CO_2 REGULATOR FREEZE UP

Harris Model HP 705 Electrically Heated Regulator

Under certain conditions, users of carbon dioxide gas (from high pressure cylinders), experience "freeze-up" problems on valves, regulators and other compressed gas equipment. The term "freeze up" refers to a pressure regulator becoming clogged with dry ice, snow or crystals, which restrict the flow of gas through the regulator or other pressure control valve. The following explains this phenomenon in an effort to help users avoid problems in CO_2 distribution systems.

Why does a regulator freeze up?

When high pressure CO_2 gas expands through a regulator seat or other flow control orifice, it can be seen downstream of the orifice on the low pressure side of the regulator as a mixture of gas with solid (snow) or liquid CO_2. If the downstream pressure is below 60 PSIG, the mixture is gas and snow, above 60 PSIG, the mixture is gas and liquid.

The amount of solid (snow) or liquid can vary from <1%, at inlet pressures under 800 PSIG when the cylinder is cool, to more than 20% under severe freeze up condition when the pressure is above 1100 PSIG resulting from a warm cylinder. Contrary to what one might expect, the most severe freeze-up conditions with CO_2 exists on warm days when a full cylinder is at 90° F or higher and the cylinder pressure is at least 1100 PSI. At normal room temperature, and full cylinder pressures of 700-900 PSI, the problem exists, but not as severe as under the conditions above.

Solid CO_2 cannot form at pressures above 60 PSIG. It occurs when the gas undergoes the pressure drop at the regulator valve from inlet pressure to a delivery pressure below 60 PSIG, emerging as a mixture of gaseous and solid CO_2 at a temperature in the range of –70° F at 60 PSIG to -100° F at the lower pressures. Under the most severe freeze-up conditions, a significant percentage of the mixture can be solid, requiring about 200 watts of heat /100 scfh of CO_2 to vaporize the solid and raise the gas to room temperature.

Why use a heated regulator?

Unheated regulators, operating at delivery pressures below 60 PSIG, are subject to classic freeze up with solid CO_2. The CO_2 snow and dry ice particles may pass through a regulator if the outlet is wide open. If an orifice or flow control valve is used, a filter is needed to prevent the solid CO_2 particles from clogging the orifice. This can result in the low pressure chamber of the regulator becoming completely filled with solid CO_2. The severity of the problem depends upon the flowrate of CO_2, the inlet conditions, the duty cycle (percentage of time that the gas is flowing) and the physical size of the regulator.

Unheated regulators, even if they avoid the classic problem of freeze up, cannot avoid the refrigerant effect of CO_2. When the pressure drops at the regulator valve, the CO_2 temperature drops sharply to the levels stated above, and at normal flow rates, frost can cover the entire regulator and extend to the downstream system. This frost is a result of the moisture in the air freezing and accumulating on the exterior surface. It is not related to the CO_2 effects described here and typically have no effect on the performance of the valve.

The Solution

Heated regulators can relieve or eliminate freeze-up problems. The Harris Model HP 705 has 200 watts of heat to provide a continuous 100 scfh of CO_2 under the most severe freeze-up conditions and higher flowrates under normal (intermittent) conditions. The regulators are two-stage, to include the advantages of the two-stage regulators discussed above. The first stage cavity serves as a boiler to vaporize CO_2 liquid and eliminate or minimize any CO_2 solids in the second stage. The second stage chamber is then available to heat the CO_2 vapor before it reaches the outlet.

HP 705

Electrically Heated - Brass Barstock Regulator

NEW!

Model HP 705-125-320-A1 shown

An electrically heated dual stage regulator used for non corrosive liquefied gases with up to 3000 PSIG inlet pressure. The Model HP 705 is suitable for:

- Chemical storage blanketing
- CO_2 incubators
- Inert gas purging
- Ph control

Recommended for non-corrosive, liquefied gases or mixtures subject to freeze up.

MATERIALS

Body	Chrome Plated Brass Barstock
Bonnet	Chrome Plated Die Cast
Diaphragm	302 Stainless Steel
Nozzle	Brass
Seat	PTFE Teflon
Seals	Buna-N
Filter	Nickel-Plated Sintered Bronze - 10 Micron
Seat Return Spring	Stainless Steel
Adjusting Knob	ABS Plastic

FEATURES

- ☑ Stainless steel diaphragm
- ☑ First stage brass piston sensor
- ☑ One piece encapsulated seat design includes a 10 micron sintered filter to protect the seat from particulate contamination
- ☑ 2 1/2" chrome plated dual scale gauges (psi/bar)
- ☑ Maximum inlet 3000 PSIG
- ☑ Cv of .15
- ☑ 200 Watt electric heater
- ☑ 120 or 240 volt
- ☑ Continuous flow up to 100 SCFH CO_2
- ☑ All electrical components are UL Listed

HP 705 ORDERING INFORMATION

HP 705 - xxx - xxx - xx - x

MODEL NO.	DELIVERY PRESSURE DELIVERY	(OUTLET GAUGE)	CGA/INLET FITTING	ACCESSORIES	SPECIFY VOLTAGE
HP 705	125 PSIG	(200 psi/14 bar)	320 326 580 000 (No Inlet)	A) 1/4" MNPT Needle Valve B) 1/4" FNPT Diaph. Valve C) 1/4" FNPT Port D) 1/4" MNPT Nipple E) 1/4" Tube Fitting F) 1/8" Tube Fitting G) 1/4" MNPT Hose Barb H) 1/8" MNPT Hose Barb J) Inert fitting (P/N: 9100986)	1) 120 VAC 2) 240 VAC

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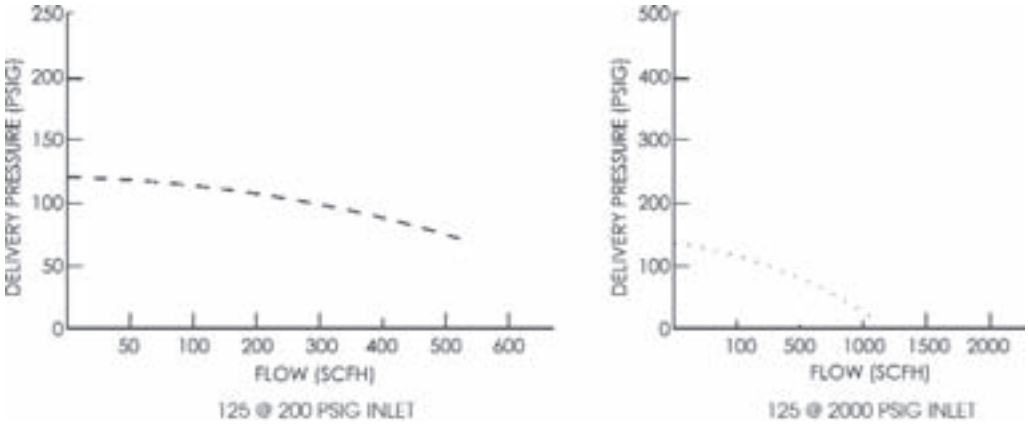
HP 705 TECHNICAL SPECIFICATIONS

FLOW DATA



SPECIFICATIONS

- C_V: .15
- Pressure Regulation: 0.9 PSIG/100 PSIG
- Weight: 6.8 Lbs.

DIMENSIONS