VALVE SEAT LEAKAGE

With increasing focus on environmental impacts and emissions, there is increased concern about valve seat leakage. For the most part, refrigeration valves available today do not conform to any seat leakage rating standard. Process valves are available that do conform to leakage classifications, but they conform to ANSI or API standards and they are more expensive than industrial refrigeration valves.

When valves do conform to a seat tightness classification, the best known of the tightness standards is ANSI/FCI 70-2 1976. When provided, the two most common classifications are Class IV for metal-to-metal seats and Class VI for soft seats. The ANSI/FCI 70-2 1976 classifications are described as follows:

- **Class I**. Identical to Class II, III, and IV in construction and design intent, but no actual shop test is made.
- **Class II**. Intended for double port or balanced singe port valves with a metal piston ring seal and metal to metal seats. Air or water at 45 to 60 psig is the test fluid. Allowable leakage is 0.5% of the rated full open capacity.
- **Class III**. Intended for the same types of valves as in Class II. Allowable leakage is limited to 0.1% of rated valve capacity.
- **Class IV**. Intended for single port and balanced single port valves with extra tight piston seals and metal to-metal seats. Leakage rate is limited to 0.01% of rated valve capacity.
- **Class V**. Intended for the same types of valves as Class IV. The test fluid is water at 100 psig or operating pressure. Leakage allowed is limited to 5 X 10 ml per minute per inch of orifice diameter per psi differential.
- **Class VI**. Intended for resilient seating valves. The test fluid is air or nitrogen. Pressure is the lesser of 50 psig or operating pressure. The leakage limit depends on valve size and ranges from 0.15 to 6.75 ml per minute for valve sizes 1 through 8 inches.

Popular terms, such as *bubble-tight, zero-leakage, high performance and fire-safe,* are being used without clear understanding of their meaning. It is clear that none of the ANSI classes can actually be considered *zero-leakage* or even *bubble-tight*. The only existing standard that requires *zero-leakage* is API 6D for gate, ball, plug and check valves for pipeline service. In 1996 and 1997, API issued supplements to API 6D that allowed some leakage across metal-to-metal seats. Prior to that, API SPEC 6D allowed *no visible leakage* from any valves.

Some new refrigeration valve standards have emerged. Europe's prEN 12284 standard limits seat leakage in terms of a percentage of normal valve capacity. The International Institute of Ammonia Refrigeration (IIAR) is reviewing a draft valve standard that requires *zero leakage*, but stops short of establishing the process of validation. The responsibility rests with the manufacturer to select/develop test methodology and fluid to suit the product being produced and demonstrate zero leakage over the test duration. Typically, manufacturers test with air under water and in the simplest set up, leakage is evidenced by bubbles. Some manufacturers use more sophisticated methods.

Although leakage is undesirable, and in some cases hazardous, it is generally recognized that complimentary plant practices must be employed to compensate. Some seat leakage is a fact of life. This is especially true if seat surfaces are damaged during piping fabrication and/or pressure testing. Among the most prominent causes of scored seats is particulate contamination, which is found in virtually every welded piping system. High velocity gas often combines with particles to score seats during pressure testing procedures.

Some companies have established in-house standards for seat leakage. It is critical that these standards, or any leakage concerns, be thoroughly reviewed prior to purchase of equipment to avoid misunderstandings later.