

# WHITE PAPER

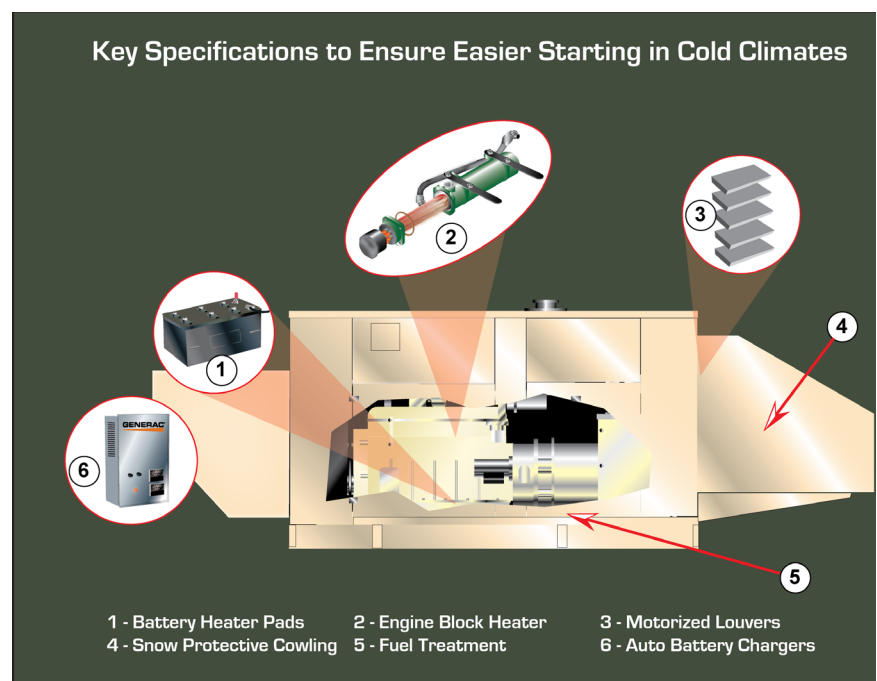
## Cold Climate Considerations for Generator Sets

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### INTRODUCTION

When emergency/standby generator systems are to be installed in an area that will experience cold temperatures, it is important to take into account several factors that can effect operation in cold climates. *This white paper discusses factors encountered for generator systems operating in cold temperatures and recommends to the system designer certain accessories that should be included in their specification.*



## MAIN AREAS OF A GENERATOR SYSTEM EFFECTED BY COLD TEMPERATURES:

An operator has to consider operationally how the cold effects the generator system when stationary and during operation. The principal issue for a stationary set is how the cold will prevent normal starting of the generator system. Once the set is running the operator has to consider what accessories or functions could be effected by the cold to cause any of the generator set equipment to shutdown.

## COMPONENTS OF GENERATOR SYSTEM WHERE COLD TEMPERATURES WILL IMPEDE STARTING:

The components of a generator system that have to be maintained at a minimum temperature or be specified for cold temperatures to ensure starting in cold ambients are:

### Engine coolant mixture

A stationary generator set system within a few hours of shutdown will be at the same ambient temperature as its surroundings. The operator should consult with the dealer for recommended coolant mixture.

### Engine coolant temperature

The most common method to maintain coolant at a optimum level for easy starting, above 60o F (16o C), is the fitting of block heaters. Block heaters are fitted to generator systems installed outside and inside.

Block heaters are considered a normal accessory for standby generators. The size is dependent on the ambient conditions for the specific installation site. A rule of thumb is that typical block heater will require 1 to 2 hours to bring the engine up to temperature for rapid starting. Most block heaters are connected to a constant electrical supply or have a thermostat included to maintain and regulate coolant temperature. It is important to automatically disconnect the heater when the engine start sequence is initiated. Several types of block heater are available:

Tank-style heaters – The most common in practice and mounted on or close to the engine with wattage up to 5000 watts.

Freeze plug heater – Replaces a core or freeze plug in the engine block and has an element inserted in the water jacket channels of the engine block. The coolant is circulated by the thermo siphon effect.

Lower radiator hose heater – Normally only utilized on small engines for generator sets under 15kW.

### Lubricating oil

Thermostatically controlled electric heaters can be mounted in the engine lubricating-oil system to maintain the oil temperature at a level for rapid starting. As for block heaters, this device must be automatically disconnected as soon as the engine start cycle is initiated.

### Batteries

The ampere hour capacity of the lead acid battery, commonly used on generator systems, reduces as the ambient temperature falls. A fully charged battery with all its cranking power available at 80oF, will only have about 40% available power at 0oF.

A weak battery may not crank the starter motor fast enough or long enough to start a cold engine. Actions for batteries are:

Correct sizing – Consult with the dealer regarding the required ampere hour capacity for the ambient temperature.

Charging – The battery should be maintained in a fully charged state, preferably with automatic battery chargers.

Battery heater pads and blankets – The NFPA 110 standard for standby or emergency generators calls for such devices to be used, where conditions make them necessary.

## COMPONENTS OF GENERATOR SYSTEM WHERE COLD TEMPERATURES CAN IMPEDE OPERATION:

In cold ambient conditions normal running operation of a generator set system can be effected. The following areas of the system should be considered to ensure reliable running while the set is in operation:

### Fuel system

Incorrect fueling will impact starting and the ability of the generator set to continue in operation. Diesel fuels are susceptible to gelling (waxing) in below freezing conditions. Running sets will shut down if the ambient conditions worsen after start.

The following actions should be taken to ensure continued fuel supply to the system in cold ambients:

Winter grade diesel fuel – It is important to use winter grade diesel fuel (often called No. 1), in lieu of the summer fuel (No. 2), where temperatures dictate. This winter grade fuel is lighter, less oily and has less lubricating qualities than No. 2 fuel.

Fuel conditioners – A number of manufacturers can supply anti-gelling additives for use on site to treat the fuel and prevent crystals forming at low temperatures, where conditions are extreme. Paraffin crystals or molecules precipitate from the fuel and form a waxy substance. This can block the fuel filter (s) which will restrict the fuel flow to the fuel pump and injectors, and need to be dispersed.

Conditioners maintain these crystals evenly throughout the fuel which helps to prevent wax clogging the fuel system. There are certain brands of conditioners that will lower the pour point of the fuel by up to 40%. Some fuel conditioners are freeze depressants that lower the freeze point of any water in the fuel, which helps to prevent damage caused by ice forming in the fuel lines.

### **Ventilation**

A major factor associated with operation in cold climates, is precipitation in the form of ice and snow. Generator sets require adequate ventilation for combustion and cooling. Where accumulation of ice and snow are expected, the set should be installed in a suitable enclosure or building with adequate apertures for inlet and exhaust air ventilation.

In locations where there is blowing snow and ice, moveable louvers can seal the apertures when the generator set is stationary. The moveable louvers should open in a positive manner. Motorized louvers are preferred over those that open with fan pressure because sleet and snow can render them inoperative in a relatively short period.

### **Air Cleaner Icing**

To avoid ice building up in the air cleaner, the air requires only enough heat to be above the dew point. In cold conditions, ensure the inlet air location of the air cleaner is located in an area that receives recirculated warm engine room air.

## **SUMMARY**

Operators have to consider how the cold weather effects the generator system when stationary and during operation. It is important to take the necessary steps to ensure easier starting in cold climates. It is also imperative the necessary actions be taken to ensure the generator set continues to run during operation. Always make sure you have the right individuals servicing your generator system to ensure proper performance when needed.

For more information about these concepts visit <http://www.cliffordpower.com/technical-sheets>. For more on the variety of Generac products available, contact Generac Power Systems at [www.generac.com](http://www.generac.com) or toll free at 1-844-ASK-GNRC.

### **Author Background**

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