USA
ULTIMATE SERVICE ASSOCIATES

*The ultimate solution for maintaining your nationwide generator network*

# Winterization Packages for Diesel Generator Sets

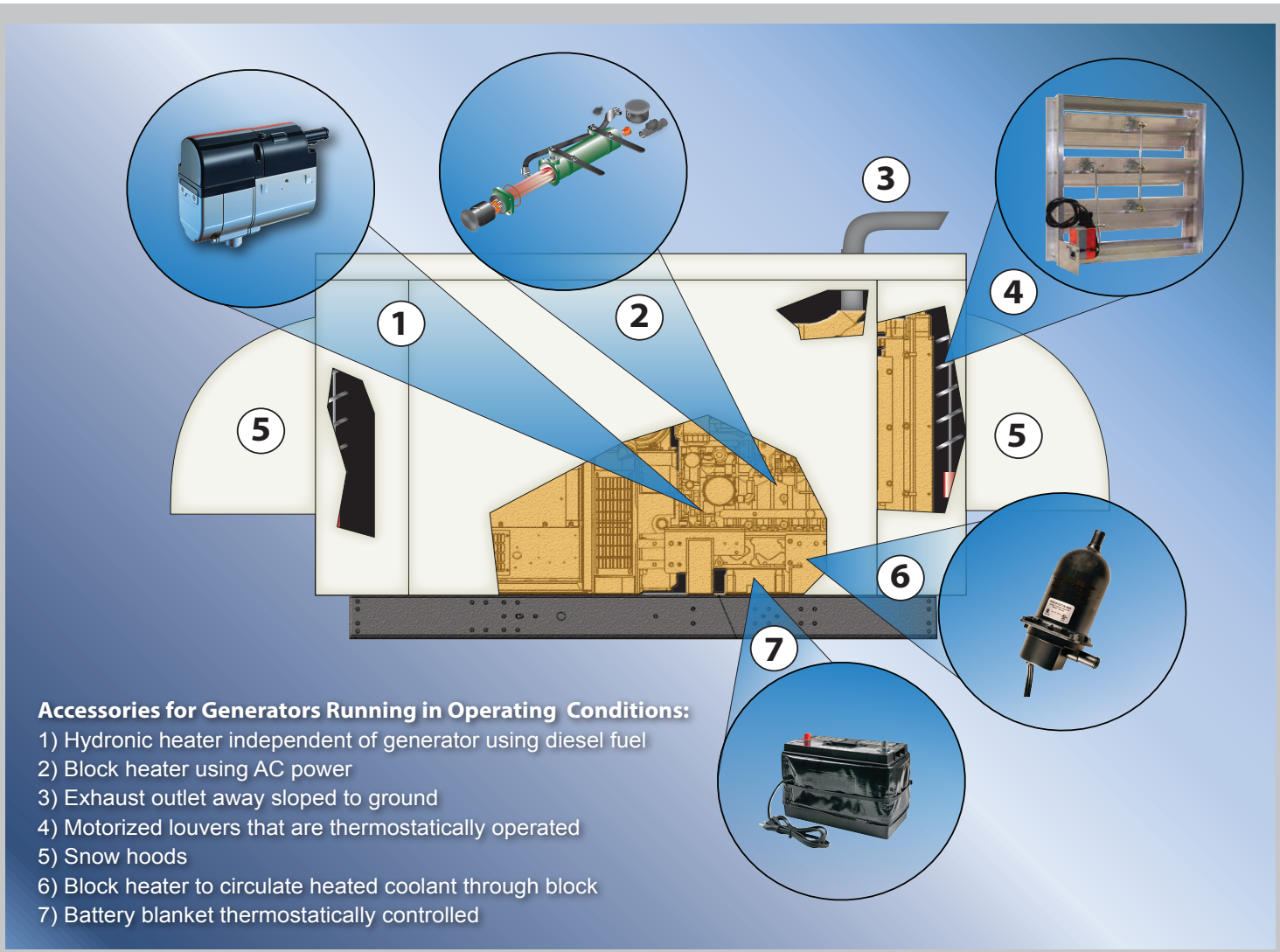
## 1.0 Introduction

Many generator set installations are installed outside the building they are supplying with standby or prime power. System designers must take into account several factors these outside installations can be subject to, particularly the ambient temperature and any form of precipitation. Applications in Northern tier regions of North America, such as oil field, rental, telecommunications, and data-centers, have to be protected from winter precipitation and extreme cold.

**This information sheet discusses winterization accessories that generator set manufacturers offer for applications in very cold climates.**

## 2.0 Issues with a Generator to be managed during Winter:

- A system designer or facility manager will have to take into account the following to ensure reliability on start and while carrying load:
- Cold Starting - Low ambient temperatures will affect the diesel engines ability to start.
- Fuel Condition - Standard diesel stored in low temperatures can to lead to the fuel gelling in fuel lines and filters.
- Air Intake - Snow and ice can disrupt air flow to engine and generator.
- Lubrication Oil - Lubrication oil can become very heavy or viscous in low winter ambient temperatures.
- Battery Condition - Battery capacity and cranking cycles greatly reduce as the ambient temperature falls.




**Accessories for Generators Running in Operating Conditions:**

1) Hydronic heater independent of generator using diesel fuel
2) Block heater using AC power
3) Exhaust outlet away sloped to ground
4) Motorized louvers that are thermostatically operated
5) Snow hoods
6) Block heater to circulate heated coolant through block
7) Battery blanket thermostatically controlled

To fulfill our commitment to be the leading network service provider in the Power Generation Industry, the USA, Inc. team maintains up-to-date technology and information standards on Power Industry changes, regulations and trends. As a service, our **Information Sheets** are circulated on a regular basis, to existing and potential Power Customers to maintain awareness of changes and developments in engineering standards, electrical codes, and technology impacting the Power Generation Industry.

### 3.0 Cold Starting:

There are various cold start aids. It is recommended to use aids that are approved by the generator manufacturer or fitted by the manufacturer or an authorized distributor. Starting aids include:

- **Engine Block Heater** - Standby generator systems frequently are fitted with an AC powered engine block heater. The thermostatically switch block heater heats the engine oil in the block and, by convection, maintains the engine at an optimum temperature for starting.
- **Coolant Heater** - Higher engine temperatures promote easier starting by speeding the time the starter cranks and combustion occurs. A thermostatically controlled electrical heater is fitted in the radiator to maintain the coolant at a temperature well above freezing. The coolant mix should follow the manufacturers' recommendations.
- **Glow Plugs** - Diesel engines below 1.0 liter per cylinder are fitted with cylinder head glow plugs that can be manually or automatically operated. They heat intake air into the combustion chamber and assist starting in low ambient temperatures.
- **Air Inlet Heater** - A heater in the air inlet duct heats air used for cooling and combustion. The warmer the engine the easier it is to start. When AC power is available they are usually electric. Diesel-fired heaters, such as rental sets, are available for application with no AC power.
- **Ether Start** - In extremely low temperatures, some systems use ether start systems that inject measured amounts of ether into the combustion fuel mixture on start. They should only be used as recommended by the generator manufacturer. Incorrect use can result in significant engine damage.
- **Control Panel Heaters** - When temperatures fluctuate significantly and a cold stationary unit sits for a while before running, there is always the possibility of condensation forming on control panel surface contacts. To avoid unwanted condensation, manufacturers offer AC powered anti-condensation heaters for electrical control panels in generator enclosures.

### 4.0 Fuel Condition:

There are several methods to ensure diesel fuel does not wax or gel in winter temperatures in northern latitudes. Again the manufacturer or authorized distributor will recommend the ideal method for any given installation. Methods include:

- **Fuel Line and Storage Tank Heaters** - Fuel stored outside can be heated with approved fuel tank AC powered heating devices. Delivery lines to the engine can be heated also. While most bulk storage tanks are located outside, some inside locations have those bulk storage tanks feed small fuel day tanks located inside next to the set to ensure fuel to the engine is at room temperature.
- **Winter Fuel Grade** - Generator manufacturers, using data from the engine manufacturer, will recommend winter grade fuels that are suitable for the generator set. Winter grade fuels are blended with additives to prevent gelling of the fuel in winter ambient conditions. With winter blend, the supplier has blended the #2 diesel with #1 kerosene. For winterized diesel, the #2 diesel has been treated with additives by the diesel supplier.

### 5.0 Air-Intake and Outlet Ducts:

When an installation is subject to heavy precipitation in the form of ice or snow, it is important to ensure air-intake ducts are not blocked. Air into the generator system is required for both combustion and cooling. Air duct protection includes:

- **Snow Hoods** - Right angle ducts, with downward-pointing entry/exit openings can be installed to air entry and exit openings to prevent snow and ice directly blowing in to the generator enclosure and restricting ventilation.
- **Motorized Louver Assemblie**s - Another method to maintain the higher temperatures in the generator enclosure is to fit the enclosure with motorized louvers. The slants of the louvers are opened and closed by an electric motor that is switched on and off by a thermostat in the enclosure. When the generator is stationary, the enclosure louvers are closed to help retain any residual heat from engine and coolant heating devices. The louvers will not open until the enclosure, with the engine running, reaches a required temperature. During operation, the thermostat will open and close the louvers to maintain the set at its optimal operating ambient temperature.
- **Gravity Slants** - Louvers fitted with gravity slants will only open when the units is running, either by sucking in, or exhaust out air from the enclosure through the slants.

### 6.0 Lubrication Oil:

The engine block heater will keep the engine oil warm while the generator is idle, but oil grades specifically formulated for cold temperatures are recommended for units that are going to be continuously run below freezing:

- Recommended Oil - The engine manufacturer's recommendation should be followed for suitable multi-grade oil. Oil that is too heavy or viscous will result in slow and difficult starts.

### 7.0 Starter Batteries:

Batteries at lower temperatures have reduced amperage hour capacity than is rated for NTP (Normal Temperatures and Pressure). The degree of drop in ampere hour capacity varies upon the battery. Most generator installations utilize lead acid batteries which at zero degrees Fahrenheit may only retain 46% of its rated NTP capacity. The following is recommended for maintaining required battery capacity:

- Battery Blankets - Generator distributors can fit AC powered thermostatically controlled battery warming blankets. This are recommended for backup generator systems when there is an available source of AC power when the generator is stationary.
- Increased Battery Size - For prime power generators, such as rental sets and remote off- grid installations, where no AC power is available, larger sized batteries should be used to ensure the required battery capacity in cold ambients. The battery supplier or generator distributor will provide the size to give the required ampere hour capacity at any given ambient

### 8.0 Exhaust:

When heavy winter precipitation is expected, the exhaust should be fitted with a rain cap at a minimum. It is even better to have the exhaust outlet pipe with a bend so snow cannot enter the pipe.

USA
ULTIMATE SERVICE ASSOCIATES

Ultimate Service Associates, LLC.
5514 South Lewis Ave.
Tulsa, OK 74105

Ph: 918.836.8701
Fx: 918.835.2748

www.usa-svc.com

MEMBER
EGSA Electrical Generating Systems Association