Vortex Pilot Gas Heater Design Needs No External Energy Source

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A new concept of pilot gas heating that requires no external energy (no chemicals and no electricity) has been applied in the Vortex Pilot Gas Heater (VPGH).

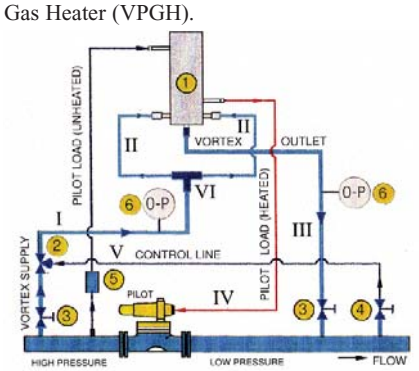

Figure 1: VPGH Schematic

In VPGH operations, the heat is produced as an outcome of the routine gas pressure reduction in the unit. The technique is based on the "vortex phenomenon" originated in the technique's proprietary cylindrical device with no moving parts (Single Flow Vortex Tube, or VT).

In the VT, an internal energy of the gas

decompressed in the VPGH inlet orifice is converted into two highly intensive thermal currents: the low-temperature current and the high-temperature current. Since the high-temperature vortex current is located close to the VT walls, its energy penetrates the walls and serves as a heating medium for an external pilot gas flow. The low- and the high-temperature currents co-exist in the VT, then exit the unit through a single discharge orifice.

Since the VT's driving force is the pressure differential available between the VT's inlet and outlet, at a pressure regulation station the VPGH is set-up in parallel to the pressure regulator, (Figure 1). Here the VT takes a high-pressure gas upstream of the pressure regulator and discharges low-pressure gas into the downstream line. Because the VT's flow is just a fraction of the entire pressure-regulated flow, the VT's discharge pressure will always be equal to the station's downstream pressure.

The unheated pilot supply gas taken upstream of the pressure regulator is directed to a heat exchanger that is set in intimate contact with the VT's outer walls. Here the pilot gas absorbs the heat radiated by the high temperature current of the vortex flow. The pre-heated pilot gas is then directed to the pilot orifice.

The VPGH installation, operating at a station with the possibility of "no-flow" conditions, includes a Fisher 627M regulator that senses the gas delivery pressure. It is important to emphasize that in the VPGH application the Fisher 627M serves only as an overpressure protection device and therefore operates either in a fully open or in a fully closed position.

In the VPGH design, a portion of the high-temperature current is applied to indirectly (through a surrounding heat-exchanger) warm the unit's inlet nozzles (spot heating) to prevent freeze up in the depressurizing gas. Main features of the VPGH:

- Adds up to 90 degrees F to the pilot supply gas.
- Heats pilot gas as an outcome of the routine gas pressure reduction.
- No lost gas, no emissions (completely GREEN technology).
- No moving parts, therefore no maintenance.
- Not sensitive to wet gas.
- Easy to install or retrofit in new or existing facilities.
- Reduces maintenance on the main pressure regulator at station's low-flow operations.

The VPGH has proven to perform efficiently over a broad range of operational parameters, even handling a single pressure cut of more than 1,000 psi pressure differential and operating outdoors under ambient temperatures as low as -44 degrees F. While working with a sulfur-containing flow, the VPGH maintains sulfur in the vapor phase thus preventing sulfur deposition in the pilot orifice. The VPGH is available in two designs:

- Single Path to serve one pilot at a time, and
- Dual Path to simultaneously serve two pilots.

There are more than 60 utilities in North and South America, Europe, Australia and New Zealand that operate more than 900 VPGHs. No VPGH performance failure has been reported.

Although the pilot gas pre-heating is the primary VPGH application, the unit is also used for pre-heating other separate gas flows such as a pneumatic gas, gas to feed the controllers and fuel gas.

Washington Gas Application

At Washington Gas (WG) pressure regulation stations the units have been used since 2003. The typical operational parameters of

these stations are: inlet pressure 200-400 psi and outlet pressure 20-55 psi.

At these conditions, pilot gas freeze up has often been experienced and therefore a different means of pilot gas heating has been used in the past.

The VPGH use began with a field test where a pilot gas temperature increment of 90 degrees F was achieved just out of the gas pressure reduction in the unit. Since that demonstration, the number of VPGHs put in service has grown.

The company's pressure operations group has 65 VPGHs in service at new and older stations as the VPGH can be easily incorporated into an existing design.

Furthermore, WG's design for pressure regulation stations includes the VPGH. Most of the installed VPGHs are left in service year round.

The added security with heated pilot gas decreases the risk of pilot freeze up and regulator failure. The absence of a pilot light — no burners that could go out or turn off — adds to the comfort of the WG's regulator station operations group.

Also, the understanding of the VPGH operation and its online reliability has allowed WG pressure operations personnel to use the available resources in other areas of operation during peak demand. Savings accrue from the avoided costs of not having to dispatch crews to verify heater operation. ***P&GJ***