

TROPICALIZING the DIESEL GENERATOR Package Utility

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Abstract:-

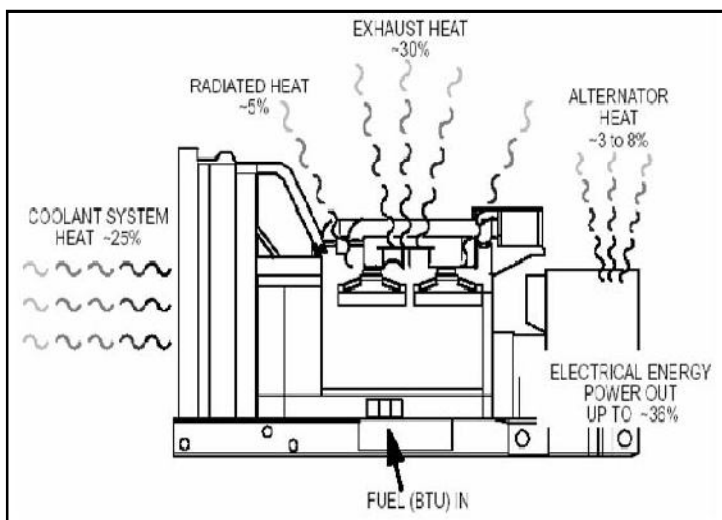
The DG set in package hood, uses the radiator fan to perform two functions namely the heat transfer and induce the engine-exhausted-hot-air draft thro exchanger fins. But practically, the radiator receives hot air & chokes in hood very early but not noticed. And thus reducing both its functions as heat transfer & engine ventilation, thus DG starves. So it is suggested here to barrier the radiator from the engine within the hood, provide fresh air openings to the same from the hood side walls and provide to the DG engine separate forced draft to the engine and as well, ventilate the same separately.

The Industry DG utility in India, is not tropicalized till date. The existing DG packages are more suited to cold climates. Increase in air intake temperature from 25°C to 40°C, the air fuel ratio decreases by about 5%, resulting in increase in fuel consumption in the range of 0.5 to 2% depending on engine design. The DG and its sub systems are put to Accelerated Ageing process due to localized heat retained inside hood.

The DG set OEM and the user industry gave priority to Units per Liter of Diesel at the package outlet. But the exhausted heat at 30 % of the heat value of the input stays at the engine surroundings only due to poor air movement across the engine. That is why, the DG sets are sold as Open-Terrace location gensets, but not instructed at site to put under Sunshade. Already the DG is running at 35 % efficiency referring to input / output values, so to sustain & improve: Listed below, are the ways to tropicalize the DG in hood.

EXISTING SYMPTOMS OF INEFFICIENCY:-

When thermal imaging was done inside a running DG set package unit, we find the inside temperature around 10 to 15°C more than the ambient temperature surrounding the unit. Having done energy audits in many industries we observe the trended output power and thermal imaging parameters. The symptom is that in a running engine, when we open side doors, you will find blast of hot air trying to escape out there.



Courtesy :- Cummins DG Manual /Cross ventilated DG engine/ Forced Fresh air at air inlet.

1. The Sankey diagram of heat flow across the DG set shows for the given Diesel input, electricity power output is only 35 %. Whereas exhaust heat at 30 % and coolant system heat at 25 % is a loss only.

2. But practically, the exhaust and coolant losses are controlled by radiator & fan externally within the hood. This radiator and fan receives hot engine exhaust air as input and dust chokes the fins further.
3. This all leads to less UPL, due to higher than ambient air intake to DG set directly. As the thermal imaging shows, the air intake mouth reveals choked and hotter inlet temperature surroundings.

HOW TO RECTIFY THE SAME AT SITE:-

SIMPLE SOLUTION:- First, put the DG under a weatherproof umbrella shed / shelter / shade.

1. Simply, open all the side doors and retrofit projected type V type NETLON type filters with SS mesh daily cleanable from outside / inside the package. So that no air suspended particles, dust or plant dirt wastes etc flying in air not to get deposited inside the internals. This will allow more air flow across the engine and ambient air to cool the heat exchanger. This is low cost and, if acoustics & aesthetics is not an issue, this option can be implemented immediately.
2. Vacuum band gauge after the air intake always not works. So provide Magnehelic type Delta P gage, viewable from outside to condition monitor the same daily routinely and keep it clean frequently.

RE-ENGINEERING at Site Services:-

1. In consultation with the OEMs, Re-Engineering at Site Service Providers can take up this quick fix job. They can retrofit / relocate HX at the DG hood and will facilitate the DG efficiency to sustain more. After the implementing the simple retrofit solutions as mentioned above, we need to further comfort.
2. Provide a slope metal sheet as barrier between the engine and the Heat exchanger. This will make the radiator to face fresh air from ambient thro hood side panels fixed with V type pre-filters to facilitate heat transfer. Here, take care to add a thermostat in fan control circuit so that the fan will operate to maintain optimum cooling temperature to Engine. Engine hot exhaust air must not reach the HX. Here we are trying to compartmentalize the engine and HX chambers to providing isolation.
3. The HOC, the heat of compression during the combustion of diesel with excess air pressure; is the major source of heat localized in the hood and it is better to provide isolated forced fresh air inlet to engine thro Heavy Duty Fresh Air fans to fix on side doors facing both sides of engine. Give Isolated Cooling to DG engine. Extend the air intake duct to the air intake wall (alternator side) of the hood.
4. Provide ventilation opening on the top area of hood where maximum exhaust air is thrown up and fix heavy duty exhaust fan horizontally as hood roof vent. This will remove hot spot areas inside. Take care fresh air is directed to engine & facilitate the hot exhaust air out of the engine to hood roof vent.
5. The Diesel tank return-cooling radiator to fix in the radiator compartment. Cut open the side wall so as to throw out hot air out of the engine. Here the diesel temp must be at 38°C for optimum viscosity and fuel saving. Whereas now, you go and measure your diesel tank temperature to find at 50 °C +.
6. The battery works for longer years at 28°C. So put battery in the proposed HX isolated compartment.
7. All these retrofits are needed to tropicalize the DG engine hood so as to run efficiently in the long run.

POINTERS TO THE INDUSTRY & OEM:-

As an industry consumer, it is not enough of this radiator-induced-air-draft to the DG set. Once the radiator chokes, very shortly the DG set suffocates and de-rates sooner. Now the trend here, is that we have to give forced draft of air to the above either directly or indirectly for sustainable efficiency. That is why Turbo vents have replaced the passive natural cement roof vents, in all the industry sheds. DG house is now kept positively cross ventilated. But let us now focus our attention first, within the engine hood. First we have to remove the heat that is arrested inside the DG hood for getting around 10 % more UPL and to sustain the DG efficiency in the long years.