Cornerstone® VALVE
SEVERE SERVICE ENGINEERING

Experience in large diameter ball valves in high temperature service:

There are literally thousands of ball valves utilized in steam service. These generally fall into two categories:

1. Small diameter floating or trunnion mounted ball designs are used in drains, vents, etc. Pressure classes range from ANSI 150 through 2500. Typically, floating ball valves become limited in size as the valve diameter increases. This is a function of stresses induced in the ball/seat interface as well as the particular design of the ball/stem joint. Large diameter floating ball designs are used less, as bore sizes get above 8", as torques increase dramatically.

2. Small and large diameter trunnion mounted ball valves are routinely used in high pressure gas services. In gas production, pressures to 10,000 psig are not uncommon. Temperatures, in this process, rarely exceed 400 to 450F. Depending upon location and fluid contents, many of the high-pressure valves are specified as metal seated. We recently produced a series of valves, metal seated, that see pressures of 10,000 psig. These were nitrogen gas tested and are bubble tight.

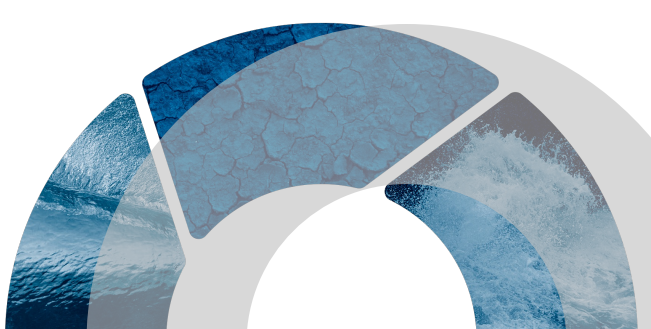
In high temperature and high pressure, especially in sizes 6" and larger, the number of applications becomes much more limited.

[We are defining high temperature as above 500F and high pressure as ANSI 2500 or higher.]

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Experience Of Technical Division In Severe Service Applications

There are applications in processing of heavy crude oils that require valves to operate at 950F and 3250 psig. Valve bore sizes, however, are generally 4" or smaller. Both trunnion-mounted and floating ball designs have been used.

Although there are many applications in similar temperature ranges in hydrocarbon processing, most operate at lower pressures. Cornerstone has experience in handling hot gas in sizes through 16" in the 800 to 900 F temperature range. They are Class 900 valves.

Each type of valve faces a particular design challenge. In the floating ball design, high torques can damage either the stem-to-ball connection or the ball seat interface. Trunnion mounting the ball reduces the torque by a factor of at least 50% -however the valve must then become an upstream sealing design.

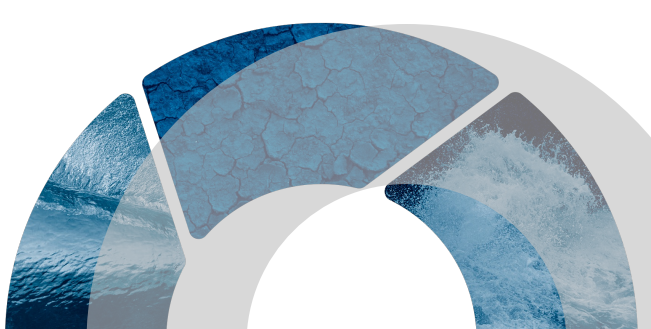
This means that there are two potential leak paths. They are the ball/seat interface (same challenge on a floating ball) and the seal between the seat spool and body. The ball/seat spool is a function of metallurgy and sphere accuracy.

The seat spool to body seal is the challenge. This area must provide positive sealing in both the radial and axial directions. In addition, it must respond to rapid temperature changes.

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We have developed a live loaded high temperature seal design that seals effectively. It is currently used on our small power valves. (Incidentally we have about a hundred of these installed over the last four years and have had zero leaks to date.)

Earlier versions of this design, developed by the undersigned in the late ?O's and early 80's operated in sizes up to 12" 900 and 10"-2500. We have a valve in Natref Refinery, installed in 1993, that operates at 800F and pressures to 5000 psig. It is shown in our "Overview 4" presentation which can be downloaded from our web site (www.CornerstoneValve.com). This valve has been trouble-free.

We will send you a detailed design of this seal but it is proprietary with our company and it will be with the understanding that this design will not be exposed to another competitor or their representative.

Robert G. Davenport, P.E.

Enc: Steam references

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