

Proper Engine Room Ventilation

Engine Room Ventilation is Key to Proper Genset Operation

Generator sets need to breathe. They require copious amounts of air to both cool and create combustion in the cylinders. It's been estimated that up to 10% of the heat content of the fuel consumed by the average internal combustion engine is dissipated to the surrounding area as heat. This heat must be removed to maintain proper and safe genset operation. In the absence of a unit-mounted radiator fan, this can be accomplished with induced draft or ventilation fans.

The most efficient method of removing this heat is with a system that pulls air past the switchgear, then over the engine, from back to front. If air curtains are used, the airflow should gather this radiant heat just above the genset, which offers greater efficiency and less exposure to high air velocities in other areas of the genset room. Airflow should be upward around each engine or in the case of engines with mounted radiators, across the back of the engine to the front. The ventilation system should sufficiently move air to control temperature in all areas of the engine room.

Ventilation Fan Sizing

The following equations provide the proper airflow (cfm or m³/s) velocity for a given genset installation, assuming 100°F (38°C) ambient temperature:

Airflow (cfm or m³/s) should increase approximately 10% for every 2,500' (760m) above sea level.

$V \text{ (cfm)} = H + \text{Engine combustion air}$

$0.07 \times 0.24 \times \text{delta } T$

$V \text{ (m}^3\text{/min)} = H + \text{Engine combustion air}$

$1.099 \times 0.017 \times \text{delta } T$

Where:

V = ventilating air

H = heat radiation

delta T = Permissible temperature rise in engine room (degrees F or C)

Density of air at 100°F = 0.07 lb/cu ft (1.099 kg/m³)

Specific heat of air = 0.24 Btu/°F (0.017 kW/°C).

Sound Control

Minimizing engine noise while maintaining adequate cooling presents some design challenges. Insulated air ducts and close attention to air inlet and outlet locations can greatly minimize noise problems. Unfortunately, air louvers and oversized exhaust silencers are not adequate to fully contain engine noise.

Cashman Power Solutions has worked on several installations where ventilation noise was a key design consideration. We can share our experiences with you during your design phase and apply that knowledge to your best benefit.

Cold Weather Considerations

In colder climates, the desired temperature rise needed to maintain optimum engine operating temperature could be as much as 80°F (27°C) instead of the usual 10 to 20°F (5.5° to 11°C). In these cases, it is better to specify a number of smaller fans than one large fan to supply ventilation air. This also allows you to adjust ventilation if the genset operates at a lower output. Movable louvers positioned to redirect engine heat back into the room until the jacket water temperatures reach 190°F (88°C) may be used. Then, these louvers close so ventilation air is exhausted.

Hot Weather Considerations

The overwhelming majority of our early hour system failures are overheats that are not a result of a defect in materials or workmanship and are therefore NOT COVERED BY WARRANTY. Proper system airflow using the specified radiator airflow plus the engine intake combustion air must be accounted for – usually with a correction factor added for good measure. Most Cat generator sets are equipped with high ambient (117°F or higher with a 10°F rise factor) radiators, but factors such as room/enclosure temperature rise, space, and location of intake/exhaust louvers must be considered.

NOTE: As noted above, Cat includes a 10° F rise in their ratings. It's critical to note many manufacturers do not factor in this rise, so that must be carefully considered. Example: Cat radiator rated for 122°F allows for air temperature at the

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radiator core of 132°F (122° + 10° rise = 132° core capability). Brand X radiator rated for 122° at core is only capable of approximately a 112° ambient (112° + 10° rise = 122° core capability).

Recirculation is a common problem – this occurs when the unit radiator (and sometimes engine exhaust as well) exhaust in some way is able to find its way back into the genset room/enclosure thus increasing the radiator core inlet air temperature. Exhaust system components not properly insulated will create the same problem. Lastly, if the unit is outdoor enclosed and does not have adequate space around it, it will also begin recirculating its rejected heat and overheat. Common solutions are more space, radiator ducted to an exterior space where it cannot reach the genset intake, or adding a turnduct to the front of the genset to force the hot air up and away from the machine.

Some Handy Rules Of Thumb:

- If you're putting the genset in a room, your radiator exhaust louvers should be 1.5-2 times the surface area of the radiator.**
- In this same case, the intake louvers should be 1.5-2 times the surface area of your exhaust louver as calculated above.**
- Always insulate the entire engine exhaust system within the room.
- Never locate exhaust components within 1' of combustible materials or sprinkler heads.
- Never have the intake and exhaust louvers adjoining or even in close proximity.
- Consider prevailing winds when locating radiator exhaust outlets.

Call Cashman - 1.800.937.2326

Achieving correct ventilation levels is best accomplished during the design phase. Cashman can help you at this juncture to best plan for ventilation needs.

**Based on typical standard fixed louvers. Sound attenuated, motorized, or many other types of architectural louvers will affect these sizes. These rules of thumbs are for quick visual estimation purposes ONLY.