

TECH NOTES

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244E ENCLOSED BURNER SYSTEM – THE SMART CHOICE



US Patent# 6,012,917 & 6,146,131

The 244E enclosed burner systems are designed to burn biogas efficiently and safely over a wide range of operating parameters. With no visible flame, the 244E system uses an innovative stack and venturi burner design that guarantees combustion efficiency.

Emissions Requirements

Many air agencies across the country and around the world have been mandated with reducing greenhouse gases. Methane (CH₄), Carbon Monoxide (CO), and Nitrogen Oxides (NO_x) are the most likely to be limited in the combustion process.

CH₄ and CO are controlled by combustion efficiency. The higher the efficiency, the higher the destruction of CH₄ and the lower the CO produced. CO is the byproduct of incomplete combustion.

NO_x is the byproduct of high temperature combustion and is controlled by introducing excess air into the combustion process.

There are a number of basic designs for enclosed flares on the market today:

Temperature Controlled - Natural Draft

The digester gas is introduced through burners near the base of a large diameter and tall refractory-lined stack. Air is introduced through louvers mounted either to the side (one or two louvers typically 180° apart) or underneath the burners arranged in burner zones. These louvers are opened and closed based on a temperature signal from a thermocouple mounted at varying points in the stack. Usually, at minimum

flow, the thermocouple measures temperature closest to the combustion zone and as the flow rate increases the temperature is measured at the stack exit.

This type of flare is designed to operate at an optimum temperature range to ensure complete combustion of the hydrocarbons. As the temperature rises above set point, the louvers are opened in order to allow more air in and keep the temperature in a specified range. If the temperature decreases below the required setpoint, the louvers are closed to restrict air flow into the chamber.

The louvers are either manually or automatically operated. For these types of flares, as long as you maintain the temperature within the optimum range, you can guarantee a Destruction Removal Efficiency (DRE) and NOX and CO emissions. In the United States, this temperature is typically 1400 °F (760°C). There is also a retention time requirement of either 0.6 or 1 second. Retention time means the amount of time required for the products of combustion to stay within the height of the stack. The longer retention time ensures complete combustion of the hydrocarbons and minimizes the emissions.

Due to the high operating temperature requirement, the combustion stack is lined with either ceramic or castable refractory to protect it from heat. This considerably increases the weight of the burner requiring support systems. It is also typically provided with heat shields due to the radiant heat.

The Varec Biogas Model 249 Enclosed Flare is a temperature controlled – natural draft flare and we guarantee >99% destruction efficiency and NOX of less than 0.06 lbs/MMBtu and CO of less than 0.3 lbs/MMBtu. The flare is sized based on a specified minimum and maximum flow rate with a typical 5:1 turndown ratio per flare.

Temperature Controlled - Forced Draft

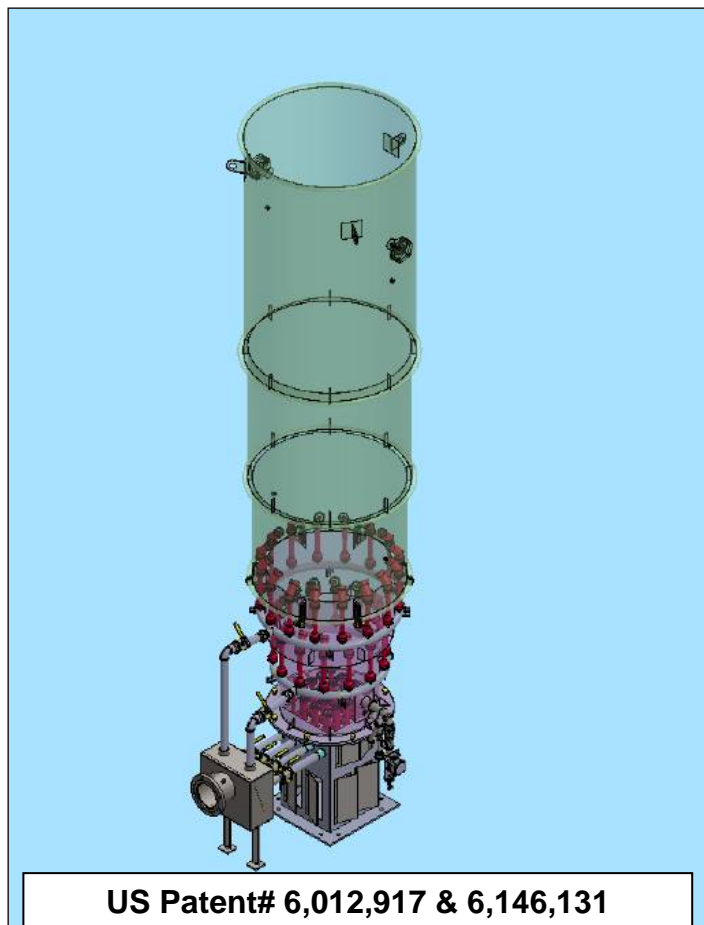
This unit is similar to the natural draft unit except that instead of having louvers it uses a blower to introduce the air. The blower usually has a VFD drive which is connected to the thermocouple near the stack exit to control the amount of air introduced. These units are typical in Europe where they use a higher temperature, 1650°F (900 °C) and a shorter retention time of 0.3 seconds. This type of flare guarantees 99% destruction removal efficiency. It can be deduced that the acceptable level of NOx would be higher since maintaining a higher temperature for too long will result in higher NOx emissions.

PATENTED DESIGN = SMARTER CHOICE

The Varec Model 244E Enclosed Burner is a unique and patented design wherein venturi nozzle burners are used to pre-mix air and gas which results in higher combustion efficiency.

The unique burner stack design consists of a number of chambers, with each chamber diameter increasing in size from the chamber below it.

Cooling air is brought in through openings between the chambers which helps reduce NOX production. Varec Biogas guarantees >99% destruction removal efficiency and NOx of less than 0.06 lbs/MMBtu and CO of less than 0.3 lbs/MMBtu which is the same as the temperature controlled units.



OPERATING PRINCIPLE

Biogas is introduced to venturi nozzle burner installed on the combustion chamber zones. Gas is introduced into the main burner zone, and additional burner zones are opened when the gas flow rate and gas pressure increases.

Air is naturally introduced from the burner stack base and the gaps between each stack chamber. The required amount of air is induced with the increase in heat release rate, thus resulting in higher combustion efficiency. The heat generated in the combustion process draws in air that allows natural cooling of the chamber to take effect.

AUTOMATIC PILOT IGNITION SYSTEM

The 244E utilizes the same state-of-the-art, pilot ignition system as the 244W. Pilot gas and air are mixed and ignited at ground level, remote from the combustion stack assembly. This controlled method results in a stable pilot flame with an ideal gas-to-air ratio.

The Model 244E is sized based on the maximum flow rate and inlet pressure to the burner manifold. The burner's performance is not limited to a specific minimum and maximum flow rate.

The unique features of the 244E Enclosed Burner System provide many installation, operational and maintenance advantages over the traditional temperature controlled flare.

1. Venturi Burners

By premixing the air and gas in the venturis, the burner is able to operate over an unlimited range of flows while still maintaining combustion efficiencies.

2. No Louvers

Louvers are a high-maintenance item on flare stacks. They are often controlled by complicated linkages and motors which require calibration to insure they are controlling temperature properly. Because the Model 244E has no louvers the controls are simpler and the amount of electricity needed to operate the burner is greatly reduced.

3. No Refractory

By eliminating the need for refractory, the Model 244E is much lighter than temperature controlled flares. This makes installation much simpler. In addition, refractory is subject to damage from intermittent operation and from flame impingement. If the refractory is damaged the structural integrity of the burner stack can be compromised leading to a catastrophic failure. Replacement of refractory can cost nearly as much as a new flare.

4. Multiple Chamber Stack

By having a stack with air inlets at multiple levels, the chance for gas build-up is eliminated. Contrast this with a large, single combustion chamber which can be affected by atmospheric conditions which could keep gas within the stack. Because of this, a purge cycle is required which increases the time lag between when the burner is required and ready to burn gas. In addition, an expensive positive proof of closure valve is often required to prevent gas leakage

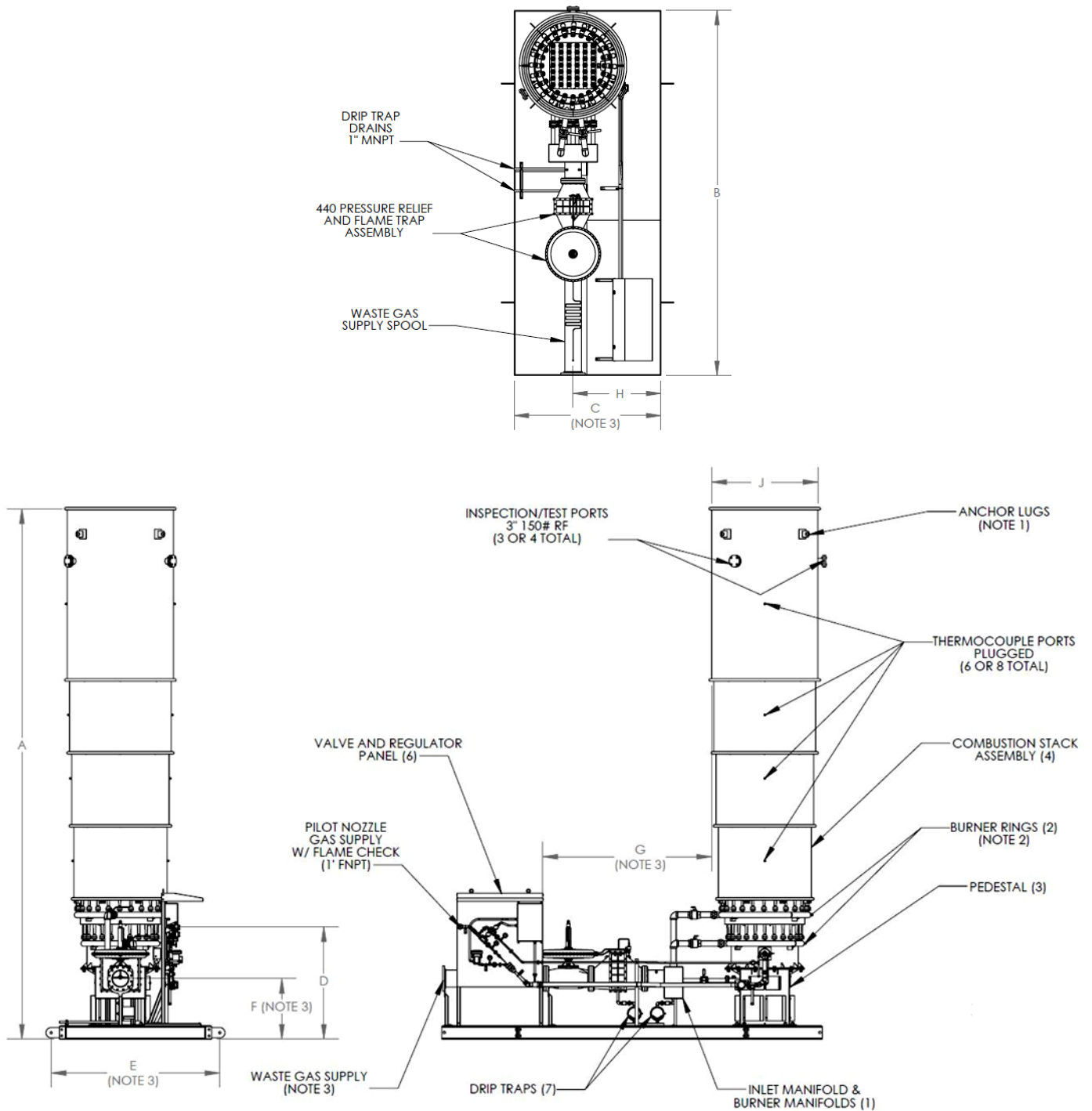
5. Smaller footprint and lighter weight

The smaller footprint and lighter weight means that installation costs will be much lower. In addition, it allows us to skid-mount the burner with all necessary valves and controls, adding convenience for the installer.

6. Simplified Controls

Because there are no dampers, no temperature controls, no purge blowers, and no positive proof of closure valves required, the controls for the Model 244E are much simpler than other burners. In addition, less current (often less than 5 amps) is required to operate the system.





244E with Automatic Continuous Pilot Ignition System – Typical Skid Mounted Layout

PRODUCT AND SERVICE RELIABILITY

Varec Biogas provides complete service that ranges from design assistance to installation inspection, commissioning and start-up assistance and operator training.

Our team of experts will provide you with a total solution to your biogas system requirements. Please contact the factory or your local authorized sales representative for pricing or further information.

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