

1.0 INTRODUCTION

A reliable generator system depends on a clean fuel supply. One of the most common reasons why a generator set might not start, be unable to carry full load, or fail while running is water in the fuel. Water is a principal contaminate found in fuel.

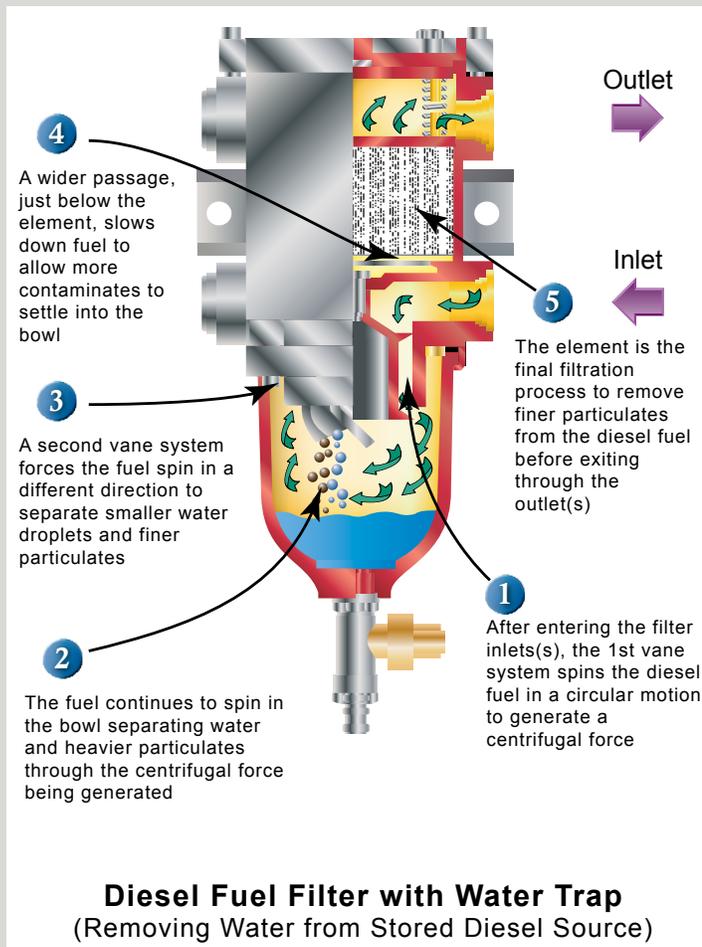
Two fuels susceptible to water contamination are diesel and natural gas (NG), two of the most frequently used fuels in generator sets.

A generator system designer has several choices to ensure unwanted water does not enter a generator's internal fuel system.

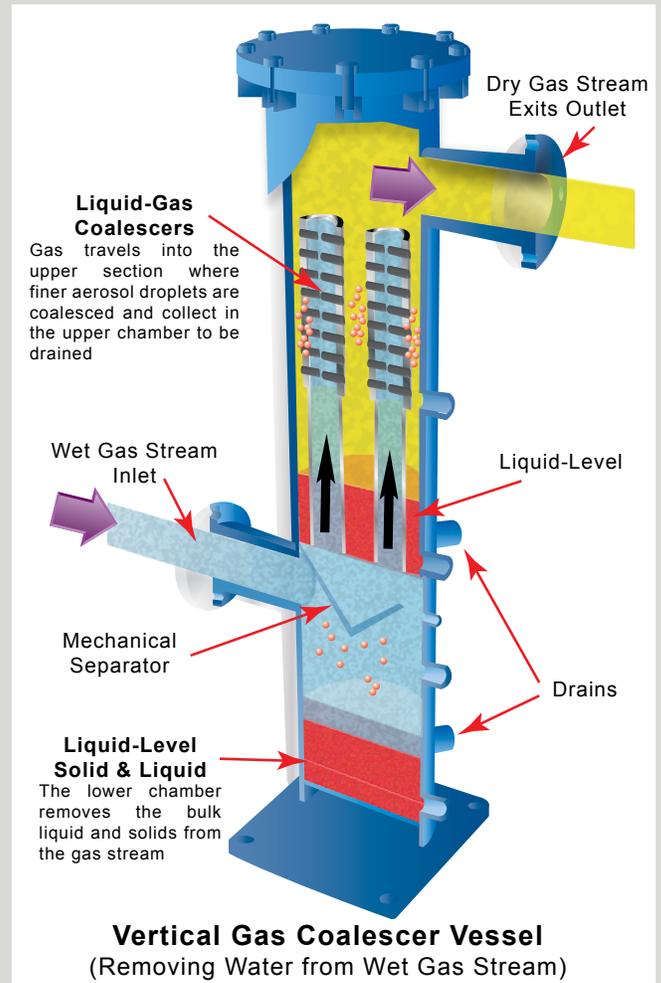
This Information Sheet discusses various solutions available to a system designer for separating water from both NG and diesel fueled generator sets.

REMOVING WATER FROM DIESEL FUEL

SEVERAL STAGE DIESEL FUEL FILTER



REMOVING WATER FROM NATURAL GAS FUEL



To fulfill our commitment to be the leading supplier in the power generation industry, the Loftin Equipment team ensures they are always up-to-date with the current power industry standards as well as industry trends. As a service, our **Information Sheets** are circulated on a regular basis to existing and potential power customers to maintain their awareness of changes and developments in standards, codes and technology within the power industry.

2.0 HOW WATER GETS INTO THE FUEL SYSTEM

Water can be found in the system because it came from the source or because on-site delivery systems and storage conditions are conducive to water contamination. NG and diesel each have distinct reasons for water entering the system. Each must be managed individually:

- **Water Contamination of Diesel** - While it is possible for diesel to be delivered to the generator set location with water contamination, most causes of water in the diesel fuel are attributable to on-site storage.

Condensation is the principal source for water contamination in diesel fuel. Diesel tanks that are not kept full have bare internal surface areas inside the tank on to which water can condense out of the atmosphere, especially in humid conditions. Other sources may include are poorly maintained fuel storage systems that allow rain or ground water to enter the system. An authorized generator distributor is trained to identify problems in fuel supply.

- **Water Contamination of NG** - NG fueled generator sets can be fueled directly from the utility line, through stored Compressed Natural Gas (CNG), or directly from wellhead gas. NG delivered from the utility has usually been treated at source to remove any water. Compressed Natural Gas has already had water removed before compression because water cannot be compressed. However, growing numbers of gaseous generator sets are designed to run directly from wellhead gas, which frequently contains water vapor that must be removed before entering the fuel system.

3.0 ADVERSE EFFECTS OF WATER IN A GENERATOR SYSTEM

Water entering a generator's fuel system can have several adverse effects. These vary depending on whether the fuel is diesel or NG.

- **Adverse Effects of Water in a Diesel System** - One of the unique properties of water is that under normal conditions, it cannot be compressed. But diesel engines inject fuel into the combustion chambers via injectors under very high pressure. Because water is not compressible, its presence in the system can damage the injector system, such as by blowing off injector nozzles. This will lead to engine failure and damage.

Water in stored diesel can also promote the growth of algae that, if left untreated, seriously degrades both the combustibility of the fuel and the ability of an engine to carry its rated load.

- **Adverse Effects of Water in a NG System** - NG contaminated with water will reduce the calorific value of the fuel and result in the engine not being able to carry its full rated load.

Water's presence in a engine system can lead to oxidization of various surfaces and a buildup of water in the lubrication oil, which reduces its lubrication coefficient and promotes premature engine wear.

4.0 METHODS TO REMOVE WATER FROM A GENERATOR SET'S FUEL SYSTEM

Manufacturers and specifiers of generator set systems have several proven solutions for ensuring water does not enter an engine's fuel system. Your authorized generator distributor will be very familiar with these solutions. There are very distinct solutions for removal of water from diesel and NG:

- **Preventing Water from Entering a Diesel System** - Most diesel engines have a fuel filtration system that is equipped with a water separator. (See Diagram 1.)
- The diesel fuel enters the filter from the storage tank. Filters normally have a vane system that spins the diesel fuel in a circular motion to generate centrifugal force. The centrifugal force continues to spin the fuel in a bowl located at the base of the filter to separate water and heavier particles contained in the fuel. A secondary vane system then circulates the water in another direction to separate smaller water droplets and finer particulates. Finally the fuel is drawn through an element to filter out even

finer particles before exiting to feed the engine's fuel system.

Routine planned maintenance schedules will ensure water and particulates that gather in the bowl are removed, the bowl cleaned and filter element replaced.

- **Preventing Water from Entering a NG System** - NG fuel requires a different technique to remove water because NG is a gas, not a liquid like diesel. (See Diagram 2.)

Generator sets being supplied from an untreated natural gas supply, such as wellhead gas, have water separators equipped with coalescing filters between the supply and NG engine. (See Diagram 2) Raw gas first enters an inlet chamber that mechanically separates larger particulates and water droplets, which fall out into a bottom chamber.

The gas then is drawn up through coalescers that remove water droplets, other smaller aerosols, and fine particulate contaminants from the natural gas (NG) streams. To filter out water naturally hydrophobic/ oleophobic micro fibers or solids material are used. The particulates and aerosols then fall into a second chamber that is equipped with drains.

A dry gas stream then exits through the outlet to feed the NG generator's fuel system.

5.0 CHECKING WATER IN THE FUEL SYSTEM AS PART OF A PLANNED MAINTENANCE PROGRAM

An authorized distributor of generator systems offers planned maintenance programs to ensure the generator set is maintained in a ready-to-run condition and able to take its full rated load when required. Many critical applications are governed by codes that specify planned maintenance programs. Checking the accumulation of water in fuel filtering systems should be part of any planned maintenance program.

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