CO2 Freezing Issues Explained

GASCON SYSTEMS

A.B.N. 74 716 626 338

Designers, Manufacturers, Suppliers of Specialised Gas Control Equipment

Correspondence to:
GASCON SYSTEMS PTY. LTD
24 Ford Crescent, Thornbury, Victoria 3071
PO Box 284, Balwyn Nth, 3104
Telephone: 61 3 9499 4100
Facsimile: 61 3 9499 4111
email: sales@gascon.com.au

Sometimes gas providers do not clearly mention the fact that there is maximum recommended cylinder withdrawal rate for gases like CO2. From the larger "G" sized, at a temperature the withdrawal rate is roughly **30 l/min (3.4 kg liquid weigh per hour)**. This is the maximum rate that the liquid in the cylinder can change phase into a gas. The ambient temperature on the cylinder plays a significant role in this withdrawal rate. The colder the temperature the lower that the withdrawal rate is, the warmer the ambient temperature, the higher the withdrawal rate (up to a certain point then after which other issues come into play).

If you required a flow of 10 kg/hr for your process, you really need to have at least 3 cylinders connected to feed the regulator. If you overdraw gas from a cylinder you will start to draw up liquid and feed that into the regulator. Most regulators do not like liquid CO2. You can tell when a cylinder is being overdrawn when you see ice forming on the cylinder or on the components located between the cylinder and the regulator.
Ice forming on the regulator is a different issue. That is the Joule-Thomson effect of expanding the gas from high pressure to low pressure through the regulator. A heater will not increase the cylinder withdrawal rate, but it will decrease icing caused by the gas expansion.

The amount of CO2 that a regulator can handle without icing becoming an issue depends on its design (every brand is different, there is no one rule for all types). Some amount of frosting or light icing is generally not a real problem. It becomes a problem when the outlet pressure gauges start to flicker about. This indicates ice is building up inside the regulating seat, then breaking off. Taken to an extreme, a regulator can ice solid and flow stops, at which point you start to damage the regulator.

It is best to ensure you have enough cylinders manifolded together for your process. Fit preheaters if necessary (usually at flows of 75 l/min heater come into play).

If what you are using are bigger than a "G" sized cylinder then it cannot be a high pressure cylinder. It must be a portable liquid vessel, something like the attached image

Even these have flow withdrawal rate limits, but they tend to be higher than normal cylinders. You should ask the companies that supply them to tell you.

The portable liquid vessel generally operates at lower pressures than cylinders. Typically, around 1100 kPa, whereas a cylinder is around 5600 kPa. This means the Joule-Thomson icing effect is a lot less. As a general observation you should be able to get 2 - 3 times the flow out of the same regulator when it is fitted to portable liquid vessel versus a high-pressure cylinder.

Regards,

Gascon Team