PROPANE-FUELED MICROTURBINES

WHAT IS A MICROTURBINE?

A microturbine is a relatively small machine used for generating electricity. It utilizes a fuel such as propane for driving a small turbine that powers an electric generator. Microturbines are relatively new devices, and in many cases, are still being developed. They typically produce between 30 kW and 250 kW of electrical power.

Microturbines can be used for a variety of applications, including stand-by or backup power for businesses, power quality and reliability when a business can't support any variation in power, locations requiring both heat and power. Microturbines can also be used in automotive applications such as buses.

Capstone is a leader in the microturbine industry with the most units in the field; over 2,500 units have been sold (30 kW and 60 kW units). Other leading microturbine manufacturers with products available in the U.S. include Bowman Power Systems, Elliott Energy Systems, IR Energy Systems, and Turbec AB.

PROPANE AS A FUEL IN MICROTURBINES

Propane is a viable source of fuel for microturbines and has been tested in the laboratory by most of the microturbine manufacturers. It is estimated that 5% to 15% of microturbine generators will preferentially use propane as a fuel. Propane microturbines have many applications, including providing power to remote locations where conventional electrical power is not available. Propane is also used as a backup fuel with diesel or natural gas in situations where fuel redundancy is required for greater overall reliability.

Vaporizer and Capstone C30 Installed

Propane-fueled microturbines have additional requirements beyond those for the operation of a standard propane appliance or a natural gas-fueled microturbine. These issues include:

- Microturbines requires relatively high vapor pressure (55-80 psig)
- Propane liquid can not enter the microturbine system, fuel must be in vapor form
- Microturbine systems are smaller than typical propane systems, requiring specialized equipment
- Many sites will not have electric power available; the propane microturbine must be able to stand alone

Additional equipment may be required to ensure that these issues are addressed.

EQUIPMENT OPTIONS

There are several options to ensure propane vapor is delivered to the microturbine without risk of recondensation. These different equipment options include:

- Natural Vaporization
- Liquid Pump and Gas Vaporizer
- Tank Heaters

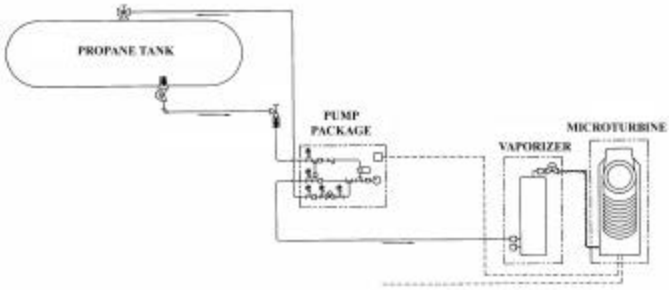
Of these options, the liquid pump and gas vaporizer provide the highest versatility and it is the only solution viable in all weather conditions.

Pump and Vaporizer

In this case liquid propane is taken from the bottom of the propane storage tank and piped to a nearby (within 2') small pump (pictured below) that insures that a minimum of 55 psig pressure will be provided to the microturbine.

The pressurized liquid propane in then piped from the pump to the propane vaporizer, which is normally located close to (within 3') the microturbine generator. The vaporizer adds heat to the liquid propane (approximately 800 Btu/gal) and converts it to a vapor form that can be used by the microturbine generator.

Just downstream of the vaporizer outlet a pressure regulator is installed. The regulator provides a constant 52 psig to the microturbine. The piping downstream of the vaporizer must be heat traced and insulated to prevent propane recondensation in this line.



The schematic illustrates an installation when using a liquid pump and separate vaporizer for a microturbine application. As shown in the schematic, the following equipment is required:

- The **storage tank** located at least 15 feet from the microturbine with a liquid line from the bottom of the storage tank with appropriate tank fittings.
- A **liquid pump** located below and close to the storage tank that is properly sized for the flow rate and pressure requirements of the microturbine.
- A **vaporizer** with an external heat source (either gas fired or electrically heated) with all the required controls included a positive shutoff that prevents liquid propane from getting past the vaporizer. There are many types of small vaporizers; gas fired, electrically heated, as well as waterbath and direct heated.
- A first stage **regulator** just downstream of the vaporizer set at 55 psig outlet pressure.
- A ? " to ½" **vapor line** from the vaporizer to the microturbine fuel manifold inlet.
- **Heat tracing** of the entire vapor line to prevent recondensation back to a liquid.

FOR MORE INFORMATION

Additional information concerning propane microturbine equipment can be found in the following two PERC projects:

- Prototype Development of Propane Fuel System Equipment for Microturbine Generators (PERC Docket No. 10263)
- Propane-Fueled Microturbine Field Test Program (PERC Docket No. 10466)

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