# UNIVERSAL VORTEX, INC.

# VORTEX SELF-HEATING PRESSURE REGULATOR

**Universal Vortex (UVI)** offers proprietary technology to eliminate the need for Line Heaters or Catalytic Heaters in pressure regulation where external heat is used for spot heating of the regulator's pressure reducing orifice to prevent it from freezing in an expanding gas caused by the Joule-Thomson effect.

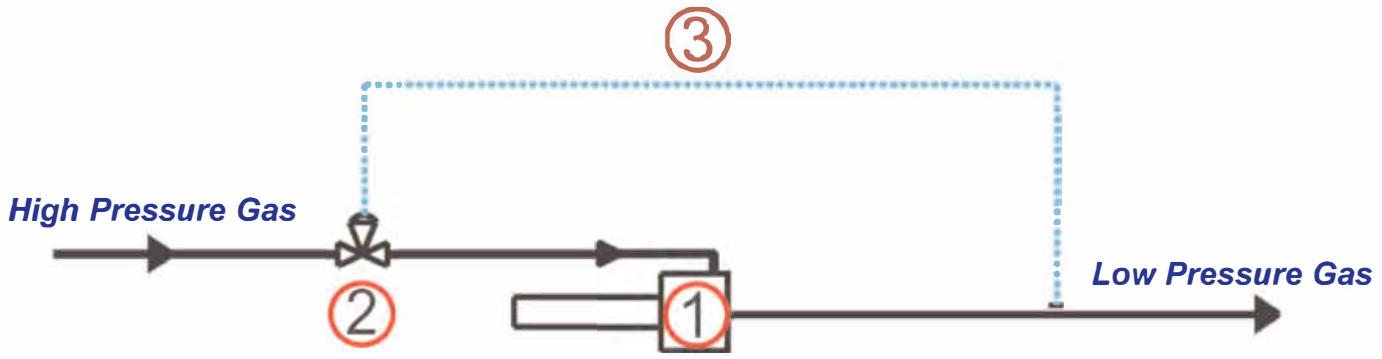
The **Vortex Pressure Regulator (VPR)** in the course of its performance reduces pressure of the inlet gas flow down to the desirable downstream pressure and simultaneously converts the energy of a decompressed gas into a thermal flux (Vortex Phenomenon), forming vortex 'cold' and vortex 'hot' fractions. These fractions co-exist in the low-pressure part of the **VPR**, merge at the unit's exit orifice and then are discharged into the downstream line. Prior to mixing up with the cold fraction, a portion of the hot fraction is directed to the heat-exchanger set up on the unit's pressure reducing orifice. Here the hot gas indirectly heats the orifice (spot heating) thus preventing freezing of the depressurized gas flow.

*The main benefits of the **VPR** are:*

- **SELF-HEATING DEVICE THAT NEEDS NO EXTERNAL HEATING**
- **GENERATES HEAT AS AN OUTCOME OF THE ROUTINE GAS PRESSURE REDUCTION**
- **STEADY NON-FREEZE PERFORMANCE REGARDLESS OF THE GAS QUALITY**
- **NO MOVING PARTS**
- **NO LOST GAS**
- **NO MAINTENANCE**
- **EASY TO INSTALL OR RETROFIT IN NEW OR EXISTING FACILITIES**

The **VPR** installation includes a monitoring valve upstream of the **VPR** for overpressure protection of the downstream line at zero demand. The valve (usually a Fisher 627M) is connected with the line downstream of the **VPR** and has a set up point equal to the delivery pressure.

A schematic of the **VPR** installation:




❶ ***Vortex Pressure Regulator*** ❷ ***Monitoring Valve*** ❸ ***Sensor Line***

On the high flow the Fisher 627M is wide open and the VPR takes the whole pressure cut. When customer's demand goes substantially down, the Fisher 627M may begin throttling gas, still letting the **VPR** take a major cut. At the very low (close to zero) customer's demand, the pressure differential in the Fisher 627M increases in the course of completely closing the unit at zero flow demand.

Under low flow conditions the pattern of gas pressure differential in the Fisher 627M and in the downstream vortex pressure reducing devices is similar for both the **VPR** and the Vortex Pilot Gas Heater in the VPGH installations.

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The **VPR** sizing is determined by the unit's ability to deliver the maximal projected gas flow at the anticipated minimal inlet gas pressure. There are four sizes of the VPR available that differ by the size of its inlet orifice.

Table lists the **VPR**'s flow rate at the quite abundant gas inlet pressure of 700 PSI:

| SIZE OF THE VPR | FLOW RATE SCFH @ 700 PSI |
|---|---|
| MINI | 2,200 |
| SMALL | 4,700 |
| MEDIUM | 7,300 |
| LARGE | 38,500 |

The **VPR**'s flow rate at different inlet pressures is proportional to the flow @ 700 PSI.

The overall dimensions of the **VPR** are:

- **MINI:** 3" DIA. X 8" LONG
- **SMALL:** 3" DIA. X 9" LONG
- **MEDIUM:** 3" DIA. X 10" LONG
- **LARGE:** 4" DIA. X 19" LONG

**Mini VPR installation by Teresen Gas at Honeymoon Creek BC, Canada.**
**Inlet pressure 750 PSI, outlet pressure 60 PSI, flow rate 300 SCFH to 1900 SCFH**

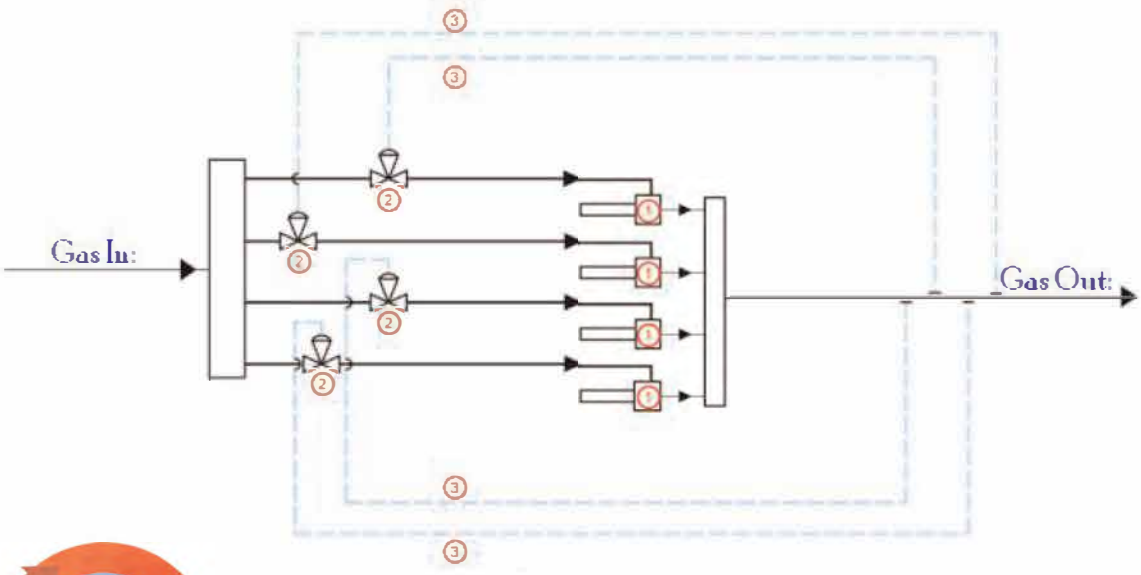
The **VPR** technology can be efficiently applied for Farm Tap installations as well as for building relatively small Pressure Regulation Stations (e.g. district and border ones). In addition to the benefits stated above, there is one more advantage for the **VPR**-equipped stations:

- No conventional pilot-operated pressure regulators are required to operate Pressure Regulating Station with the **VPR**. Therefore, no possibility of Pilot Gas freezing.

To comply with the flow rate much larger than what is typical for the Farm Taps, the **VPR**-equipped Station may consist of multiple runs; in this case to better size the Station each run may have the **VPR** of a different size.

To better respond to the variable gas demand the Fisher(s) 627M upstream of the **VPR** may have an individual set up pressure.

A schematic of the Pressure Regulating Station (with four **VPR**):

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