Weir Control & Choke Valves provides a wide range of control valves for the process industry. These include severe service, choke, desuperheating and turbine bypass applications.

Our world-wide reputation is based on engineering excellence applied to a comprehensive range of specialist products and effective customer support.

Quality assurance

Weir is qualified to industry standards and working practices including:
- ASME BPVC Section III (N and NPT Stamp)
- NQA-1 Quality system
- 10CFR50 App. B
- 10CFR21
- RCC-M
- CSA 2299
- Performance testing and qualification to:
  - ASME QME-1
  - ASME B16.41
  - IEEE 323
  - IEEE 344
  - IEEE 382
  - ISO 9001
  - ISO 14001
  - PED 97/23/CE
  - API Q1 TO API LICENCES:
    - API 6D (6D-0182)
    - API 6A (64-0445)
  - TUV-AD MERKBLATT WRD HP0
- Test specifications:
  - ASME 1" to 24" (API 1" to 16"
- NACE compliance
- NORSOK compliance

Weir Severe Service Choke Valve

Weir are the oldest control/choke valve supplier in the UK through it’s Blakeborough® heritage brand. The Weir range of choke valves includes ASME & API designs. Through continuous research and development we are able to offer choke valve trim solutions that can be used in the following applications:

Applications

- Production
- Water Injection
- Gas Injection and Gas Lift
- Chemical Injection
- Fracturing clean up
- High pressure drops
- Multi-phase flows
- Flaring
- Pump discharge
- Overboard dump applications
- Methanol injection

Features

- Flexible trim designs: application specific
- Non-collapsible trim (brickstopper)
- Bolted, clamped or screwed bonnet
- High toughness carbide trims
- X-Stream® Severe service trim
- Anti clogging design trim
- Streamlined flow passages
- Cast, forged or hipped body options
- Top entry bonnet, valve can be serviced without removal from the line
- Sand erosion resistant trim
- Stable internally guided trim.
- Low noise or anti-cavitation trim
- Easy service trim (no screwed components)
- Wide range of end connections
- Metallic scraper rings

Pressure ratings:
- ASME 150 – ASME 4500LB
- API 2000 – 15,000 PSI

Available Body Sizes:
- ASME 1” to 24” (API 1” to 16”)

Available End Connections:
- Flanged/RF/RTJ/Hubbed

Available Actuation:
- Linear pneumatic/Hydraulic
- Pneumatic/Hydraulic/Stepping
- Manual
- Electric

Compliance:
- NORSOK compliance
- NACE compliance

Weir Control & Choke Valves
Engineered valves for protection & process control

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X-Stream® trim

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A proven track record

We have extensive references and a proven track record in the supply of valves across a number of key industries.

Our valves are industry renowned brands, each with an established reputation for quality engineering and reliability.

Valve testing

All pressure containing items are hydrostatically tested, seat leakage tested and functionally tested. We can also perform gas, packing emission, cryogenic and advanced functional testing, as well as seismic testing for nuclear applications.

Material testing

- Non-destructive examination by radiography, ultrasonics, magnetic particle and liquid penetrant.
- Chemical analysis by computer controlled direct reading emission spectrometer.
- Mechanical testing for tensile properties at ambient and elevated temperatures, bend and hardness testing. Charpy testing at ambient, elevated and sub-zero temperatures.

Aftermarket solutions

Our valve aftermarket solutions are based on our engineering heritage, applying our OEM knowledge and expertise to maintenance strategies, life extension and upgrade projects.
The Weir choke valve range is produced to meet the requirements of one of the following design standards, either API 6A/ISO 10423/ASME B16.34 but fundamentally the designs of valves offer the following advantages over externally guided or disc style choke valves.

Body design
Due to the potential for contaminated processes choke valves are usually angle valves with flow over the plug head. Choke valves can be provided if specifically required. The body consists of streamline flow passages to prevent abrasion due to contaminated flows.

Low pressure recovery
Weir have extensive experience in designing valves for high pressure drop applications coupled with the added potential for erosion due to fluid contamination such as sand inclusions in the flow stream. Weir use the 'internally' guided cage trim design of valve for these applications which is a low pressure recovery trim design ensuring the minimum amount of energy is generated at the plug head.

The single stage Multi-Flow trim is suitable for most choke applications either with the addition of a carbide insert or a solid carbide trim. The flow is broken down into a series of multiple jets by a number of radial holes located in the circumference of the cage. The flow is usually from outside to inside the cage (flow over) so that jet impingement/ high turbulent levels are controlled within the confines of the valve cage. Impingement of the jets within the cage produces a more stable downstream flow, with the added benefit of noise reduction. This reduces the effect of large scale separation and produces a smaller scale turbulence structure in the valve outlet.

Internal cage guiding
The plug diameter is supported in the cage through the full stroke of the valve, eliminating the potential for noise and vibration through high pressure drops. Seal areas are located within the upper section of the valve plug thereby divorcing the seals from the main flow area. Additionally for highly contaminated duties scraper rings can be provided to ensure protection of the softer resilient seal.

Noise control by low pressure recovery
The cage guided valve reduces the acoustic efficiency of the flow stream and changes the power spectrum of the generated noise, both of which factors contribute to an overall noise reduction of between 15 and 20dB. This ensures maximum stability of the valve plug in highly turbulent, high pressure drop situations. The balancing effect in the plug ensures an equal pressure both above and below the plug head which ultimately leads to reduced actuation forces to close the valve. Weir ensures that the balance hole diameters are maximised to prevent scaling, which in turn could reduce the shut off capabilities of the valve.

Seal design
Internally guided choke valve plugs are susceptible to impingement of contaminated flows onto the seating surface of a traditionally seated valve plug. Seating on these trims is accomplished by means of an an angle chamfer which is located on the plug outside diameter, as shown below. As the flow passes through the cage holes then the pressure drop and consequent velocity increase take place causing erosion of the seating face.

The Weir choke valve is designed with protected seating faces. The special plug head contour ensures that the seating face of the plug is protected from the cage flow area by means of an extended lip on the outside of the plug nose. Additionally the use of the protected seat design ensures a deadband before flow starts to pass through the cage. This ensures a reduced velocity through the trim and consequently a reduced rate of erosion.

Balanced designs
The valve trim in a choke valve is usually a balanced design (unbalanced designs can be applied for specific applications). This ensures maximum stability of the valve plug in highly turbulent, high pressure drop situations. The balancing effect in the plug ensures an equal pressure both above and below the plug head which ultimately leads to reduced actuation forces to close the valve. Weir ensures that the balance hole diameters are maximised to prevent scaling, which in turn could reduce the shut off capabilities of the valve.

Pressure drop considerations
Choke valves are required to handle some of the most severe operating conditions: pressure drops of up to 500 bar, with erosive flow mixtures of hydrocarbon liquids, hydrocarbon gases, sea water and sand.

The problems associated with this application are flow erosion to the valve body, valve trim and the downstream pipework, vibration and noise. The range of products used on this application range from the bean type choke with a fixed area, to needle and seat designs which are high recovery and multistage trims.

Consider a fluid passing through a simple orifice (bean) choke. Under high pressure drop conditions the fluid pressure drops rapidly below its vapour pressure thereby producing vapour bubbles. As the fluid recovers downstream of this orifice either cavitation or flashing can occur depending on whether the downstream pressure is higher or lower than the fluid vapour pressure. If the pressure is lower than the vapour pressure, flashing occurs, and this can cause erosion damage in the downstream pipework. If the downstream pressure is higher than the vapour pressure then as the pressure recovers vapour bubbles formed during the throttling process are no longer in equilibrium and will collapse (or implode) resulting in very high forces being generated. This energy release can result in significant erosion damage, and extensive noise and vibration problems. On high recovery designs and on severe applications whole sections of metal can be eroded away, affecting the pressure integrity of the valve body and downstream pipework.

On gas flows high uncontrolled velocities can result in shock waves/turbulence interaction leading to high noise levels and vibration problems.
Severe service trims

Weir Control and Choke Valves have a unique trim specifically designed for severe service applications. The Weir X-Stream® was developed for applications where standard caged trim designs could not meet the necessary noise attenuation, vibration levels and trim velocity control limits. Using a series of stacked plates/discs, multiple stages of pressure letdown are provided using series of complex flow paths. The X-Stream® is exceptionally versatile and even its method of manufacture can be altered to provide a custom design solution (for example, clamped disc stacks for individually replaceable discs).

Features

The X-Stream® flow path, was developed using the latest in computational fluid dynamics software and fluid dynamics research. Most disc stack trim designs now conform to the internationally recognised trim exit velocity limits, in order to reduce the erosive impact of the fluid. However, Weir also believe that velocity must also be controlled and limited at all points of the trim and have thus proposed “Total Velocity Control”. During extensive research, it was discovered that a number of other disc stack designs were too focused on limiting the trim exit velocity and as such were suffering from exceptionally high velocities at the first few stages of pressure letdown, as they tried to expand the flow area too quickly, thus increasing the erosion potential at these areas.

- The X-Stream® trim, is custom designed for each application and uses fixed areas for the first few stages of pressure letdown, providing Total Velocity Control across the entire disc, keeping velocities within a set limit.
- The X-Stream® trim uses all 3 of the methods of pressure reduction:
  1. Contraction and Expansion of the Fluid
  2. Change of Direction (The most popular method)
  3. Sell Impingement - This splits the flow stream into multiple parts and directs two or more of them into each other.
- Reduced areas of high turbulence, by using a more streamlined approach to change of direction than other disc stack designs. Sharp right angle turns increase the potential for blockage and areas of high velocity. X-Stream® smooth flow path approach minimises velocity and contains a natural anti-clogging/self cleaning flow path which reduces maintenance time and costs.
- X-Stream® can be offered with a wide variety of dynamic performance characteristics, from standard Linear, Equal percentage and other custom characteristics.
- Conforming to the latest developments in Aero and Hydrodynamic noise calculations, X-Stream’s unique design, minimises noise by avoiding jet coalescence and with added features on Gas applications to further reduce noise by incorporating a ‘mesh’ of columns at the exit of the trim.
- The overall ability to custom design nearly all aspects of the X-Stream® disc, make this trim exceedingly versatile. The extensive research carried out in conjunction with some of the leading experts in the field of Fluid Dynamics, means X-Stream® is the optimal solution for Severe Service.

In trims with a tortuous path there are large areas of re-circulating flow (blue area). When debris is present in the flow these areas can cause blockages. Additionally, in trims with a tortuous flow path localised sections of high velocity (red area) can cause premature erosion and loss of control.

Jet impingement causes pressure reduction without the negative effects of trim damage.

The X-Stream® trim is designed with smooth flow paths to minimise the areas of re-circulating flow and eliminate localised high velocity.

The X-Stream® trim is designed to minimise sections of high velocity so the velocity gradient is spread across the trim profile.

Severe Service

Jet impingement causes pressure reduction without the negative effects of trim damage.

The X-Stream® trim is designed to minimise sections of high velocity so the velocity gradient is spread across the trim profile.

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Issues with externally sleeved choke valves

Some choke valve manufacturers have adopted the externally sleeved choke valve trim design. Rather than running the plug inside the valve cage the plug slides over the external diameter of the cage. In having the plug outside the throttling area, then theoretically the plug seating face is outside the throttling zone and therefore less susceptible to erosion. Experience has highlighted several issues with this design of trim.

The cage in an externally sleeved choke valve is often designed with four large holes to achieve the flow area. This results in a high pressure recovery factor which on liquid applications can cause premature erosion due to high pressure drops at the vena contracta. It can also mean that the trim is more susceptible to cavitation as the static pressure drops and then recovers above the vapour pressure. On gas applications the resulting pressure recovery can induce low frequency noise and vibration.

On internally guided choke valves the plug is guided through the valve stroke ensuring a high degree of stability. Externally guided choke valves have a minimum amount of guiding, especially when the valve is fully open, which ultimately results in severe vibration of the trim.

The main method of handling high pressure drops is to stage the drop over multiple stages of pressure letdown. This can only be achieved in a very crude manner on externally guided choke valves. In addition the design means that the plug is located between the pressure letdown stages, which could result in line debris becoming trapped between the plug and the cage.

Externally guided choke valves can have a seat ring screwed into the valve body. This causes several problems, especially during service and repair, where it becomes difficult to remove the seat ring.

None Collapsible Trims (Brickstopper)

Choke valve designs often require the use of tungsten carbide trims. These materials are used to reduce the trim erosion due to sand particulates in the process flow. Although tungsten carbide is exceptionally hard it is also brittle and therefore subject to cracking or fracture due to the impact of solids at high velocity. In these situations internally guided choke valves have significant advantages as the carbide components are protected by an outer steel cage.

System concerns with trim collapse are:
- Drawdown on well formations
- Flow and erosion dynamics
- Downstream equipment damage due to fragments,
- Pressure increase imposed on downstream equipment
- Flow rate increases imposed on downstream equipment

Consequences of Debris

Debris travels through the valve.
- No damage occurs to the choke valve.
- No shutdown necessary

Debris fractures valve trim
- Increased valve capacity (Cv) resulting in reduced THP and increased downstream pressure
- Trim fragments travel downstream
- System shutdown for valve service
- Debris lodges in valve inlet
- Decrease in valve capacity (Cv)
- Debris blocks valve inlet resulting in alteration to fluid entry profile resulting in erosion
- System shutdown for valve service

The Weir trim solution ensures maximum protection of the tungsten carbide due to a fully enclosed trim.

Cage (Referred to as the Brickstopper)

The valve cage features a steel outer sleeve which gives maximum protection against large solids in the process flow. Erosion control is achieved via a carbide inner sleeve which is either shrunk or laser welded into the cage.

Plug and Seat

There are two methods of manufacture for the plug head depending upon the particular process requirements:
- The plug is manufactured as a two piece construction, the upper portion from steel and the lower portion from carbide. In this construction the two sections are clamped together by the valve stem. The lower carbide section gives maximum erosion control while the upper steel section allows for guiding in the cage.
- For maximum resistance against collapsibility the carbide can be laser clad onto the plug. This ensures maximum support of the carbide due to the steel base through the length of the plug. Laser cladding of the valve plug additionally ensures a backup steel support which would ensure flow control if the carbide fails.

Example of failure of externally sleeved Choke

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Summary

- Handle high pressure drop liquids choke with entrained sand
- Cavitation & erosion control
- Customer did not want a trim with a tortuous path due to the potential for blockage.
- Conversion nose trim specified to flush the solids through the trim as the plug lift.
- Additional slots at the bottom of the plug for additional flushing.
- Tungsten carbide trim fitted to reduce sand erosion.

Engineered valves for protection & process control

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Weir Control & Choke Valves

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Weir Severe Service Choke Valve

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API Choke valve body materials

There are several factors that need to be considered when selecting the most appropriate valve body material. If the choke is defined as an ASME/ASME valve then the materials can be selected from ASME B16.34. Materials for API rated chokes are selected from API 6A. API 6A does not specify specific grades of material, but rather sets the physical properties that the material must meet and assigns it a material ‘rating’ either 45k, 60k or 75k.

Flanges must all be made with at least a 60k material or for an API 15000 rated choke valve at least a 75k material.

Valve bodies (without flanges) can be manufactured from any of these materials up to API 15000. The material classes (60k etc.) will usually be specified by the customer, however the standard used by Weir (up to API 10000) would be a 60k material for body and flanges on a cast valve.

Table 1 - API Choke valve body materials

<table>
<thead>
<tr>
<th>Generic material</th>
<th>Material type</th>
<th>Material Max. temp. (Deg C)</th>
<th>Material Min. temp. (Deg C)</th>
<th>NACE</th>
<th>Material API 6A Material designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon steel</td>
<td>ASTM A487</td>
<td>Cast</td>
<td>482</td>
<td>-46</td>
<td>✓✓✗</td>
</tr>
<tr>
<td></td>
<td>Grade 4 C</td>
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<td></td>
<td></td>
<td>AA, BB, DD &amp; EE</td>
</tr>
<tr>
<td>Duplex</td>
<td>ASTM A995</td>
<td>Cast</td>
<td>370</td>
<td>-29</td>
<td>✓✓✗</td>
</tr>
<tr>
<td></td>
<td>Grade 4A</td>
<td></td>
<td></td>
<td></td>
<td>CC &amp; FF</td>
</tr>
<tr>
<td>Super Duplex</td>
<td>ASTM A995</td>
<td>Cast</td>
<td>370</td>
<td>-29</td>
<td>✓✓✗</td>
</tr>
<tr>
<td></td>
<td>Grade 6A</td>
<td></td>
<td></td>
<td></td>
<td>CC &amp; FF</td>
</tr>
<tr>
<td>AISI 4130</td>
<td>Forged</td>
<td></td>
<td></td>
<td></td>
<td>AA, BB, DD &amp; EE</td>
</tr>
<tr>
<td>AISI 4140</td>
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<td></td>
<td></td>
<td>AA, BB, DD &amp; EE HH with Inconel cladding</td>
</tr>
<tr>
<td>Duplex</td>
<td>UNS S31803</td>
<td>Forged</td>
<td>370</td>
<td>-29</td>
<td>✓✓✗</td>
</tr>
<tr>
<td></td>
<td>Forged</td>
<td></td>
<td></td>
<td></td>
<td>CC &amp; FF</td>
</tr>
<tr>
<td>Super Duplex</td>
<td>UNS S32760</td>
<td>Forged</td>
<td>370</td>
<td>-29</td>
<td>✓✓✗</td>
</tr>
<tr>
<td></td>
<td>Forged</td>
<td></td>
<td></td>
<td></td>
<td>CC &amp; FF</td>
</tr>
<tr>
<td>LF6</td>
<td>ASTM A350</td>
<td>Forged</td>
<td>500</td>
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<td>✓✓✗</td>
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<td></td>
<td>LF6 Class 2</td>
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<td></td>
<td></td>
<td>AA, BB, DD &amp; EE</td>
</tr>
<tr>
<td>660</td>
<td>ASTM A638</td>
<td>Forged</td>
<td>600</td>
<td>-196</td>
<td>✓✓✓</td>
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<tr>
<td></td>
<td>Grade 660</td>
<td></td>
<td></td>
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<td>CC &amp; FF</td>
</tr>
<tr>
<td>AISI 4140</td>
<td>Forged</td>
<td></td>
<td></td>
<td></td>
<td>AA, BB, DD &amp; EE</td>
</tr>
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</table>
| Note: Forged choke valves can either be directly produced from forged material or by HIPping. Table is shown for guidance. Consult API 6A for detailed information.
Table 2 - Requirements for PSL testing (continued)

<table>
<thead>
<tr>
<th>Trim</th>
<th>PSL 1</th>
<th>PSL 3</th>
<th>PSL 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>API 6A designated material</td>
<td>API 6A designated material</td>
<td>API 6A designated material</td>
</tr>
<tr>
<td>Chemical</td>
<td>Not required</td>
<td>Not required</td>
<td>Required</td>
</tr>
<tr>
<td>Mechanical</td>
<td>Not required</td>
<td>Not required</td>
<td>Required</td>
</tr>
<tr>
<td>Impact</td>
<td>Not required</td>
<td>N/A</td>
<td>Required</td>
</tr>
<tr>
<td>Hardness testing</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>NDE</td>
<td>Not required</td>
<td>Not required</td>
<td>100% PT after machining</td>
</tr>
<tr>
<td>Welding</td>
<td>Controlled by qualified procedures</td>
<td>Controlled by qualified procedures</td>
<td>Controlled by qualified procedures</td>
</tr>
</tbody>
</table>

Testing

<table>
<thead>
<tr>
<th>Hydro test</th>
<th>Pressures as per API 6A</th>
<th>Pressures as per API 6A</th>
<th>Pressures as per API 6A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gauges</td>
<td>Calibrated to API 6A</td>
<td>Pressures as per API 6A</td>
<td>Pressures as per API 6A</td>
</tr>
<tr>
<td>Test results</td>
<td>Recorded by production</td>
<td>Recorded by production</td>
<td>Recorded by someone independent from production</td>
</tr>
<tr>
<td>Tests</td>
<td>Raise to static pressure and hold. Reduce to zero. Raise to static pressure and isolate from pressure source</td>
<td>Raise to static pressure and hold. Reduce to zero. Raise to static pressure and isolate from pressure source</td>
<td></td>
</tr>
</tbody>
</table>

| Medium | Water or gas | Water or gas | Water or gas |
| Test time | 3 mins & 15 mins | 3 mins & 15 mins | 3 mins & 15 mins |
| Gas shell test | Not required | Not required | Only required for PSL 3 G. Required at rated working pressure. Gas test to be in an approved location |
| Gas seat test | Not required | Not required | Only required for PSL 3 G. Required - test is two stage primary and working secondary at 5 - 10% of rated working pressure. Required - test is two stage primary and working secondary at 5 - 10% of rated working pressure. Gas test to be in an approved location |

Note: Table is shown for guidance. Consult API 6A for detailed information.

Table 3 - Liquid velocity limits

<table>
<thead>
<tr>
<th>Ins.</th>
<th>Low alloy ft/s</th>
<th>High alloy ft/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 8</td>
<td>25 - 200</td>
<td>52.5 16</td>
</tr>
</tbody>
</table>

Table 4 - Gas/vapour velocity limits

<table>
<thead>
<tr>
<th>Ins.</th>
<th>Low alloy ft/s</th>
<th>High alloy ft/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 8</td>
<td>25 - 200</td>
<td>490 150</td>
</tr>
</tbody>
</table>

Table 6 - API Temperature class

<table>
<thead>
<tr>
<th>Temp. Class</th>
<th>c° min.</th>
<th>c° max.</th>
<th>f° min.</th>
<th>f° max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>-60</td>
<td>82</td>
<td>-75</td>
<td>180</td>
</tr>
<tr>
<td>L</td>
<td>-40</td>
<td>82</td>
<td>-50</td>
<td>180</td>
</tr>
<tr>
<td>P</td>
<td>-29</td>
<td>82</td>
<td>-20</td>
<td>180</td>
</tr>
<tr>
<td>R</td>
<td>Room temperature</td>
<td>Room temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>-18</td>
<td>66</td>
<td>0</td>
<td>150</td>
</tr>
<tr>
<td>T</td>
<td>-18</td>
<td>82</td>
<td>0</td>
<td>180</td>
</tr>
<tr>
<td>U</td>
<td>-18</td>
<td>121</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>121</td>
<td>35</td>
<td>250</td>
</tr>
</tbody>
</table>

Note: The temperature rating will be determined by the end user/customer. The material of the body etc. must then be selected from Table 7. Table is shown for guidance. Consult API 6A for detailed information.
### Table 8 - Materials of construction

<table>
<thead>
<tr>
<th>Service</th>
<th>Body</th>
<th>Trim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Carbon St. WCB/AISI 4130/ASME A487</td>
<td>316 &amp; stellite Gr. 6</td>
</tr>
<tr>
<td>Sour</td>
<td>Carbon St. WCB/AISI 4130/ASME A487</td>
<td>316 &amp; stellite Gr. 6 (NACE)</td>
</tr>
<tr>
<td>Corrosive sour</td>
<td>Carbon St. WCB or AISI 4130 + inconel in seal area ASTM A182 F316</td>
<td>316 &amp; stellite Gr. 6 (NACE)</td>
</tr>
<tr>
<td>High duty production</td>
<td>Carbon St. WCB/AISI 4130/ASME A487</td>
<td>17-4 PH &amp; tungsten carbide</td>
</tr>
<tr>
<td>High duty production with contaminate, sour</td>
<td>Carbon St. WCB or AISI 4130 + inconel, Duplex St.St. Super Duplex St.St</td>
<td>17-4 PH &amp; tungsten carbide with protected seat design</td>
</tr>
<tr>
<td>Water injection</td>
<td>Carbon St. WCB or AISI 4130/ASME A487</td>
<td>316 &amp; stellite Gr. 6</td>
</tr>
<tr>
<td>Water injection - high duty</td>
<td>Carbon St. WCB or AISI 4130/ASME A487</td>
<td>316 &amp; stellite Gr. 6 (NACE) &amp; tungsten carbide/advanced ceramics</td>
</tr>
</tbody>
</table>

**Note:** Tables are shown for guidance. Consult API 6A for detailed information.

### Table 9 - ASME outline dimensions

<table>
<thead>
<tr>
<th>Nominal End Connections (ins)</th>
<th>End Connections Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ASME 900</td>
</tr>
<tr>
<td>2</td>
<td>F</td>
</tr>
<tr>
<td>3</td>
<td>8 1/8</td>
</tr>
<tr>
<td>4</td>
<td>9 1/4</td>
</tr>
<tr>
<td>6</td>
<td>12 1/4</td>
</tr>
<tr>
<td>8</td>
<td>14 1/4</td>
</tr>
</tbody>
</table>

**Note:** The above dimensions are based on standard valve designs. Choke valves are often manufactured to customer requirements and/or have specific body designs. For valves outside the above range, please consult the factory.