**Instructions and recommendations for the layout of Generator-set room and common mistakes**

Regardless of the type of application (hospital, datacenter, residence, military facility, factory, etc.), it is essential to use RELIABLE POWER for the operating activities of the facility. When it is time to purchase a generator set, it is crucial to consider where the generator set will be positioned and how it will be operated. If you plan to position the generator set in a room/building, you must make sure that you comply with all generator room design requirements.

The space requirements for emergency generator sets are not at the top of an architect's list for the building design. Since large power generators, in particular, take up more space, problems do occur when providing necessary areas for installation. At the start of a building/facility design, we recommend that the design of the building is conducted in a manner according to design requirements and in consultation with experts so that the gen-set can operate smoothly with all of its equipment.

**1. Generator-Set Room:**
Generator set and its equipment (control panel, fuel tank, exhaust silencer, etc.) are integral together and this integrity should be considered at the design-phase.

The generator room floor should be liquid-tight to prevent leakage of oil, fuel, or cooling liquid from leaking into the soil.

Generator room design should comply with the requirements of the local regulations and laws.

The generator room should be clean, dry, well-lit, well-ventilated, not too hot and smoke, oil vapour, engine exhaust fumes, etc. should not enter into the room.

Materials selected to be used in the room for insulation etc. should be of the non-flammable/flame retardant class.

The floor and base of the room should be designed taking into account the static and dynamic weight of the generator set.

**2. Room Layout:**
The door width/height of the generator room should be such that the gen-set and its equipment can easily be moved into the room.

Generator set equipment (fuel tank, silencer etc.) should be positioned close to the generator. Otherwise, pressure losses might occur and back-pressure might increase.

The control panel should be positioned correctly for the ease of use by maintenance/operating personnel.

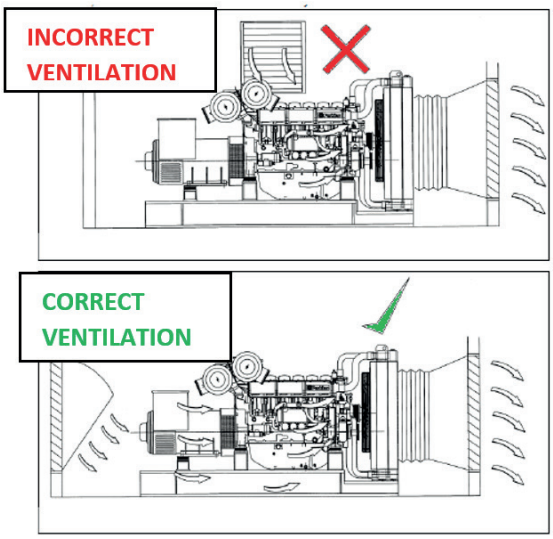
Sufficient space should be available for the periodic maintenance.

There should be an emergency exit and no equipment (cable tray, fuel pipe) should be present on the emergency escape route that prevent personnel from evacuating the building.

There should be three-phase/single-phase sockets, water lines and if possible air lines available in the room for ease of maintenance/operation. If the daily fuel tank of the generator is of external type, the fuel piping should be fixed up to the generator set and the connection from this fixed installation to the engine should be made with a flexible fuel hose so that the engine vibration can not be transmitted to the installation. We recommend the fuel system to be installed via a duct through the ground. Power and control cables should also be installed in a separate duct. Since the generator will oscillate on the horizontal axis in case of start, initial loading and emergency stop, the power cable to be connected should be connected by leaving a certain amount of clearance.

**3. Ventilation:**
Ventilation of the generator room has two main purposes; they are to ensure that the life-cycle of the gen-set does not shorten by operating it correctly and to provide an environment for the maintenance/operation personnel so they can work comfortably.

In the generator room, right after the start, an air circulation begins due to the radiator fan, fresh air enters from the vent located behind the alternator. That air passes over the engine and the alternator, cools the engine body to a certain degree, and the heated air is discharged into the atmosphere through the hot air outlet located in front of the radiator.




For efficient ventilation the air inlet/air outlet opening should be of suitable dimensions.

Louvres should be fitted to the windows to protect the air outlets. The louver fins should have openings of sufficient dimensions to make sure that air circulation is not being blocked. Otherwise, the occurring back-pressure might cause the generator set to overheat. The biggest mistake made in this regard in generator rooms is the use of louver fin structures of similar designs which are used in transformer rooms.

For information on air inlet/air outlet openings sizes and the louver details, the manufacturer of the generator set should be consulted with.

A duct should be used between the radiator and the air discharge opening. The connection between this duct and radiator should be isolated using materials such as canvas cloth/ canvas fabric in order to prevent the vibration of the gen-set from being conducted to the building.

For rooms where ventilation is constrained, a ventilation flow analysis should be performed to analyse that ventilation can be performed properly.

The engine crankcase ventilation should be connected to the front of the radiator via a hose. In this way, oil vapour should be easily discharged from the room to the outside. Precautions should be taken so that rain

water does not enter the crankcase ventilation line.
Automatic louvers systems should be used in applications with gaseous fire-extinguishing systems.

**4. Fuel System**
Fuel tank and its design should comply with the requirements of the local regulations and laws.

The fuel tank should be installed in a concrete or metal bund.

The ventilation of the tank should be carried out outside the building or if the tank is to be installed in a separate room, there should be a ventilation outlet openings in that room.

The fuel piping should be installed away from the hot zones of the generator set and the exhaust line.

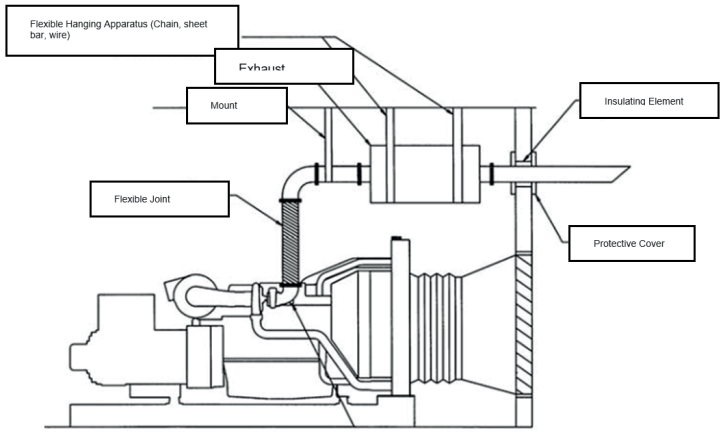
Black steel pipes should be used in fuel systems. Galvanized, zinc and similar metal pipes, that can react with fuel, should not be used. Otherwise, impurities generated by chemical reactions may clog the fuel filter.

Sparks (from grinder, etc.), flames(welding machine) and smoking should not be allowed in places where fuel is present. Warning labels mus be assigned.

Heaters should be used for fuel systems installed in cold environments.
Tanks and pipes should be protected with insulation materials.
Filling of the fuel tank should be considered and designed during the room design.

Fuel tank and generator set should be preferred to be positioned at the same level. If a different application is required, support from the gen-set manufacturer should be obtained.

**5. Exhaust System**
The exhaust system (silencer and pipes) is installed to reduce the noise from the engine and to direct the toxic exhaust gases to appropriate areas.




Sample Exhaust System Layout

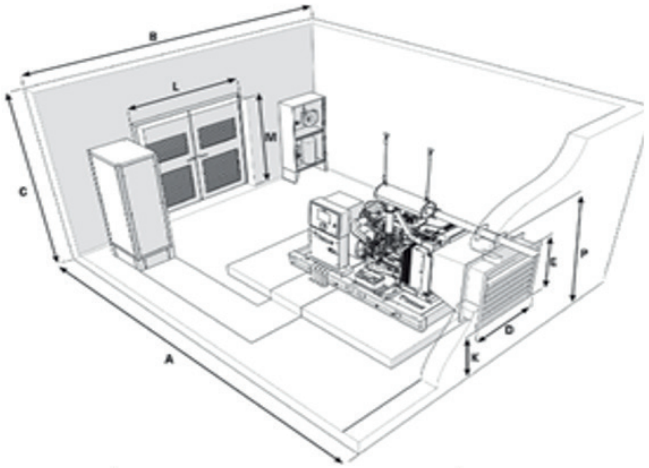
Inhalation of exhaust gases is a possible death hazard. Penetration of the exhaust gas into the engine reduces engine life. For this reason, it should be sealed to the appropriate outlet.
The exhaust system should consist of flexible compensator, silencer and pipes that absorb vibration and expansion.
Exhaust pipe elbows and fittings should be designed to expansions due to temperature.

When designing the exhaust system, the main objective should be to avoid back-pressure. The pipe diameter should not be narrowed in relation to the orientation and the correct diameter should be selected. For the exhaust pipe route, the shortest and least turning path should be selected. A rain cap that is actuated via exhaust pressure should be used for vertical exhaust pipes.

The exhaust pipe and silencer inside the room should be insulated. Otherwise, the exhaust temperature increases the room temperature, thus reducing the performance of the generator set.

The direction and outlet point of the exhaust gas is very important. There should be no settlements, facilities and roads present in the direction of exhaust gas discharge. The prevailing wind direction should be taken into account.

Where there is constrain regarding the hanging the exhaust silencer on the ceiling, an exhaust stand can be applied.




Room Placement Example

References:
1. Teksan Generator-set Maintenance & Operations Manual
2. Perkins 4000 Series Installation Manual TPD1987
3. Mitsubishi Engine Installation Planning February 2010 Pub. No. 98CAB-61000

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