intake louvers shall be provided. Motorized intake louvers shall be 120VAC. Exhaust louvers shall gravity type.

#### 2.07 EXHAUST SILENCER

- A. Internal silencer shall be mounted by the packager according to manufacturer's recommendations. External silencer shall be mounted at the job-site by the installing contractor when the silencer is loose-shipped due to height restrictions in transit. External silencers shall be pre-mounted and fit at the factory before shipment. The silencer shall be mounted such that its weight is not supported by the engine nor will exhaust system growth due to thermal expansion be imposed on the engine. Exhaust pipe sizes shall be sufficient to ensure that exhaust backpressure does not exceed the maximum limitations specified by the engine manufacturer. All interior piping and interior exhaust parts shall be provided with an exhaust blanket to protect users from possible burn hazards.

#### 2.08 TAIL PIPE

- A. Each silencer shall be fitted with a 90° tail pipe extension (elbow) terminating in a vertical position and, to prevent the entrance of rainwater, shall be fitted with a weighted, rain cap.

#### 2.09 RAIN SKIRT

- A. At the point where the exhaust pipe penetrates the roof of the enclosure, a suitable "rain skirt" and collar shall be provided by the packager. It shall be designed to prevent the entrance of rain yet allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system.

#### 2.10 WALKAROUND PROVISIONS

- B. Maintain all NEC-required working spaces, clearances and access. An aisle, at least 24" wide, shall be provided on each side of the generator set and an extra 36" behind the generator set shall be included where possible.

#### 2.11 OIL & RADIATOR DRAINS

- A. All necessary fittings, hoses, shut-off valves, etc., shall be provided by the packager to facilitate lube oil and radiator draining through one of the man doors of the enclosure. In addition, engines equipped with crankcase breather tubes shall have this tube terminate through the radiator plenum.

#### 2.12 ENCLOSURE FLOORING

- A. The floor of the enclosure shall be designed and constructed in such a manner as to prevent the entrance of rodents. This shall be accomplished with solid metal or "diamond plate" but, in any event, must be capable of fully supporting any ancillary equipment specified which may be secured to it plus the anticipated weight of maintenance personnel and their tools.

#### 2.13 SKID BASE MOUNTING

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- A. The generator set and enclosure shall be mounted and shipped to the customer on the structural steel skid base manufactured by the packager. Provisions for crane unloading of the complete package shall be designed into the base of the unit.

#### 2.14 WEIGHT

- A. The weight of the entire unit consisting of generator set, base, enclosure and other specified items including shall be calculated by the packager utilizing manufacturer's data. The base of the unit shall be designed and manufactured as a heavy duty, structural steel construction with lifting provisions to support the calculated weight.

#### 2.15 BASE TANK

- A. Fuel Oil Storage: Provide a sub-base fuel tank for the generator set of sufficient capacity to run the generator for a minimum of 10-hours. The sub-base fuel tank shall be UL142 listed and labeled. Installation shall be in compliance to NFPA 37. The side rails of the beams must be sand blasted to a SSPC-5. "Tape tests" must be maintained to guarantee the quality of the sand blast process. 3-5 mil paint thickness must be applied to the entire base. The fuel tank shall be a double-walled, steel construction and include the following features:
  - 1. Lockable Fill Cap
  - 2. Emergency tank and basin vents.
  - 3. Mechanical level gauge.
  - 4. Fuel supply and return lines, connected to generator set with flexible fuel lines as recommended by the engine manufacturer and in compliance to UL2200 and NFPA 37 requirements.
  - 5. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
  - 6. Low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level.
  - 7. Removable lifting provisions
  - 8. A one piece rain welded rain skirt shall be provided between the top of the base tank and the enclosure wall panels.

#### 2.16 CONTAINMENT BASIN:

- A. The unit shall be equipped with a fuel containment basin with a normal capacity of 110% of the main fuel tank and shall be supplied with a leakage detector switch in the basin and wired to an indicating light on the generator control panel.

#### 2.17 PAINT

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- A. The base tank shall be powder coated or prime painted with a minimum of two (2) coats of rust-inhibiting primer and finished with a minimum of two (2) coats of polyurethane. The base tank shall be powder coated or wet painted to match color of the enclosure.

#### 2.18 LOW FUEL INDICATOR

- A. The fuel tank shall be fitted with a low fuel level alarm, which shall be wired to an indicating light on the generator control panel of the generator set. This switch shall activate whenever the fuel level in the tank is 40% or less remaining.

#### 2.19 HIGH FUEL INDICATOR

- A. The fuel tank shall be fitted with a high fuel level alarm, which shall be wired to an indicating light on the generator control panel of the generator set. This switch shall activate whenever the fuel level in the tank is 100% or more remaining.

#### 2.20 RUPTURE BASIN LEAK INDICATOR

- A. The fuel tank shall be fitted with a rupture basin leak alarm, which shall be wired to an indicating light on the generator control panel of the generator set. This switch shall activate whenever the fuel level in the rupture tank is 5% or more remaining.

#### 2.21 INTERNAL WIRING

- A. All wiring within the enclosure shall be in conduits made from rigid metal, EMT, or liquid-tight material specifically manufactured for electrical use. All connections at the generator set shall be flexible. To avoid excessive conduit running throughout the enclosure, a wire raceway shall be used for all AC and DC wiring. EMT Conduit runs shall be provided where needed such as departures from the wire way.

#### 2.22 LOAD CENTER

- A. The enclosure shall be equipped with a Sq D 100amp 120/208-volt 3 phase 4 wire load center for the battery charger, jacket water heater(s), lighting, receptacles, etc., as specified and as shown on the drawings. The load center shall be mounted within the enclosure and allow for a single entry point for commercial power supply conduit and wiring by the installing contractor. The placement of this load center shall be shown on the submittal drawings. All internal conduit and wiring to the various ancillary equipment supplied with the package and shall be pre-wired by the packager in accordance with all governing codes pursuant to this application. The load center shall be considered as part of the emergency load and shall derive its power source downstream from the load transfer switch specified elsewhere. If a step-down transformer is required, to be placed ahead of this load center, it together with a properly sized protective device shall be supplied and installed by the packager within the enclosure.

#### 2.23 INTERIOR FLUORESCENT LIGHTING: (AC)

- A. Two-tube, F32T8 fluorescent lights shall be installed within the enclosure and strategically located on either side of the generator set. They shall be ceiling mounted and parallel to the length of the unit. Their AC power source shall be taken from the

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commercial power supply at the job-site and wired-in by way of the load center specified elsewhere. The light switch box, located by one of the entranceway doors, shall have its own-grounded duplex receptacle mounted therein for use by maintenance personnel.

#### 2.24 EXTERIOR LIGHTING

- A. The enclosure shall be equipped with a 70W HPS light on the exterior of the building above each door, wired into the commercial power supply load center, and activated automatically by way of a photoelectric cell which will switch the light on during evening hours and off during daylight hours. The fixture for the light shall be of vandal-proof design, mounted above one of the side doors.

#### 2.25 EMERGENCY LIGHTING

- A. The enclosure shall be equipped with (2) dual head emergency lights with battery backup power supply, meeting UL 924, NFPA 101 and OSHA illumination standards.

#### 2.26 EXHAUST FAN

- A. The enclosure is to be fitted with a 120-volt shutter mounted exhaust fan with control

#### 2.27 SPACE HEATER

- A. The enclosure is to be fitted with (2) 5kW, 240V, single phase space heaters complete with a thermostat.

#### 2.28 CLEARANCE

- A. The base and enclosure assembly shall allow room within the package to mount and maintain the specified battery charger, engine starting batteries, racks and cables, main line circuit breaker, engine-generator control panel, and other items as specified or as shown on the drawings.

#### 2.29 BATTERY TRAY

- A. A battery tray shall be provided for the batteries and shall conform to NEC 480-7 (b). It shall be constructed and so treated as to be resistant to deterioration by battery electrolyte. Further, construction shall be such that any spillage or boil-over of battery electrolyte shall be contained within the tray to prevent a direct path to ground. A separate tray shall be provided for each battery bank and placed on each side of the engine on all dual starter motor equipped units.

#### 2.30 BATTERY CHARGER

- A. A current limiting, automatic DC battery charger shall be furnished to automatically re-charge the batteries.

#### 2.31 FIRE DETECTION AND SUPPRESSION SYSTEMS

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A. Available fire suppression system options are micromist, CO2, or FE-227.

1. A Micromist fire suppression system shall be designed in accordance with NFPA 750. It shall have a water tank and nitrogen cylinder that are properly sized for the enclosure. The system shall have the necessary number of weatherproof strobe/horn units, manual pull stations, discharge nozzles and heat detectors.
2. A CO2 fire suppression system shall be designed in accordance with NFPA-12. It shall have a CO2 tank properly sized for the enclosure. The system shall have the necessary number of weatherproof strobe/horn units, manual pull stations, discharge nozzles and thermal detectors. The system shall also have UV/IR detectors if required.
3. A FE-227 fire suppression system shall be designed in accordance with NFPA-2001. It shall have a FE-227 cylinder properly sized for the enclosure. The system shall have the necessary number of horns, strobes, manual pull stations, discharge nozzles, IR detectors and thermal detectors.

#### 2.32 GAS DETECTION SYSTEMS:

- a. Provide gas detection system if required.

#### 2.33 REMOTE EMERGENCY STOP SWITCH

- A. The enclosure shall be equipped with exterior emergency breakglass stations to shutdown the generator. A minimum of 2 are required, one per side. Nameplate of each breakglass station to read "EMERGENCY STOP OF GENERATOR".

#### 2.34 STRIP HEATER

- A. Thermostatically controlled unit arranged to maintain stator winding above dew point to prevent anti-condensation.

#### 2.35 JACKET WATER HEATER

- A. One jacket water heater 9,000W, 208 volt, single phase, with thermostatic control and oil pressure disconnect switch to maintain engine at constant temperature of 90°F to 120°F. Jacket water heater shall be furnished with ball valve shut-offs at the inlet and outlet and factory wired relays to disconnect power during engine operation.

#### 2.36 WIRING AND CONNECTORS:

- A. All conduits, wire, cables, interconnections, etc., entering or exiting the generator enclosure shall be furnished and installed by the installing contractor. All wiring shall be in conduits sized in accordance with the NEC. All power and control wiring shall be THHN/THWN copper, installed for a complete and operating system.

#### 2.37 GENERATOR OVERCURRENT AND FAULT PROTECTION:

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- A. Generator Circuit Breaker: Molded or Insulated case case, LSI trip, 100% rated, complying with UL 489
    - (1) 24VDC SHUNT TRIP: Connected to trip breaker upon generator shutdown by other protective devices.
    - (2) AUXILLIARY SWITCHES: 2A/2B aux contacts for customer use for remote breaker status monitoring.
    - (3) BELL ALARM: 1 form C contact for customer use to monitor circuit breaker "Tripped" status
  - B. Ground Fault Indication: Comply with NFPA, "Emergency System" signals for ground-fault. A from C dry contact will be provided to allow customer annunciation upon a ground fault condition. Ground fault alarm module to be WOKA GFA300 model or approved equal.

### **PART 3 - EXECUTION**

#### **3.01 LOAD BANK TESTING**

- A. Provide load bank testing. The load bank will be capable of definite and precise incremental loading and shall not be dependent on the generator control instrumentation to read amperage, voltage, or frequency. Rather, the test instrumentation will serve as a check of the generator set meters. Further, the load bank shall be power factor matched to the rating of the generator set as shown in the manufacturer's published data and as specified for this project.

#### **3.02 WARRANTY**

- A. Equipment furnished under this Section shall be guaranteed against defective parts and workmanship under the terms and conditions of the manufacturer and dealers standard warranty. But, in no event shall it be for a period of less than one year from date of initial start-up of the system and shall include labor and travel time for necessary repairs at the job-site. Submittal start-up data received without written warranties as specified will be rejected in their entirety.

**END OF SECTION**