Haldatec

Self Contained Regulator - Sizing

Introduction

Self contained pressure regulators are those that are not pilot/instrument operated.
They consist of three elements

1. A restricting element that varies the amount of flow that is allowed to pass through the regulator– inner valve / poppet / disc.
2. A loading element, generally a spring.
3. A measuring element diaphragm / piston. Most regulators have a diaphragm as it's measuring device.

All these elements will affect the performance of the regulator.

- A large restricting element will create out-of-balance force due to the pressure drop. If the pressure drop varies then the set point will vary
- The loading element depending on its stiffness will affect the set pressure sensitivity and capacity.
- The measuring element will affect capacity and more particularly set pressure, depending on its stiffness and effective area changes throughout the stroke.

In addition to these elements there is a further contributing factor to sizing, that is the body configuration, the geometry of which will affect the capacity due to the recovery coefficient or pressure drop ratio factor.

Changes in any of these will affect the capacity and outlet pressure variation.

In any single regulator, the diaphragm or piston can be considered stable as will the geometry. Changes in capacity will be affected by changes in the pressure drop and spring characteristics and setting.

Capacity Sizing

Regulating

To accurately predict what will happen under any circumstance i.e. range of set pressures with various spring selections, variations in pressure drop, is difficult without running capacity testing for all the combinations and variations.

Most manufacturers do run some tests, from these tests a flow coefficient will be derived. A responsible manufacturer will publish a coefficient that will give the user a predicable flow using the Universal Sizing Equations for gas and liquid standardised by ANSI/ASA/IEC
The published coefficient usually given as Cv can be used for sizing normal regulated flows within a reasonable offset from the pressure set point, 20% is considered an acceptable deviation (usually lower than set point).

Turndown

Self contained regulators usually have a high turndown ratio. It can be seen when in a domestic situation, the house meter regulator will be capable of maintaining a single pilot light and delivering enough gas for heaters and a stove.
The available turndown will depend on the spring rating and adjustment, the diaphragm/piston sensitivity, orifice/diaphragm ratio and pressure drop all of which will vary in the same model regulator as well as in different types.
Considering the various flow charts presented by the various manuafactures with critical pressure drop, most regulators up to ½ ” size can be accepted as having a turndown of 100:1or more. Larger regulators have to be considered as one off cases with turndowns sometimes as low as 15:1.

Relief Sizing

This coefficient will not give the maximum flow capability of the regulator as this will vary across a range of pressure drops. However should the regulator fail in the wide open position this regulating capacity could be exceeded.
For this reason when sizing relief devices for downstream relief, a further *25% capacity should be added* to that indicated by the published sizing coefficient.