



GALLI & CASSINA

Plus Valves

SINCE 1919



LUBRICATED



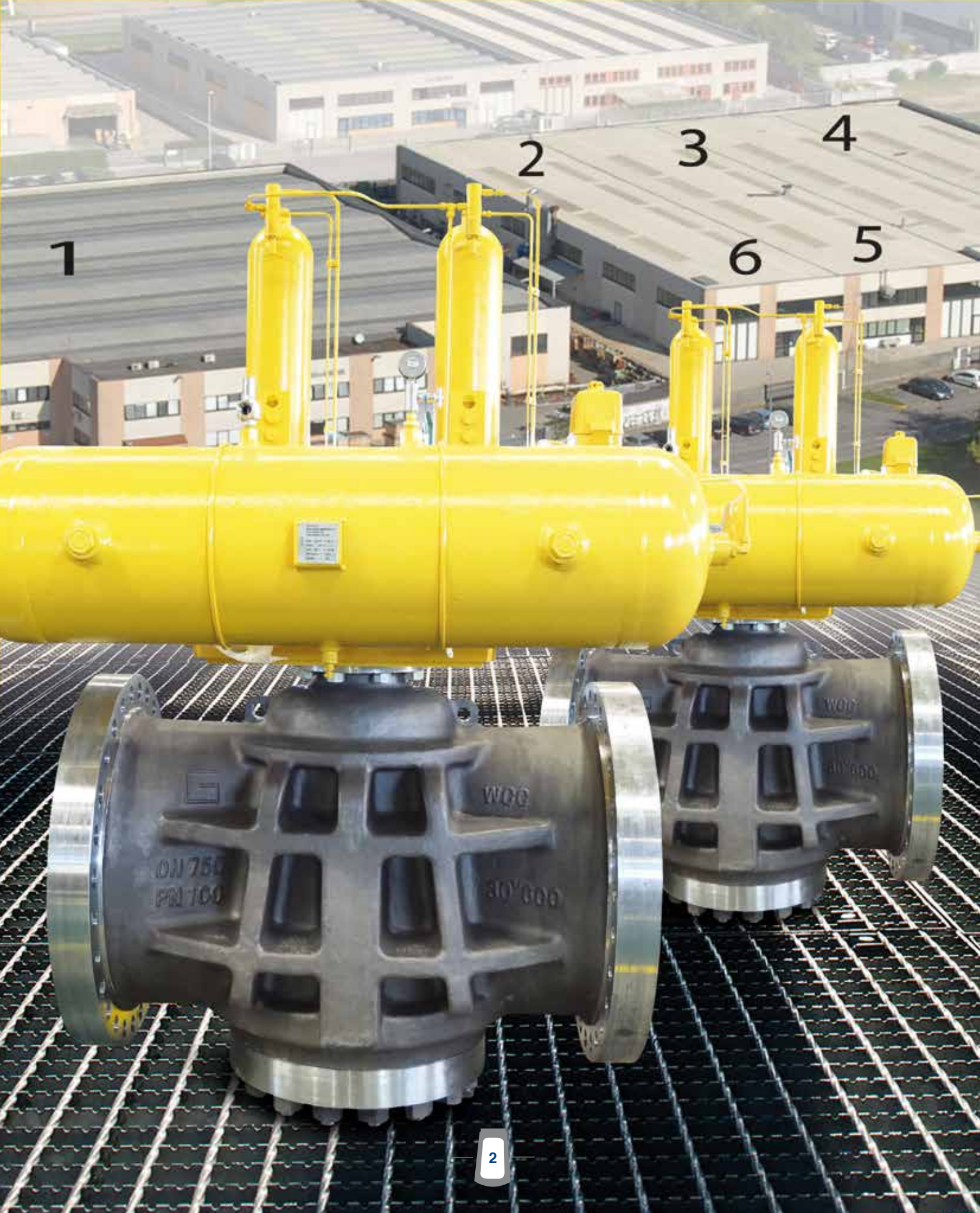
PLUG VALVES

PRESSURE BALANCED TYPE





Galli&Cassina Profile



1

2

3

4

6

5

DN 750
PN 100

WCC

30'000

WCC

30'000



Galli&Cassina Profile



Galli&Cassina is a prominent Italian Company, leader in Design and manufacturing a complete range of Lubricated Plug valves.

The company is located in Solaro near to Milan (Italy)

Galli&Cassina was founded in 1919, and it is one of the oldest Italian companies which today is still in the valve business; in the beginnings G&C business activity was concentrated in the production of valves to serve the domestic growing market.

After the first ten years the company gradually turned its production towards the newly born Chemical Industry.

G&C was the first in Italy to produce valves in stainless steel and other special material in light with the demand

of the most important chemical companies.

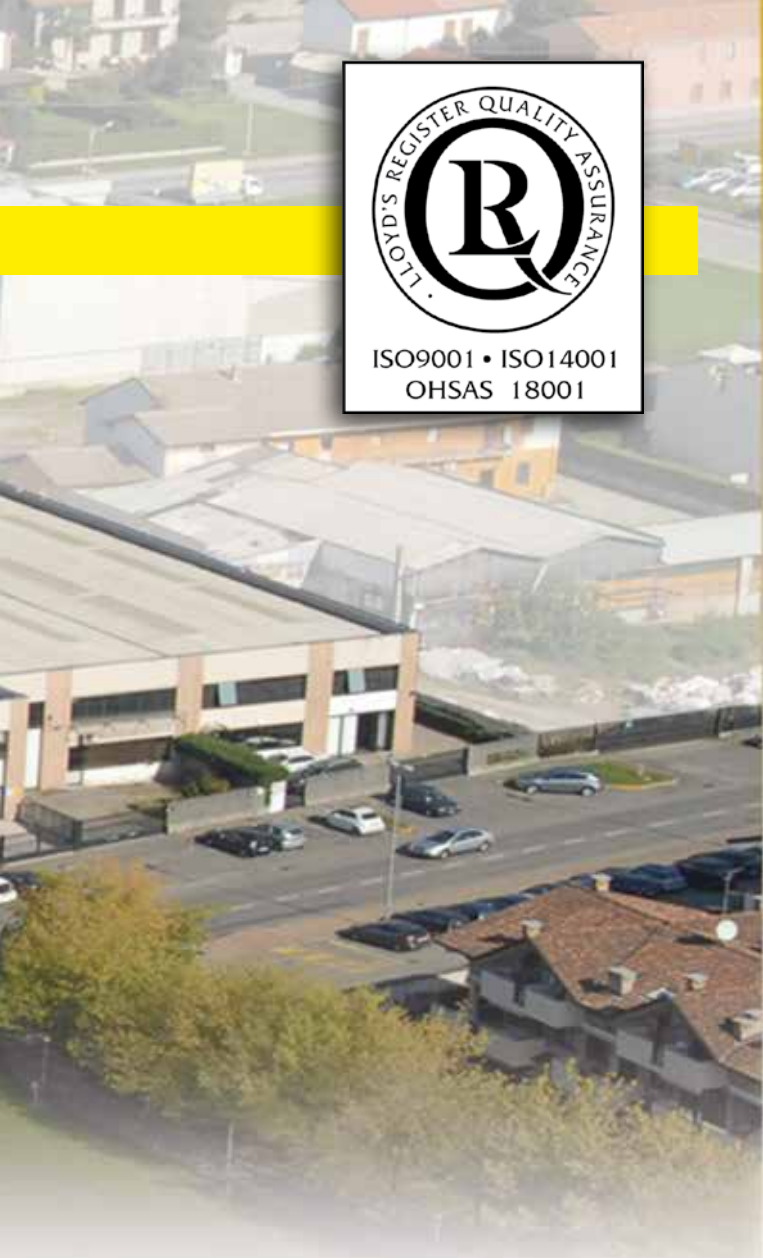
It was not possible to expand further the Milan factory which was built in 1930 and enlarged after the second world war, for this reason in 1991 **Galli&Cassina** has moved to a new location in Solaro (Milan) with modern building and facilities.

After 30 years of experience in chemical valves, **Galli&Cassina** started the production of Plug Valves to serve the Oil & Gas worldwide market becoming one of the most significant supplier for all



with extensive offices and workshop covering 12.000 sq.mt. area including 5000 sq.mt. of covered space.





1. WORKSHOP & OFFICES.



2. WELDING.



3. MATERIAL RECEIVING.



4. TESTING AND INSPECTION.



5. PACKING AND SHIPPING.



6. WAREHOUSE.

International Oil & Gas companies across the world.

Its sales activity covers most of the continents with a leading and growing presence in Europe, Middle East, North & South America and Far East resulting in a sales and service network with subsidiaries, branch offices and distributors, achieving the reputation of high quality and reliable product.

Galli&Cassina pays a particular attention to company development in every area, to be in line with the continuous market evolution.

The proved technical, production, and financial

capabilities combined with experience of human resources are the result of Galli&Cassina reputation all over in the world.

Galli&Cassina's Quality Assurance System & HSE according to ISO 9001-2008, ISO 14001 & ISO 18001 have been assessed, approved and certified by Lloyd's Register, while the API 6D and 6A monogram have been certified by API

(American Petroleum Institute) - Washington U.S.A. Nowadays Galli&Cassina is

proud to celebrate its 95 years presence in the world valves market.

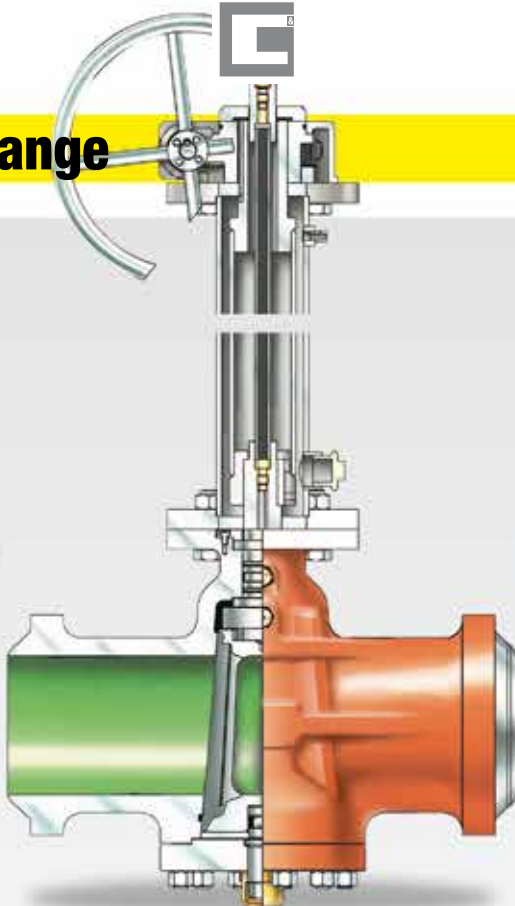


Plus Valves.

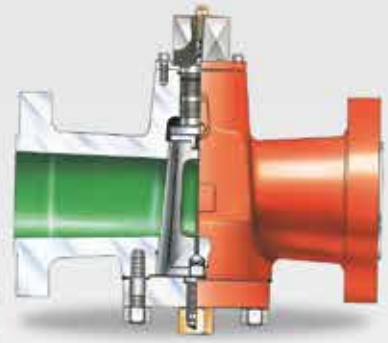
The Production Range



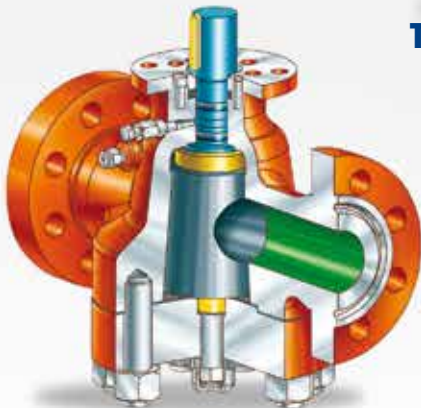
Two Way Standard Type



Two Way Pressure Balanced Type with Stem Extension



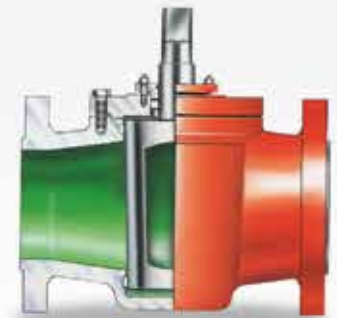
Two Way Pressure Balanced Type



Two Way LGC Pressure Balanced Full Bore Type



Two Way Pressure Balance Type Gear Operated



Two Way with PTFE Sleeve 3S Series

Actuators Availability

Electric



Pneumatic



Electro Hydraulic

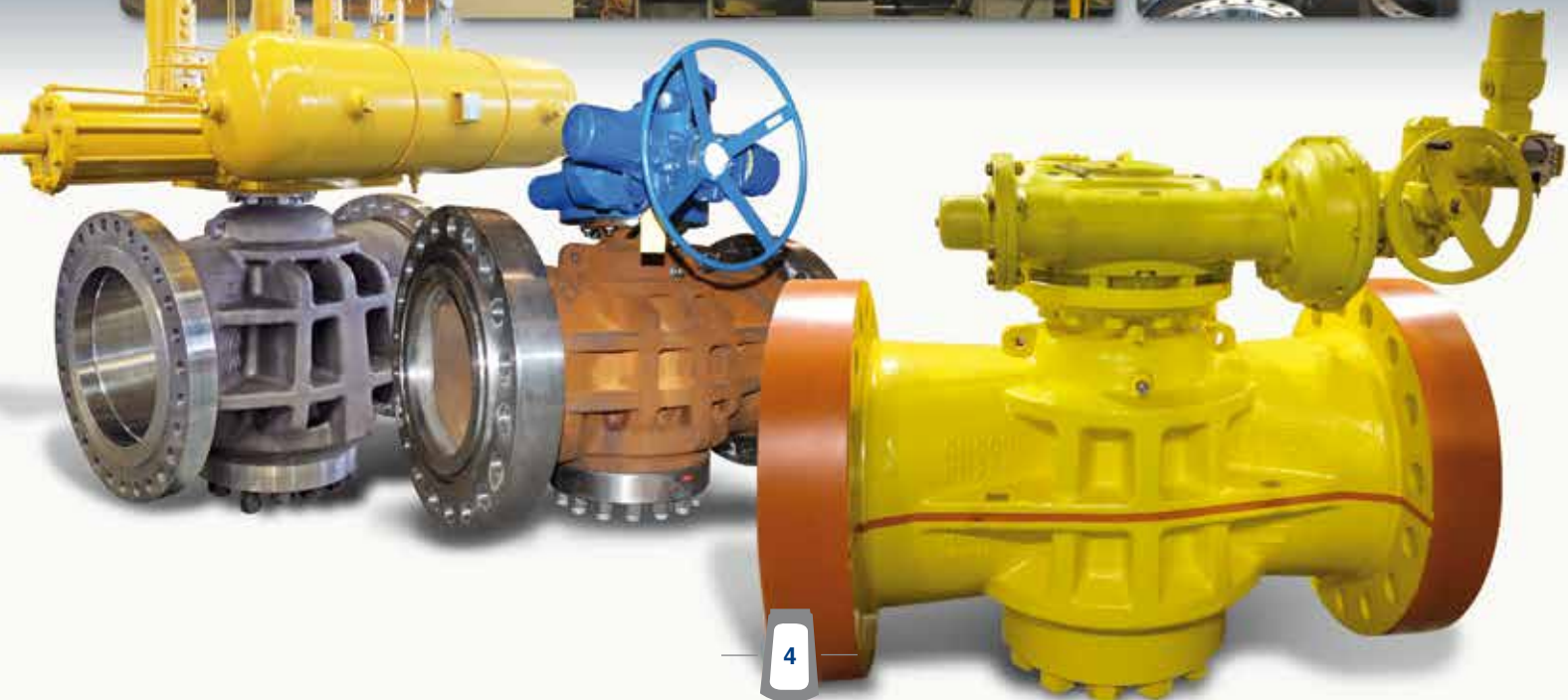


Gas Overoil





Machining and Manufacturing





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The data reported in this catalogue refer to the International Standards applicable at the time of its issue date.

Galli&Cassina reserves the right to modify its products without any obligation to notify, provide or install such modification on products previously or subsequently sold.

However Galli&Cassina will use the best afford to keep the customers informed of any changes made.

GALLI & CASSINA



Material Selection Guide for GALLI&CASSINA Valves

Trim materials are designed according to the service conditions.

- 1** Standard Carbon Steel Body and Plug. (ASTM-A216 WCB/WCC material) suitable for general services.
- 2** Carbon Steel Body and Plug (A352 LCB/LCC material) suitable for low temperature services.
- 3** Carbon Steel Body and Plug (ASTM A216WCB/WCC material) suitable for "SOUR SERVICE"(H₂S and CO₂) according to NACE-MR.01.75/Latest Edition.
- 4** Special Austenitic (6MO) and Ferritic-Austenitic Stainless Steel (Duplex and Superduplex) suitable for sea water and corrosive services.
- 5** Nickel-Chromium-Iron alloy (i.e. Alloy 20), Titanium & Titanium alloy, carbon steel with Inconel 625 cladding and stellite or Tungsten carbide hardfacing for abrasive/corrosive service.
- 6** Other materials upon request.

Standard Design Categories (Typical Construction Materials)

| Trim Service | Class | Body/Cover | Plug | Stem and Oldham Coupler | Bolting |
|-----------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|---------------------------------------------|
| 1 Standard service Natural gas Hydrocarbons | 150 to 2500 | ASTM A105 ASTM A216 WCB/WCC Max C 0.25% | ASTM A105 ASTM A216 WCB/WCC | ASTM A29 Gr. 4140 | ASTM A193-B7M ASTM A194-2HM |
| 2 Low temperature Natural gas Hydrocarbons | 150 to 2500 | ASTM A350-LF2 ASTM A352 LCB/LCC Max C 0.23% | ASTM A350-LF2 ASTM A352- LCB/LCC | ASTM A29 Gr. 4140 | ASTM A320-L7 ASTM A194 Gr.7 |
| 3 Sour Service (H ₂ S and CO ₂) Hydrocarbon s | 150 to 2500 | ASTM A105 ASTM A216 WCB/WCC Max C.0.23% Max HRC22 | ASTM A105 ASTM A216 WCB/WCC Max C.0.23% Max HRC22 | ASTM A29 Gr. 4140 Max HRC22 | ASTM A193-B7M ASTM A194-2HM MAX HRC22 |
| 4 Sea Water | 150 to 2500 | UNS S31254 ASTM A 351 CK3MCuN (6MO) | UNS S31254 | UNS S31254 | ASTM A453 Gr.660A |
| | | UNS S31803 ASTM A 890 J92205 (Duplex 22% Cr) | UNS S31803 | UNS S31803 | ASTM A453 Gr.660A UNS S32760 |
| | | UNS S32750 ASTM A 890 J93404 (Super duplex 25% Cr) | UNS S32750 | UNS S32750 | UNS S32760 |
| | | UNS S32760 ASTM A 890 J93380 (Super duplex 25% Cr) | UNS S32760 | UNS S32760 | UNS S32760 |
| 5 Abrasive/Corrosive Slurry service | 150 to 2500 | ASTM B348 Gr 3 or 5 (Titanium) | ASTM B348 GR 3 or 5 | UNS S31254 UNS S32760 | ASTM A453 Gr.660A |
| | | UNS N08020 ASTM A 351 CN7M (Alloy 20) | UNS N08020 ASTMA351CN7M | UNS S32750 UNS S32760 | ASTM A453 Gr.660A UNS S32760 |
| | | ASTM A 105 ASTM A 216 WCB/WCC Hardfacing (Stellite/WC) and Cladding (Inconel 625) | Gr 4140 | ASTM A 29 ASTM A194 2HM | ASTM A193 B7M |



Applicable Standard-Specification

Lubricated Plug Valves are designed to use with most refining services according to API 599 or BS 5353 norms whichever is applicable.

API 6D norm aims to standardize the materials as well as instructions to manufacture valves suitable for energy transportation in the pipelines.

| | | | |
|-------------------|------------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------|
| API 6A | Specification for wellhead and christmas tree equipment. | BS 1504 | Specification for Steel Casting for Pressure Purposes. |
| API 6D | Specification for Pipeline Valves. | BS 2080 | Face to Face - Centre to Face - End to End - Steell Valves. |
| API 6FA | Specification for Fire Test for Valves. | BS 5353 | Specification for Steel Plug Valves. |
| API RP6F | Recommended - Practice for Fire Test for Valves. | BS 6755 part 1 | Testing of Valves (Spec. for Production Pressure Testing Requirements). |
| API 598 | Valve Inspection and Testing. | BS 6755 part 2 | Testing of valves (Spec. for Fire Safe Testing Requirements). |
| API 599 | Steel Plug Valves Flanged or Butt Welding Ends. | | |
| ASME/ANSI B 16.5 | Pipe Flanges and Flanged Fittings. | CSA Z 245. 15 | Canadian Standard Association. |
| ASME/ANSI B 16.10 | Face-to-Face and End-to-End Dimensions of Valves. | MSS-SP6 | Standard Finish for contact Face of Pipe Flanges. |
| ASME/ANSI B 16.25 | Buttwelding Ends. | MSS-SP25 | Standard Marking System for Valves. |
| ASME/ANSI B 16.34 | Valves-Flanged, threaded and Welding Ends. | MSS-SP44 | Steel Pipe Line Flanges. |
| ASME/ANSI B 31.3 | Chemical Plant and Petroleum Refinery Piping. | MSS-SP53 | Quality Standard for Steel Casting-Magnetic Particle Examination Method. |
| ASME/ANSI B 31.4 | Liquid Trasportation System for Liquid Petroleum Gas. | MSS-SP54 | Quality Standard for Steel Casting-Radiographic Examination Method. |
| ASME/ANSI B 31.8 | Gas Transmission and Distribution Piping System. | MSS-SP55 | Quality Standard for Steel Casting Visual Method. |
| ASME | Boiler and Pressure Vessel SECTION VIII - DIV.1 & 2 | MSS-SP61 | Pressure Testing of Steel Valves. |
| ASME | Boiler and Pressure Vessel Section V. | | |
| ASNT-TC-1A | Reccomended Practice for Personnel Qualification and Certification in Non destructive Testing. | NACE Std. MR 01.75 Latest Edition | National Association of Corrosion Engineers. |
| | | ASTM | American Society for Testing and Materials. |



Introduction

- *Plug Valves are probably the oldest and most commonly used valves in modern pipelines.*
- *Plug Valves have been used more than 2000 years, ever since the time of ancient Rome.*
- *Lubricated Plug Valves use special lubricant to ease their operation over a wide range of operating pressure. The lubrication film (between plug and body) also provides a seal and only requires periodic lubricant injection.*
- *No spare parts.*
- *Bubble tightness is always guaranteed in critical service.*
- *Maintenance is reduced to a periodic lubricant injection.*
- *Complete overhauling of the valve, or line shut off “are not required” in case of seat leakage.*

Standard Features: the Pressure Balance System

The operating system of Pressure Balanced Plug Valves (shown in Fig.A) consist in the pressure equalization between the port area and the top/bottom of the plug with two holes. The upper hole connects the plug port area with the top of the plug, while the lower maintains the pressure equalization between the port area and the bottom of the plug. The Pressure Balance System ensure line pressure acts on the plug to reduce the valve torque and avoid the possibility of plug seizure, even after a prolonged time in the open or closed position. The tapered shape of the plug guarantees that the force created by line pressure pushes the plug against the seat. As differential pressure increase so does the sealing capability of the Pressure Balanced

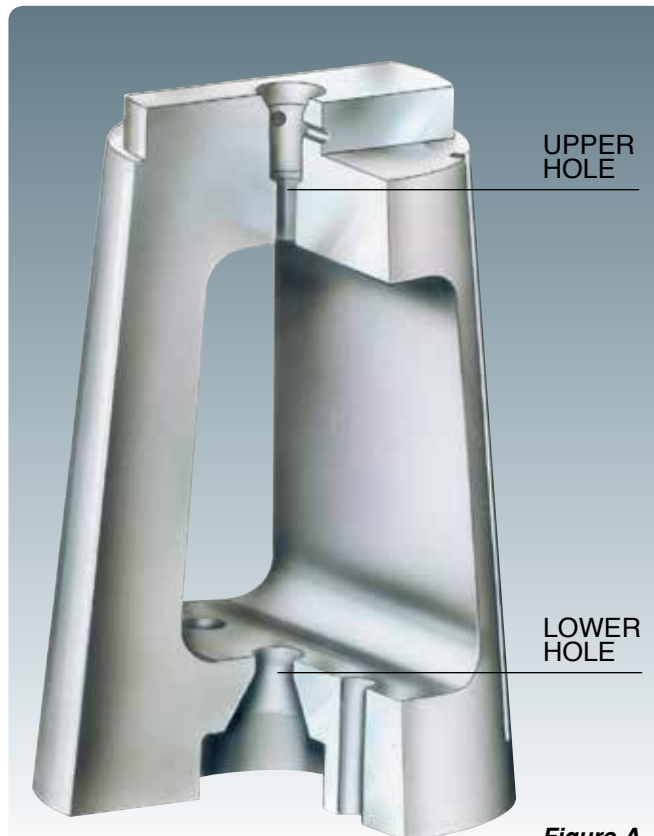


Figure A



Plug Valve. Thanks to pressure balance feature, and to the integral metal to metal design, Plug Valve can always be opened against the maximum delta p. No by-pass is necessary to preserve seat integrity. Periodic lubricant injection, and seat adjustment can be carried out when the Plug Valve is under full pressure. Only severe seat damage will cause a reduction of valve sealing.

Standard Features Patterns:

Galli & Cassina Plug Valves are available in four different patterns. The pattern indicates basic information about the

Short Pattern

Short Pattern Plug Valves have compact face to face dimensions (like a Gate Valve) and rectangular port areas of 40% to 60% of a Full Bore Plug Valve. This provides an economical valve for services where some reduction of flow rates can be tolerated. The Short Pattern is only in classes 150 and 300.

Venturi Pattern

Venturi Pattern Plug Valves also have a longer face to face but with a rectangular port areas of 40-50% of a Full Bore Plug Valve. These are typically used on services where flow rate is not critical. The long lead into and out of the port minimises pressure drop when the valve is fully opened.

valve in terms of end to end dimension (according to API 6D & BS 5353) & the size of the flow port through the valve.

Regular Pattern

Regular Pattern Plug Valves have longer face to face dimensions and rectangular port areas of 50-70% of a Full Bore Plug Valve. This configuration provides minimal loss of flow while economising on the overall valve dimensions from using rectangular port.

Full Bore

Full Bore Plug Valves have long face to face dimensions and a round port than is not smaller than minimum diameter specified in Annex A of ASME B16.34 or/and API 6D. This configuration provides unrestricted flow and allows the passage of pigs through the valve. It is also recomanded for highly abrasive conditions as it minimises pressure drop and erosion in the valve.



Standard Features: Plug PTFE Antifriction Treatment

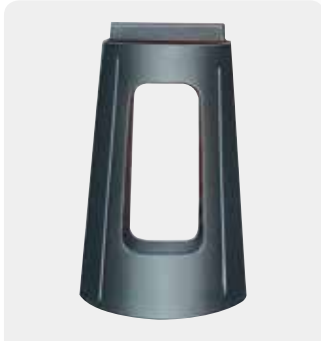
Carbon Steel plugs are subjected to the following treatments:

- A) Case hardening.
 - B) Antifriction treatment.
- The case hardening has the purpose to increase

only the hardness of the plug surface which is subjected to wearing, keeping at the same time the mechanical properties of the base material unchanged.

Consequently the base material has more toughness and resistance against impacts. The Antifriction treatment is basically carried out on the plug to obtain

- the following advantages:
- Low friction between plug and body.
 - Low torque.
 - Wear resistance.
 - Resistance to seizure.



Plug with PTFE Antifriction treatment.



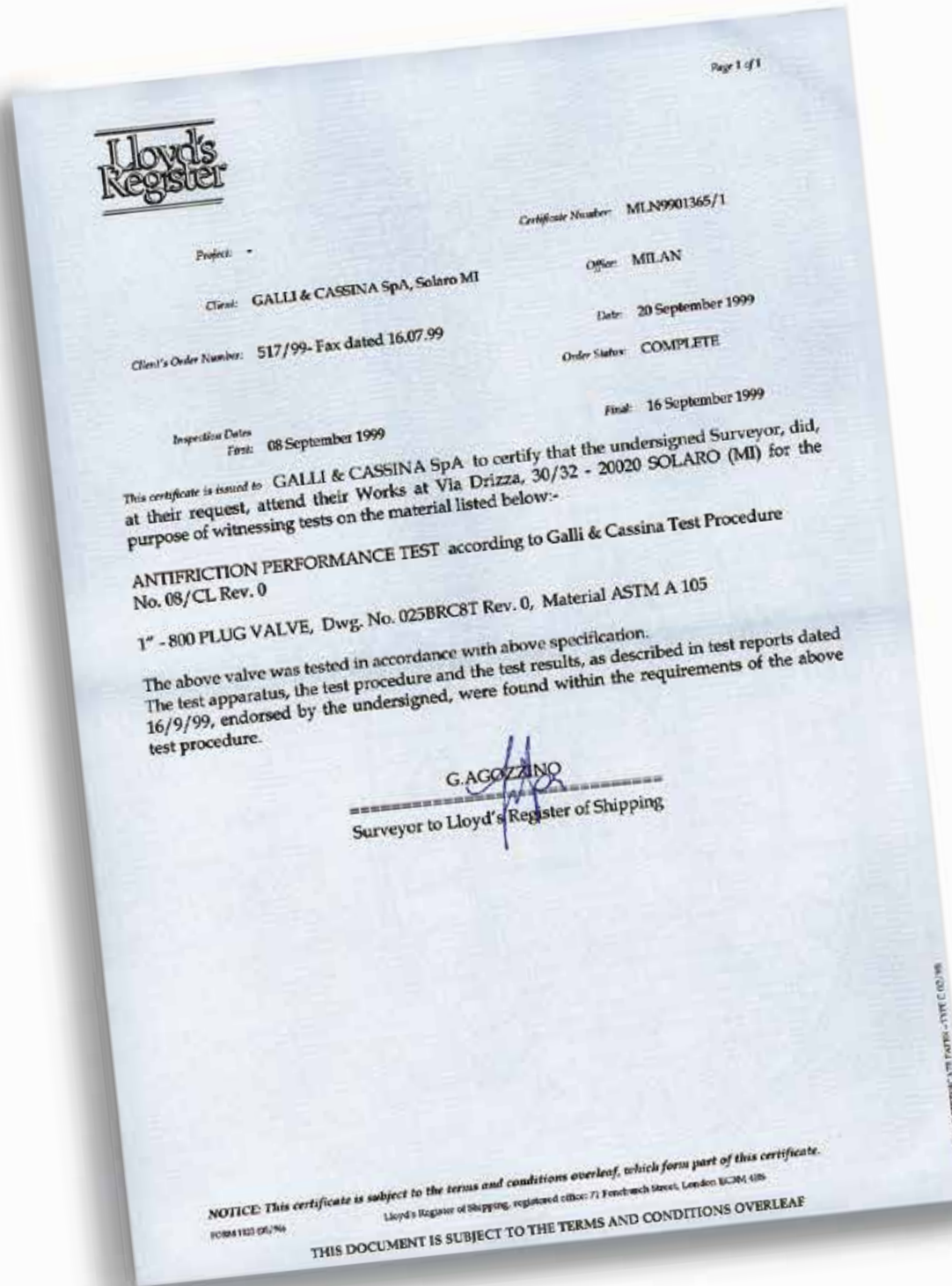
Plug without PTFE Antifriction treatment.



Plug with PTFE Antifriction treatment.



Plug without PTFE Antifriction treatment.



▲ The purpose of the above test is to prove that Galli&Cassina antifriction treatment made on plug surface, is guaranteed even after 30,000 cycles (open/closed position).



Special Features: Coating & Overlay

Hardfacing

The most common damages of valves are either due to abrasion by solids in the flow lines, or the exposure of main components to corrosion attack. Galli&Cassina's researching and development in cooperation with specialized companies and laboratories, have been the development of special hardfacing and corrosion resistant materials, which have achieved excellent results in Off-Shore application. Most of the main materials used are as follows:

Stellite-Duplex-6MO
Inconel 625-Nickel
Alloy 686 Ultimet Alloy (UNSR31233)
Tungsten Carbide.



Electrolles

Nickel Plating

The transport of wet hydrocarbon gases contaminated with hydrogen sulphide, carbon dioxide or other similar fluids containing appreciable level of sulphur, can create various corrosion problems to some component in plug valves.

These environments are not always recognized under service conditions,

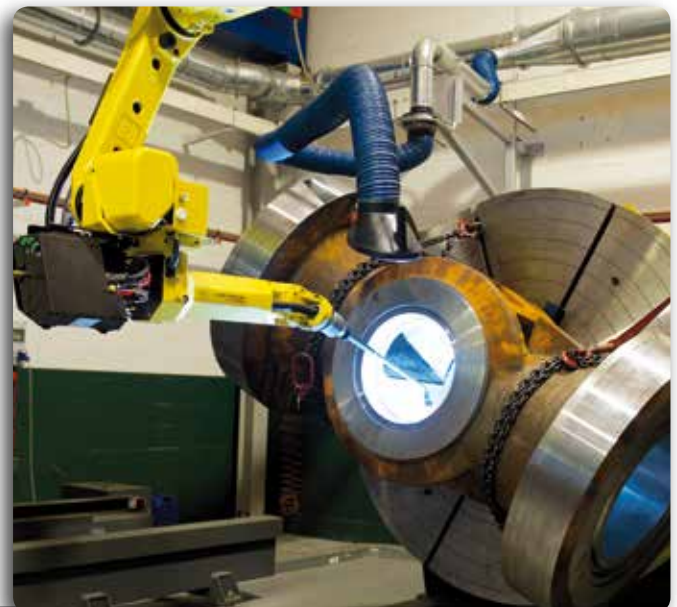
therefore in order to obtain a high quality corrosion resistant, all the material for each component of the valves, are selected in accordance with the requirements of NACE-Std. MR-01-75 Latest Edition. Moreover the use of an electroless nickel plating on plug surface provides more corrosion protection to hydrogen sulphide crack-resistant base metal. Standard ENP is in

accordance with ASTM B733 Std with a minimum 0.003" (76 Microns) thickness, unless otherwise specified in the customer's specification.

Tungsten Carbide Coating

A series of metal carbide coatings (WC+Ni, Cr or WC+Co or WC+Co, Cr), usually known as Tungsten Carbide (TCC)

allows to achieve higher performance in terms of valve working life. These performances are specially highlighted in case of severe operating conditions. Moreover, higher hardness values (greater than 1100 HV / 70 HRC) compared to standard hardfacing Stellite 6, (37 - 40 HRC) provide a very good abrasion & wear resistance.





Fire Safe Test

All Galli&Cassina's Plug Valves have been tested against fire resistance, according to API - 6FA and BS 6755 - Part 2 standards and witnessed by international third party.



Metal to Metal Seat, diaphragm sealing as well as the stem sealing compound with graphite guarantees a high reliability performance of our Plug Valves while in exposure to Fire Test conditions.

Available Tests

| Type of Test | Applicable Standards | Performance |
|---------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|
| X AND GAMMA RAYS | ANSI B16.34 - Annex-B ASME VIII - Div.1 - MSS - SP 54 ASTM E446 - E186 - E280 | 100% all butt welding ends and body. |
| DYE PENETRANT | ASME V - art.6 and 24 - ASTM E142 100% ANSI B16.34 - Annex-D MSS-SP-93 | All butt welding ends |
| MAGNETIC - PARTICLES (Dry and wet) | ASME V - art.7 and 25 ANSI B16.34 - Annex C - MSS - SP 53 | 100% of all valves |
| ULTRASONIC | ASME V - art.4 and 23 ASME VIII - Div.1 - ASTM - A388 | Upon customer request |
| VISUAL AND DIMENSIONAL | MSS - SP 55 ANSI B16.5 - B16.10 API 6D - (Table 4.2) | 100% of rough and finished machined components and assembled valves |
| HARDNESS | NACE - MR.01.75 Latest Edition | 100% of wetted components |
| HYDROSTATIC AND PNEUMATIC | API - 6D - API 598 BS 6755 - Part.1 - MSS - SP 61 | 100% of all valves |
| OPERATION TORQUE | API - 6D | Upon customer request |
| HIGH PRESSURE CLOSURE | API - 598 - Par. 4-5 | Upon customer request |
| POSITIVE MATERIAL IDENTIFICATION | ASTM A751 | 100% of pressure containing components |

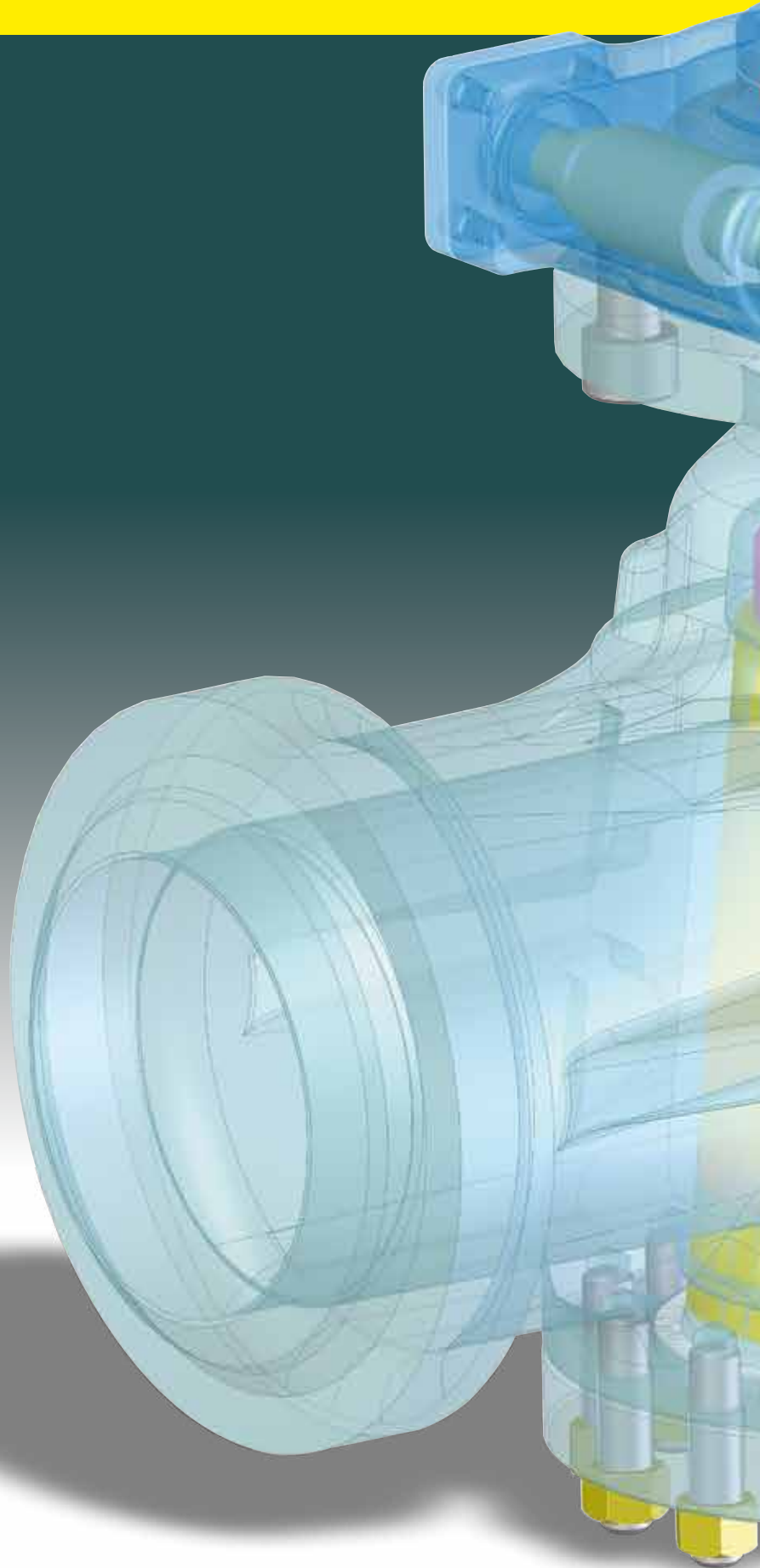
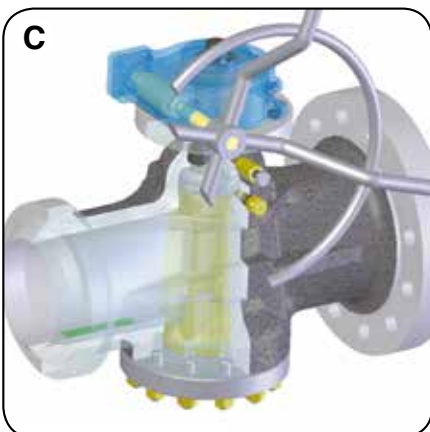
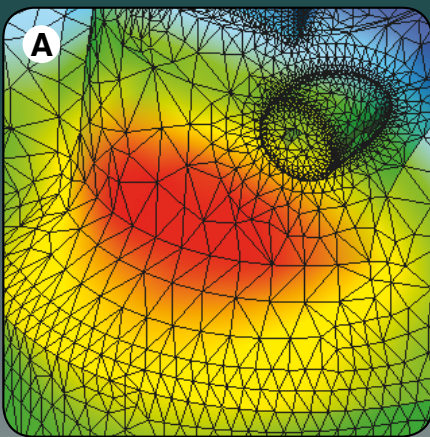


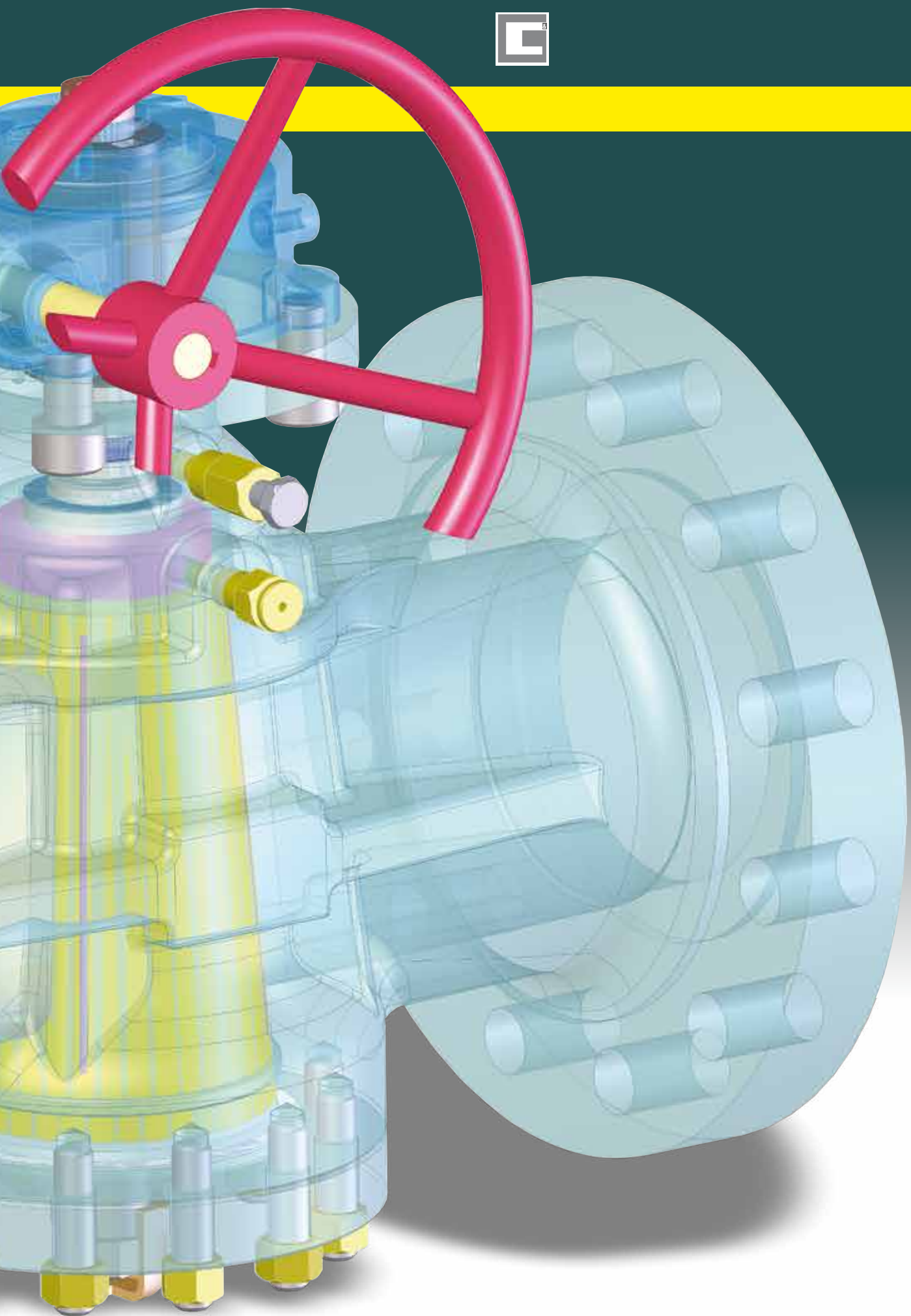


Advanced Design

Three-dimensional CAD system and the Finite Element Modelling allow the optimization of every step of valve's design:

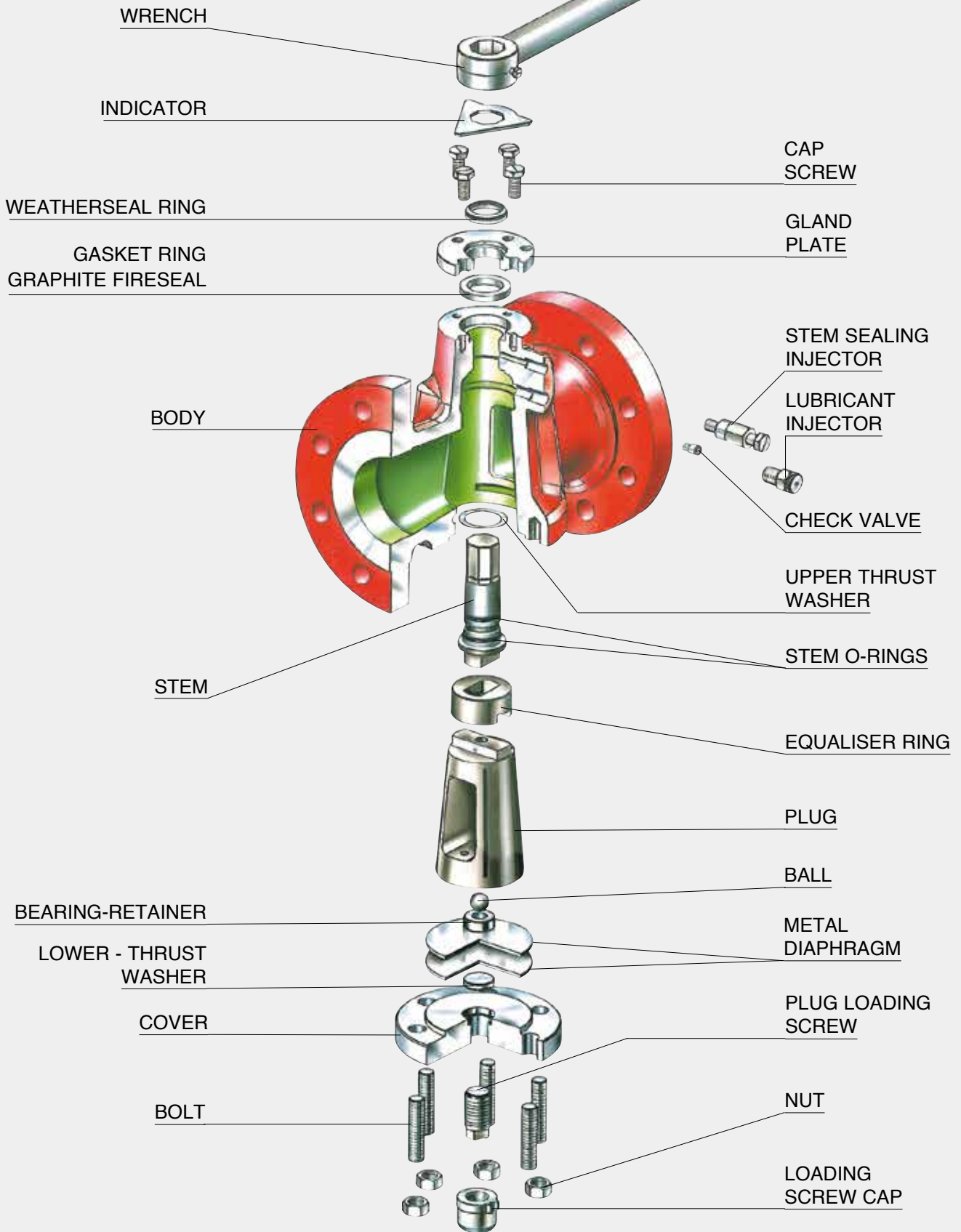
- FEM stress calculation of the pressure containing parts **(A)**
- Raw Casting design **(B)**
- Final Assembly Design Check **(C)**





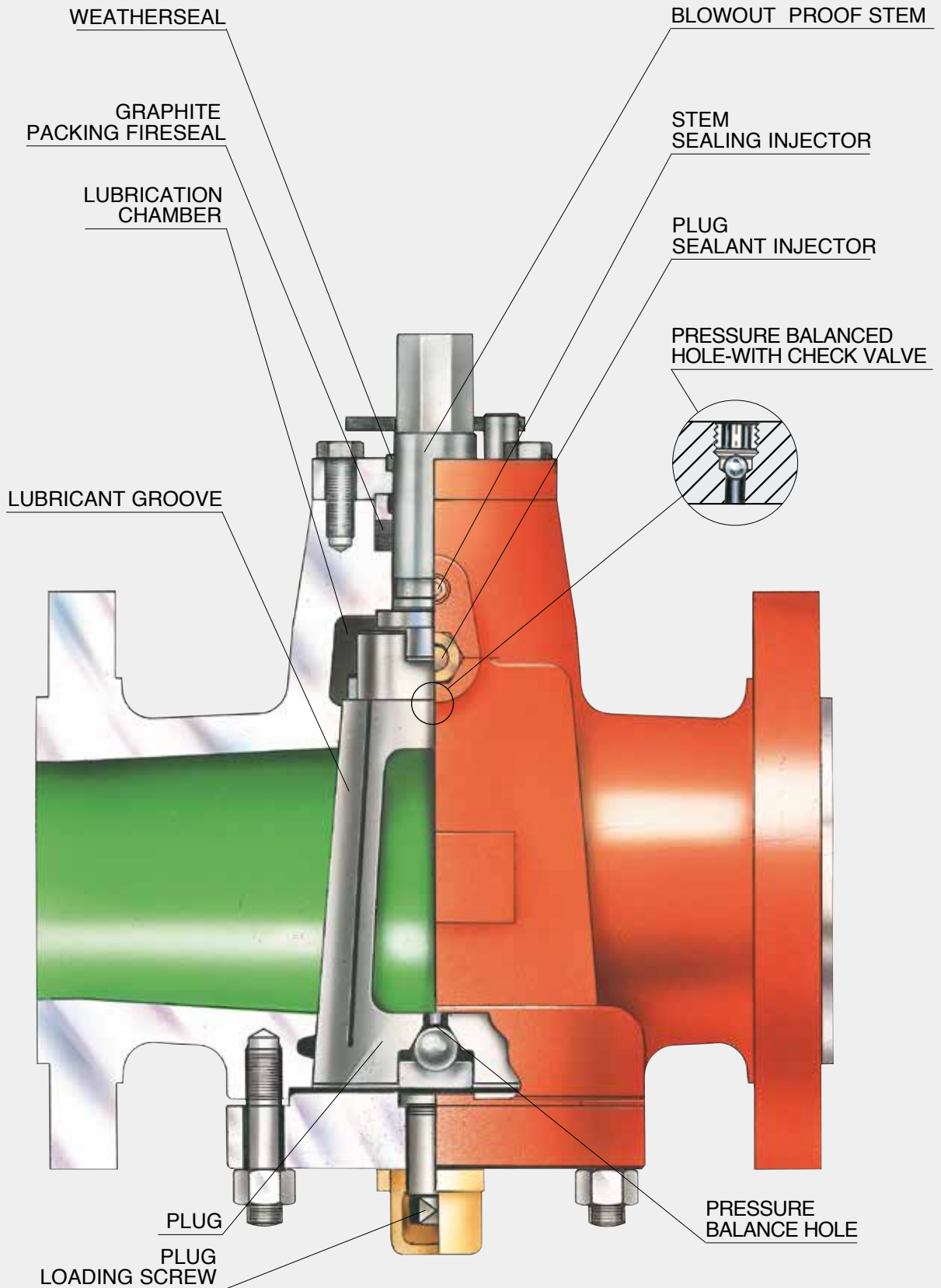


Valve Assembly





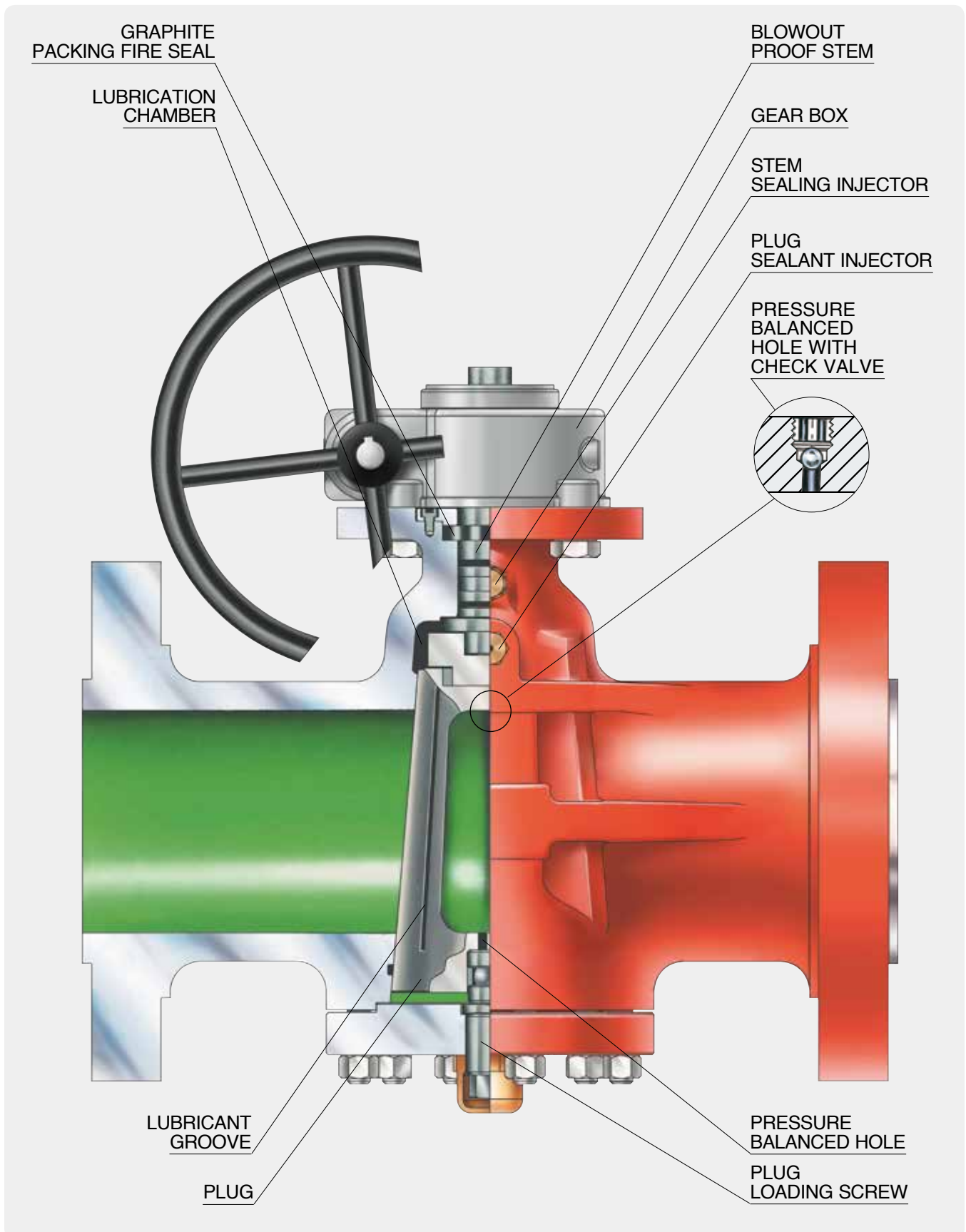
Valve with Wrench: Cross Section Drawing



NOTES: Each valve with wrench operation, the plug open and closed position are assured by corresponding stop indicator fitted on bare stem. The open position of the valve has the stop indicator parallel to flow direction of the fluid.



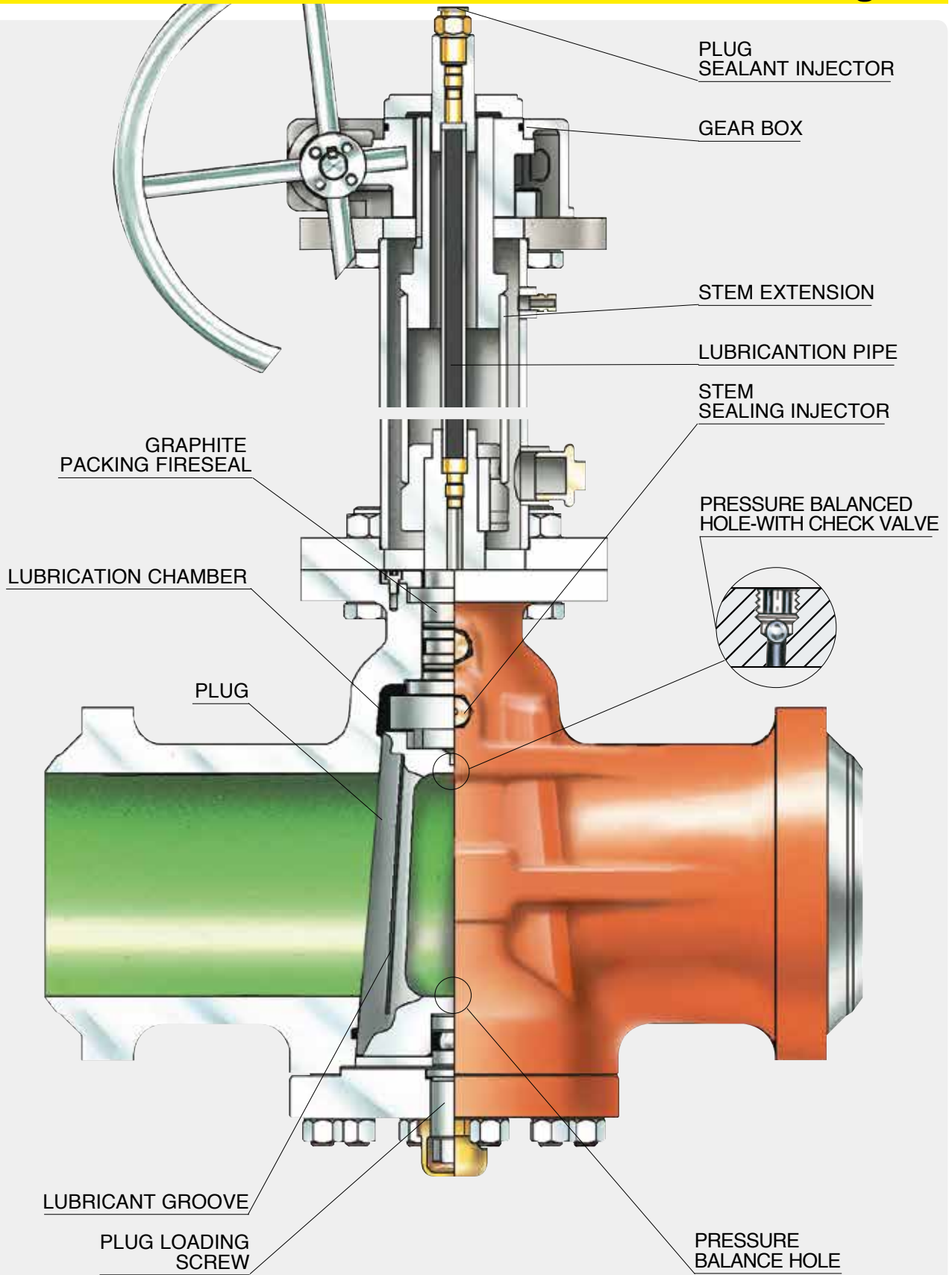
Valve with Gear: Cross Section Drawing



NOTES: Each valve with gear operation, the plug open and closed position are assured by corresponding stop indicator fitted on top of gear. The open position of the valve has the stop indicator parallel to flow direction of the fluid.



Valve with Stem Extension: Cross Section Drawing



NOTES: Specify the distance required from the valve center - line to the handwheel center - line at the ordering time.



Product Identification System

Identification numbers here shown are used to describe essential features of Galli & Cassina valves.

Example: 300 B R R 06 W P 0001

300

Size

- 1/2" 015 • 3" 080 • 12" 300 • 20" 500
- 3/4" 020 • 4" 100 • 14" 350 • 22" 550
- 1" 025 • 6" 150 • 16" 400 • 24" 600
- 1 1/2" 040 • 8" 200 • 18" 450 • 30" 750
- 2" 050 • 10" 250

B

Valve Type

- **B** Pressure Balanced
- **S*** Standard
- **V*** Standard with Jacket
- **Z*** Standard Full Jacketed

R

Pattern

- **V** Venturi
- **C** Short
- **R** or **W** Regular
- **F**** Full bore
- **K**** Short Full bore

R

Valve Operator Type

- **C** Lever
- **R** Gear
- **E** Gear with Electric Motor
- **A** Actuator (Pneumatic or Gas overoil)
- **B** Bare Stem

06

Working Pressure Class

- | | | | |
|----------------------|-----------|----------------------|------------|
| API 6D Valves | | API 6A Valves | |
| • 150 01 | • 300 03 | • 2000 20 | • 3000 30 |
| • 400 04 | • 600 06 | • 5000 50 | • 10000 00 |
| • 900 09 | • 1500 15 | • 15000 1K | |
| • 2500 25 | | | |

W

Valve End Connection

- **F** Threaded
- **T** Socket
- **R** RF Flange
- **W** Butt Weld
- **B** Butt Weld by Flange
- **J** Ring Joint Flange
- **C** Clamp

P

Optional Special Features

- **T** Completely Buried
- **P** Partially Buried
- **N** Pups
- **J** Partially Buried and Pups

0001

Internal Material Identification

According to client's materials requirement

The Code used as sample above (300 B R R 06 W P 0001) identifies a: DN 300 (12") - Pressure balanced plug valve - Regular pattern - Gear operated - ANSI 600 (PN 100) - Butt welding ends connection (w.t. according to client's requirement) - Stem extension (length from pipeline center line to the top of the stem extension according to client's requirement) - Standard carbon steel materials suitable for ambient and higher temperature service.

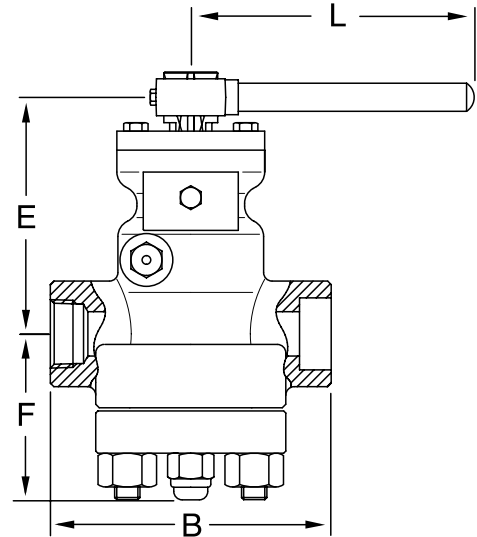
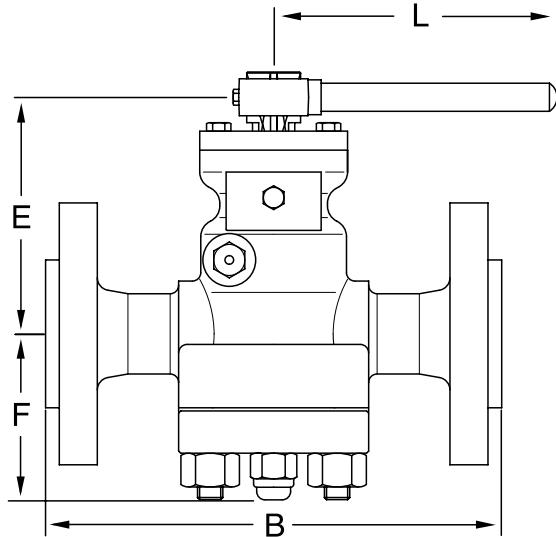
* See G&C blue catalogue "LUBRICATED PLUG VALVES STANDARD & JACKETED TYPE".

** See G&C green catalogue "LUBRICATED PLUG VALVES PRESSURE BALANCED FULL BORE TYPE".

*** See G&C silver catalogue "FULL BORE PRESSURE BALANCED TYPE WITH LGC* LUBRICATION SYSTEM".



ANSI Class 150 to 2500 (PN 20 to PN 420)



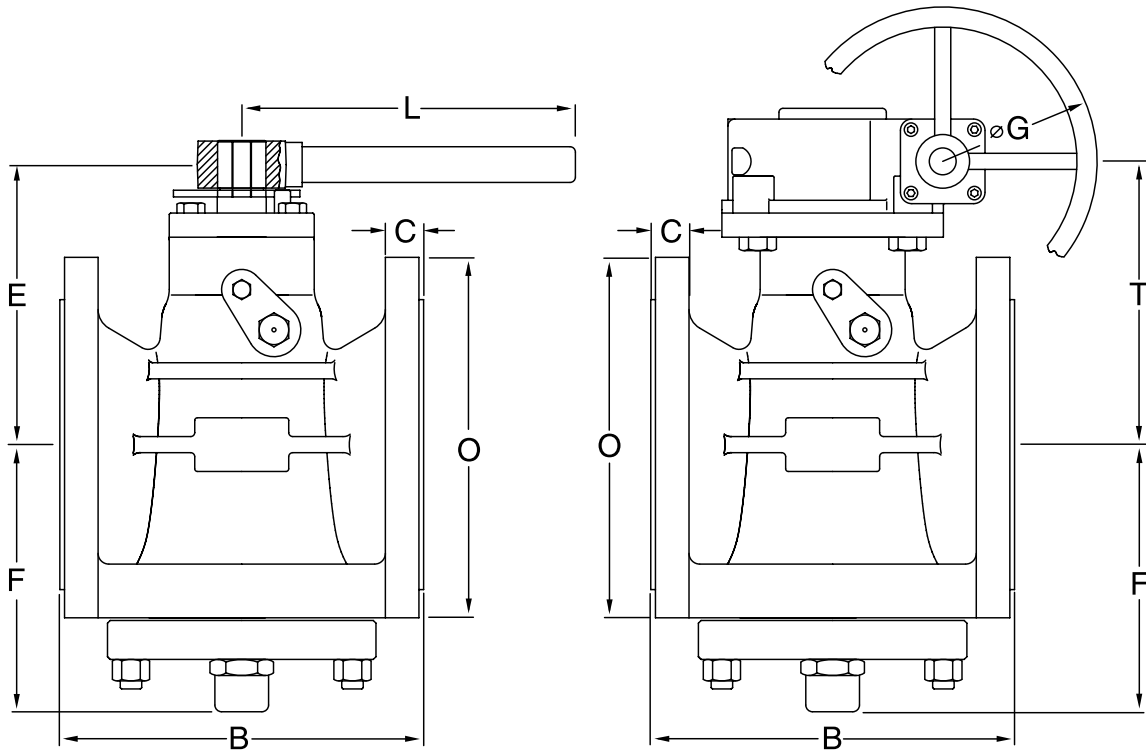
| Size | NPS DN | RF Flanged Ends** | | | | Screwed & Socked Ends | | | | |
|-------------------------------|-----------|-------------------|-----------|---------|-------------|-----------------------|-----------|---------|-------------|---------|
| | | 1/2 15 | 3/4 20 | 1 25 | 1 1/2 40 | 1/2 15 | 3/4 20 | 1 25 | 1 1/2 40 | 2 50 |
| Face To Face | | | | | | | | | | |
| ANSI 150 (PN 20) | B | 140* | 140* | 140* | 165 | 114 | 114 | 133 | 187 | 267 |
| ANSI 300 (PN 20) | B | 140* | 152 | 159 | 191 | 114 | 114 | 133 | 187 | 267 |
| ANSI 600 (PN 100) | B | 165 | 191 | 216 | 241 | 114 | 114 | 133 | 187 | 292 |
| ANSI 800 (PN 140) | B | - | - | - | - | 114 | 114 | 133 | 187 | 371 |
| ANSI 900-1500 (PN 150/250) | B | 216 | 229 | 254 | 305 | 133 | 133 | 133 | 187 | 371 |
| ANSI 2500 (PN 420) | B | 264 | 273 | 308 | 384 | 133 | 133 | 187 | 229 | 451 |
| Top of Stem to Center Line | E | 125 | 125 | 125 | 160 | 125 | 125 | 125 | 160 | 180 |
| Body Cap to Center Line | F | 80 | 80 | 80 | 130 | 80 | 80 | 80 | 130 | 100 |
| Length of Wrench | L | 300 | 300 | 300 | 500 | 300 | 300 | 300 | 450 | 450 |
| Weight kg | | | | | | | | | | |
| ANSI 150 (PN 20) | | 8,1 | 8,2 | 9,2 | 17,8 | 7 | 7 | 7,3 | 15 | 17 |
| ANSI 300 (PN 50) | | 8,3 | 9,4 | 10,4 | 20,6 | 7 | 7 | 7,3 | 15 | 17 |
| ANSI 600 (PN 100) | | 8,5 | 9,8 | 10,8 | 21,4 | 7 | 7 | 7,3 | 17 | 20 |
| ANSI 800 (PN 140) | | - | - | - | - | 7 | 7 | 7,3 | 18 | 21 |
| ANSI 900-1500 (PN 150/250) | | 12,4 | 13,5 | 16,3 | 28,1 | 8 | 8 | 8,5 | 21 | 23 |
| ANSI 2500 (PN 420) | | 15,6 | 16,3 | 20,3 | 39,7 | 9 | 9 | 11 | 27 | 29 |

NOTES: (*) In case of body in forged material, the face to face dimension is 152 mm.

(**) Available also with Ring Joint, Butt Welding and Clamp end connections.



ANSI Class 150 (PN 20)

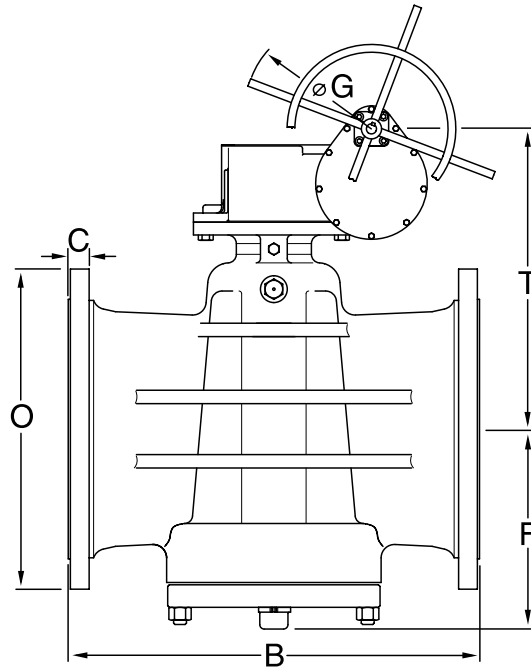


| Size | NPS DN | Short Pattern | | | | | | Regular Pattern | | | | |
|-------------------------------------|-----------|---------------|---------|----------|----------|----------|-----------|-----------------|----------|----------|-----------|-----------|
| | | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 | 6 150 | 8 200 | 10 250 | 12 300 |
| Face To Face RF | B | 178 | 203 | 229 | 267 | 292 | 330 | 356 | 394 | 457 | 533 | 610 |
| RTJ | B | 191 | 216 | 241 | 279 | 305 | 343 | 368 | 406 | 470 | 546 | 622 |
| BW | B | 267 | 330 | 356 | 457 | 521 | 559 | 635 | 457 | 521 | 559 | 635 |
| Flange Diameter | O | 152 | 191 | 229 | 279 | 343 | 406 | 483 | 279 | 343 | 406 | 483 |
| Flange Thickness | C | 16 | 19 | 24 | 26 | 29 | 30 | 32 | 26 | 29 | 30 | 32 |
| Top of Stem to Center Line | E | 180 | 220 | 240 | 250 | - | - | - | - | - | - | - |
| Body Cap to Center Line | F | 120 | 165 | 180 | 210 | 270 | 320 | 365 | 195 | 250 | 305 | 320 |
| Center Line Valve to CL Operator | T | - | - | - | 280 | 320 | 370 | 420 | 280 | 280 | 365 | 375 |
| Handwheel Diameter | G | - | - | - | 560 | 560 | 560 | 500 | - | - | - | - |
| Length of Wrench | L | 450 | 500 | 750 | 1000 | - | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 18 | 34 | 53 | 78 | 157 | 220 | 325 | 117 | 175 | 250 | 365 |
| Weight BW | kg | 15 | 30 | 45 | 67 | 124 | 195 | 290 | 82 | 158 | 215 | 320 |

NOTES: Short Pattern valve flanges from NPS 3" to 10" have 2 tapped holes UNC threaded, NPS 12" has 4 tapped holes UNC threaded. NPS 6" available wrench or gear operated.
Handwheel dimension (G) is indicative only.
The exact dimension depends of the maximum breakway force allowed.
The same range of valves is available for Regular Pattern with face to face dimension in accordance with BS5353.



ANSI Class 150 (PN 20)

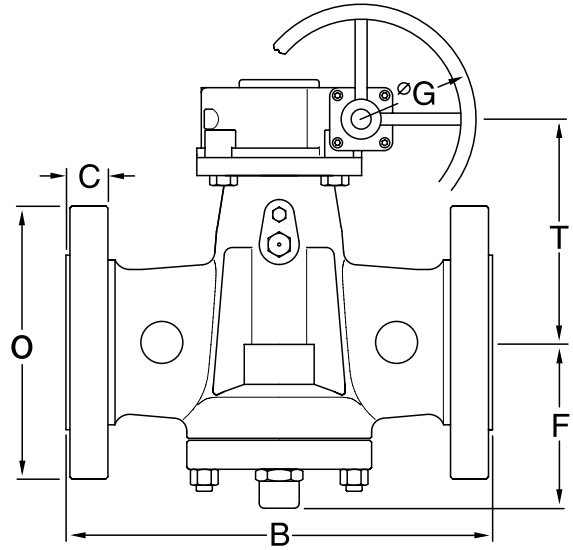
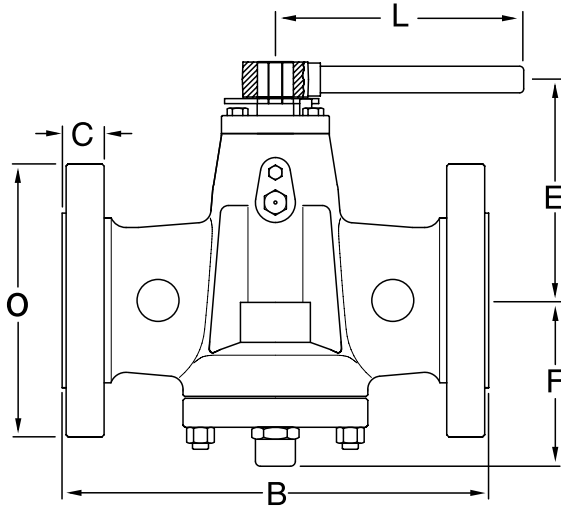


| Size | NPS DN | Venturi Pattern | | | | | | | | | |
|-------------------------------------|-----------|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | 10 250 | 12 300 | 14 350 | 16 400 | 18 450 | 20 500 | 24 600 | 26 650 | 30 750 | 36 900 |
| Face To Face | | | | | | | | | | | |
| RF | B | 533 | 610 | 686 | 762 | 864 | 914 | 1067 | 1245 | 1295 | 1600 |
| RTJ | B | 546 | 622 | 699 | 775 | 876 | 927 | 1080 | 1258 | 1308 | 1613 |
| BW | B | 559 | 635 | 686 | 762 | 864 | 914 | 1067 | 1245 | 1295 | 1600 |
| Flange Diameter | O | 406 | 483 | 533 | 597 | 635 | 699 | 813 | 870 | 984 | 1168 |
| Flange Thickness | C | 30 | 32 | 35 | 37 | 40 | 43 | 48 | 68 | 75 | 90 |
| Body Cap to Center Line | F | 320 | 365 | 380 | 400 | 420 | 470 | 530 | 580 | 610 | 850 |
| Center Line Valve to CL Operator | T | 370 | 420 | 420 | 420 | 450 | 500 | 550 | 600 | 660 | 910 |
| Handwheel Diameter | G | 560 | 500 | 500 | 700 | 700 | 700 | 800 | 800 | 800 | 800 |
| Weight RF/RTJ | kg | 220 | 325 | 430 | 760 | 900 | 1150 | 1500 | 2670 | 3870 | 5460 |
| Weight BW | kg | 190 | 270 | 355 | 670 | 795 | 1010 | 1350 | 2350 | 3490 | 4920 |

NOTES: Face to Face of NPS 26"/28" in accordance with API 6D Class 300.
 Face to Face of NPS 30" - 36" in accordance with ASME B16.10.
 Flange dimensions of NPS 26" - 30" - 36" in accordance with MSS-SP44.
 Handwheel dimension (G) is indicative only.
 The exact dimension depends of the maximum breakway force allowed.
 The same range of valves is available for Regular Pattern with face to face dimension in accordance with BS5353.



ANSI Class 300 (PN 50)



| Size | NPS DN | Short Pattern | | | | | | Regular Pattern | | | |
|-------------------------------------|-----------|---------------|---------|----------|----------|----------|-----------|-----------------|----------|----------|-----------|
| | | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 | 6 150 | 8 200 | 10 250 |
| Face To Face | | | | | | | | | | | |
| RF | B | 216 | 283 | 305 | 403 | 419 | 457 | 502 | 403 | 502 | 568 |
| RTJ | B | 232 | 298 | 321 | 419 | 435 | 473 | 518 | 419 | 518 | 584 |
| BW | B | 267 | 330 | 356 | 457 | 521 | 559 | 635 | 457 | 521 | 568 |
| Flange Diameter | O | 165 | 210 | 254 | 318 | 381 | 445 | 521 | 318 | 381 | 445 |
| Flange Thickness | C | 22 | 29 | 32 | 37 | 42 | 48 | 51 | 37 | 42 | 48 |
| Top of Stem to Center Line | E | 180 | 220 | 240 | 250 | - | - | - | - | - | - |
| Body Cap to Center Line | F | 115 | 165 | 180 | 220 | 285 | 320 | 400 | 195 | 250 | 310 |
| Center Line Valve to CL Operator | T | - | - | - | 280 | 330 | 370 | 370 | 280 | 280 | 350 |
| Handwheel Diameter | G | - | - | - | 560 | 560 | 560 | 700 | 560 | 560 | 700 |
| Length of Wrench | L | 500 | 750 | 750 | 1000 | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 21 | 39 | 62 | 100 | 180 | 290 | 400 | 150 | 215 | 325 |
| Weight BW | kg | 16 | 33 | 50 | 80 | 148 | 240 | 330 | 120 | 195 | 290 |

NOTES: Handwheel dimension (G) is indicative only.

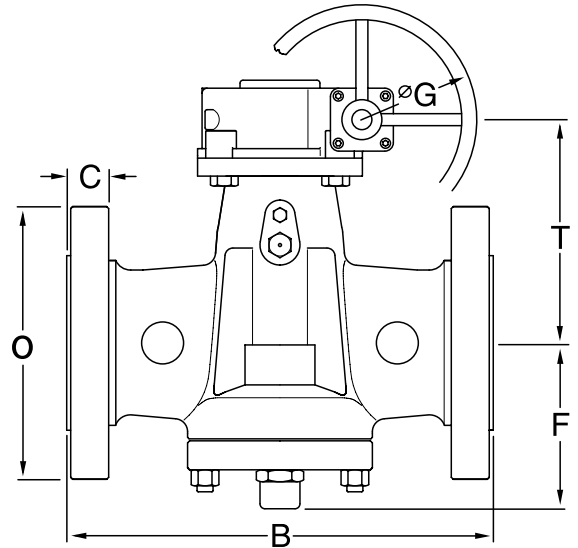
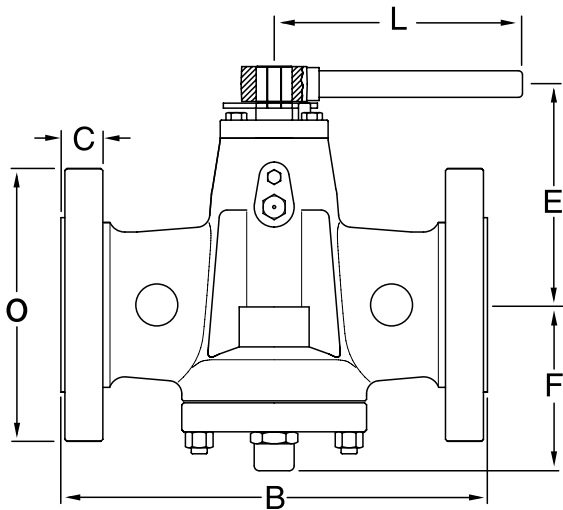
The exact dimension depends of the maximum breakway force allowed.

NPS 6" available wrench or gear operated.

The same range of valves is available for Regular Pattern with face to face dimension in accordance with BS5353.



ANSI Class 300 (PN 50)



Venturi Pattern

| Size | NPS DN | 6 150 | 8 200 | 10 250 | 12 300 | 14 350 | 16 400 | 18 450 | 20 500 | 24 600 | 26 650 | 30 750 | 36 900 |
|-------------------------------------|-----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Face To Face | | | | | | | | | | | | | |
| RF | B | 403 | 419 | 457 | 502 | 762 | 838 | 914 | 991 | 1143 | 1245 | 1397 | 1727 |
| RTJ | B | 419 | 435 | 473 | 518 | 778 | 854 | 930 | 1010 | 1165 | 1270 | 1422 | 1756 |
| BW | B | 457 | 521 | 559 | 635 | 762 | 838 | 914 | 991 | 1143 | 1245 | 1397 | 1727 |
| Flange Diameter | O | 318 | 381 | 445 | 521 | 584 | 648 | 711 | 775 | 914 | 972 | 1092 | 1270 |
| Flange Thickness | C | 37 | 42 | 48 | 51 | 54 | 58 | 61 | 64 | 70 | 84 | 95 | 111 |
| Top of Stem to Center Line | E | 250 | - | - | - | - | - | - | - | - | - | - | - |
| Body Cap to Center Line | F | 220 | 285 | 320 | 380 | 400 | 385 | 460 | 450 | 580 | 580 | 650 | 850 |
| Center Line Valve to CL Operator | T | - | 330 | 370 | 430 | 445 | 455 | 490 | 580 | 600 | 600 | 780 | 910 |
| Handwheel Diameter | G | 560 | 560 | 560 | 700 | 700 | 700 | 700 | 800 | 800 | 800 | 800 | 800 |
| Length of Wrench | L | 1000 | - | - | - | - | - | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 120 | 180 | 270 | 400 | 550 | 694 | 1100 | 1370 | 1900 | 2400 | 4500 | 7470 |
| Weight BW | kg | 80 | 165 | 240 | 330 | 446 | 560 | 870 | 1220 | 1780 | 1980 | 3600 | 5990 |

NOTES: NPS 6" available wrench or gear operated.

Flange dimensions of NPS 26" - 30" - 36" in accordance with MSS-SP44.

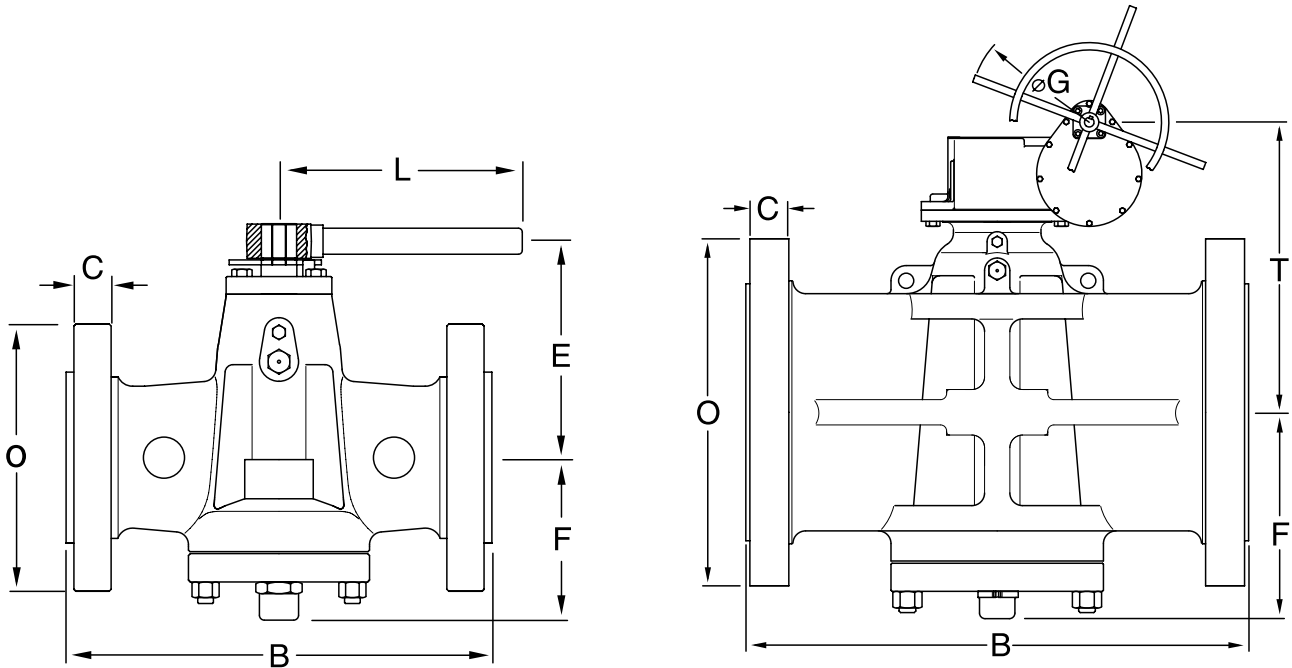
Handwheel dimension (G) is indicative only.

The exact dimension depends of the maximum breakway force allowed.

The same range of valves is available for Regular Pattern with face to face dimension in accordance with BS5353.



ANSI Class 600 (PN 100)



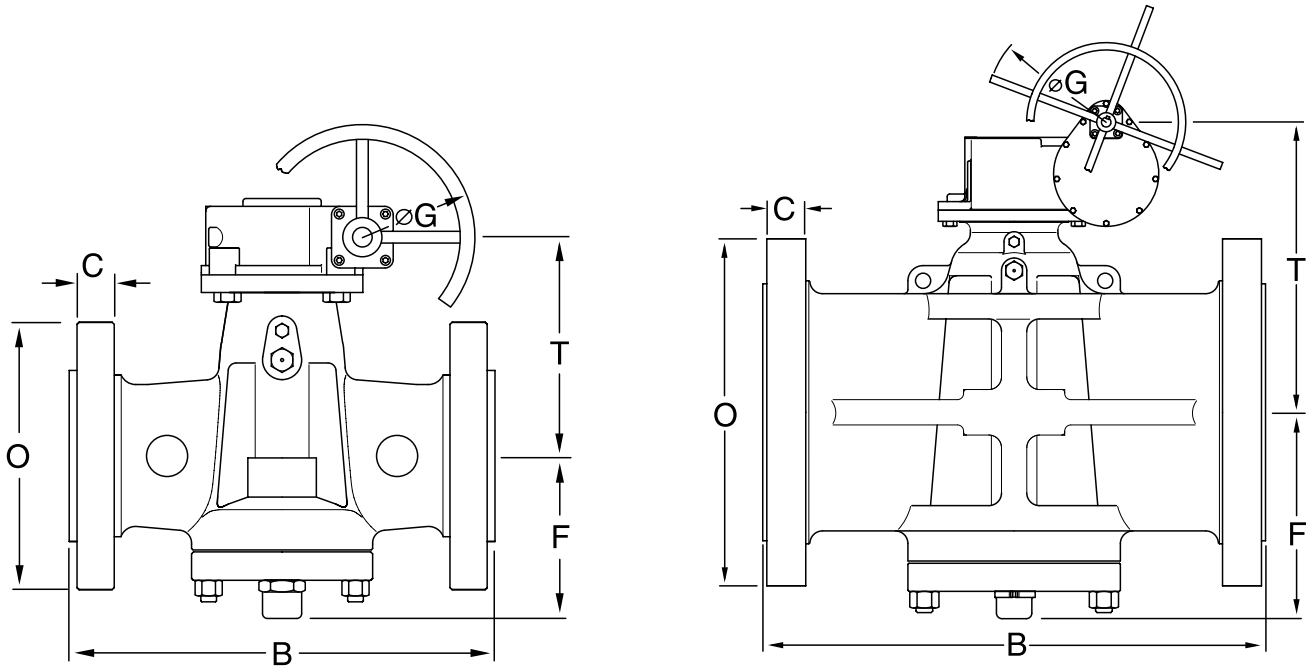
Regular Pattern

| Size | NPS DN | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 | 14 350 | 16 400 | 20 500 | 24 600 |
|-------------------------------------|-----------|---------|---------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Face To Face | | | | | | | | | | | | |
| RF | B | 292 | 356 | 432 | 559 | 660 | 787 | 838 | 889 | 991 | 1194 | 1397 |
| RTJ | B | 295 | 359 | 435 | 562 | 664 | 791 | 841 | 892 | 994 | 1200 | 1407 |
| BW | B | 292 | 356 | 432 | 559 | 660 | 787 | 838 | 889 | 991 | 1194 | 1397 |
| Flange Diameter | O | 165 | 210 | 273 | 356 | 419 | 508 | 559 | 603 | 686 | 813 | 940 |
| Flange Thickness | C | 26 | 32 | 38 | 48 | 56 | 64 | 67 | 70 | 76 | 89 | 102 |
| Top of Stem to Center Line | E | 180 | 220 | 240 | - | - | - | - | - | - | - | - |
| Body Cap to Center Line | F | 120 | 145 | 165 | 210 | 275 | 350 | 390 | 420 | 410 | 510 | 610 |
| Center Line Valve to CL Operator | T | - | 220 | 220 | 270 | 320 | 490 | 420 | 540 | 475 | 610 | 790 |
| Handwheel Diameter | G | - | - | 560 | 300 | 300 | 700 | 800 | 800 | 760 | 800 | 800 |
| Length of Wrench | L | 500 | 750 | 1000 | - | - | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 28 | 47 | 81 | 175 | 290 | 585 | 905 | 1080 | 1330 | 2600 | 4300 |
| Weight BW | kg | 22 | 38 | 55 | 125 | 220 | 470 | 735 | 820 | 1050 | 2280 | 3420 |

NOTES: NPS 4" available wrench or gear operated.
Handwheel dimension (G) is indicative only.
The exact dimension depends of the maximum breakway force allowed.



ANSI Class 600 (PN 100)



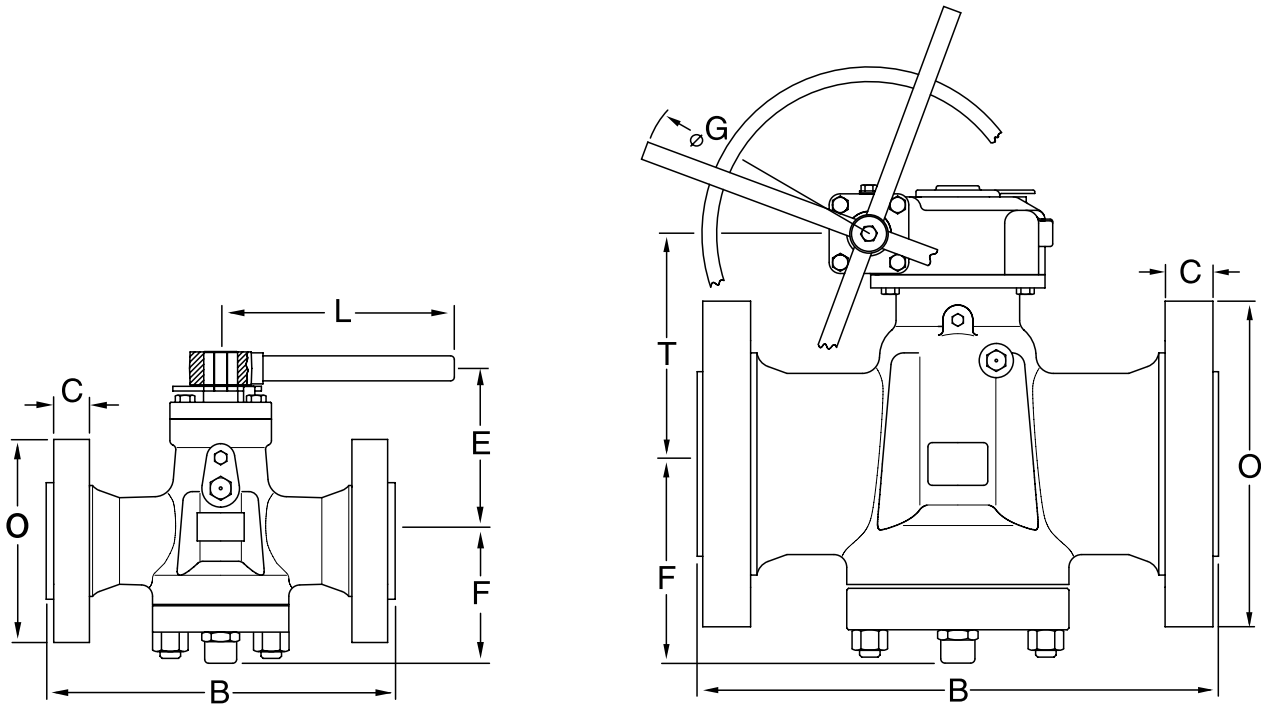
Venturi Pattern

| Size | NPS DN | 6 150 | 8 200 | 10 250 | 12 300 | 14 350 | 16 400 | 18 450 | 20 500 | 24 600 | 26 650 | 28 700 | 30 750 | 36 900 |
|-------------------------------------|-----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Face To Face | | | | | | | | | | | | | | |
| RF | B | 559 | 660 | 787 | 838 | 889 | 991 | 1092 | 1194 | 1397 | 1448 | 1549 | 1651 | 2083 |
| RTJ | B | 562 | 664 | 791 | 841 | 892 | 994 | 1095 | 1200 | 1407 | 1461 | 1562 | 1664 | 2099 |
| BW | B | 559 | 660 | 787 | 838 | 889 | 991 | 1092 | 1194 | 1397 | 1448 | 1549 | 1651 | 2083 |
| Flange Diameter | O | 356 | 419 | 508 | 559 | 603 | 686 | 743 | 813 | 940 | 1016 | 1073 | 1130 | 1314 |
| Flange Thickness | C | 48 | 56 | 64 | 67 | 70 | 77 | 83 | 89 | 102 | 108 | 111 | 114,5 | 124 |
| Body Cap to Center Line | F | 245 | 245 | 310 | 350 | 380 | 410 | 410 | 470 | 510 | 615 | 625 | 670 | 710 |
| Center Line Valve to CL Operator | T | 290 | 300 | 370 | 490 | 425 | 540 | 480 | 635 | 610 | 790 | 810 | 835 | 890 |
| Handwheel Diameter | G | 560 | 300 | 700 | 700 | 700 | 700 | 760 | 800 | 800 | 900 | 900 | 900 | 900 |
| Weight RF/RTJ | kg | 162 | 260 | 500 | 715 | 920 | 1100 | 1650 | 2080 | 3010 | 4260 | 5475 | 6690 | 11150 |
| Weight BW | kg | 112 | 190 | 410 | 580 | 730 | 870 | 1400 | 1670 | 2420 | 3700 | 4750 | 5800 | 8750 |

NOTES: Handwheel dimension (G) is indicative only.
 The exact dimension depends of the maximum breakway force allowed.
 Flange dimensions of NPS 26" - 28" - 30" - 36" in accordance with MSS-SP44.



ANSI Class 900 (PN 150)

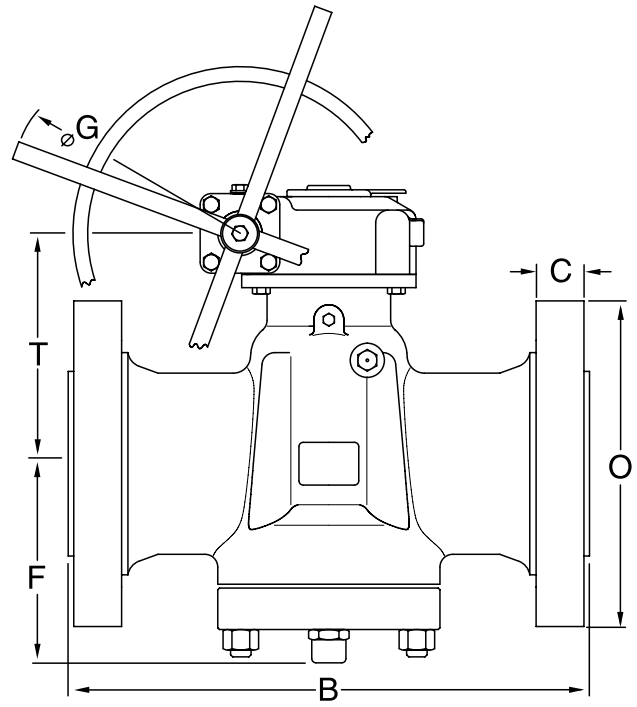
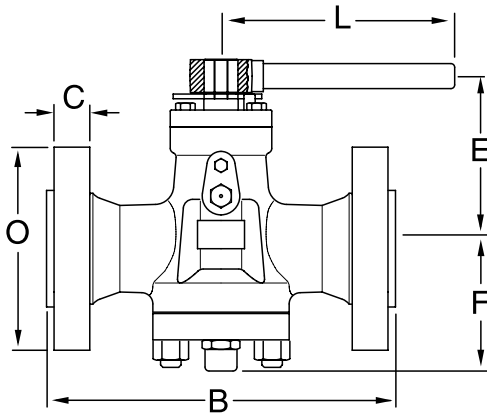


| Size | NPS DN | Regular Pattern | | | | | | Venturi Pattern | | | | | | |
|-------------------------------------|-----------|-----------------|---------|----------|----------|----------|-----------|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|
| | | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 | 14 350 | 16 400 | 20 500 | 24 600 | 28 700 | 30 750 |
| Face To Face | | | | | | | | | | | | | | |
| RF | B | 368 | 381 | 457 | 610 | 737 | 838 | 965 | 1029 | 1130 | 1321 | 1549 | 1753 | 1880 |
| RTJ | B | 371 | 384 | 460 | 613 | 740 | 841 | 968 | 1038 | 1140 | 1334 | 1568 | 1775 | 1902 |
| BW | B | 368 | 381 | 457 | 610 | 737 | 838 | 965 | 1029 | 1130 | 1321 | 1549 | 1753 | 1880 |
| Flange Diameter | O | 216 | 242 | 292 | 381 | 470 | 546 | 610 | 642 | 705 | 857 | 1041 | 1169 | 1232 |
| Flange Thickness | C | 38 | 38 | 45 | 56 | 64 | 70 | 80 | 86 | 89 | 108 | 140 | 172 | 183 |
| Top of Stem to Center Line | E | 210 | 220 | 240 | - | - | - | - | - | - | - | - | - | - |
| Body Cap to Center Line | F | 140 | 180 | 190 | 255 | 275 | 320 | 380 | 430 | 470 | 500 | 580 | 655 | 700 |
| Center Line Valve to CL Operator | T | - | - | 250 | 290 | 310 | 430 | 450 | 495 | 590 | 600 | 635 | 950 | 820 |
| Handwheel Diameter | G | - | - | 560 | 560 | 560 | 700 | 700 | 700 | 800 | 800 | 800 | 1000 | 800 |
| Length of Wrench | L | 500 | 1000 | 1000 | - | - | - | - | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 50 | 80 | 145 | 220 | 380 | 580 | 1080 | 1250 | 1505 | 2830 | 4380 | 7660 | 9670 |
| Weight BW | kg | 36 | 65 | 125 | 145 | 294 | 460 | 720 | 920 | 1250 | 2370 | 3190 | 7270 | 7750 |

NOTES: NPS 6" up to 24" valves available in Regular Pattern.
 NPS 4" available wrench or gear operated.
 Face to Face of NPS 14" - 20" - 24" in accordance with ASME B16.10
 Handwheel dimension (G) is indicative only.
 The exact dimension depends of the maximum breakway force allowed.
 Flange dimensions of NPS 28"-30"-36" in accordance with MSS-SP 44



ANSI Class 1500 (PN 250)

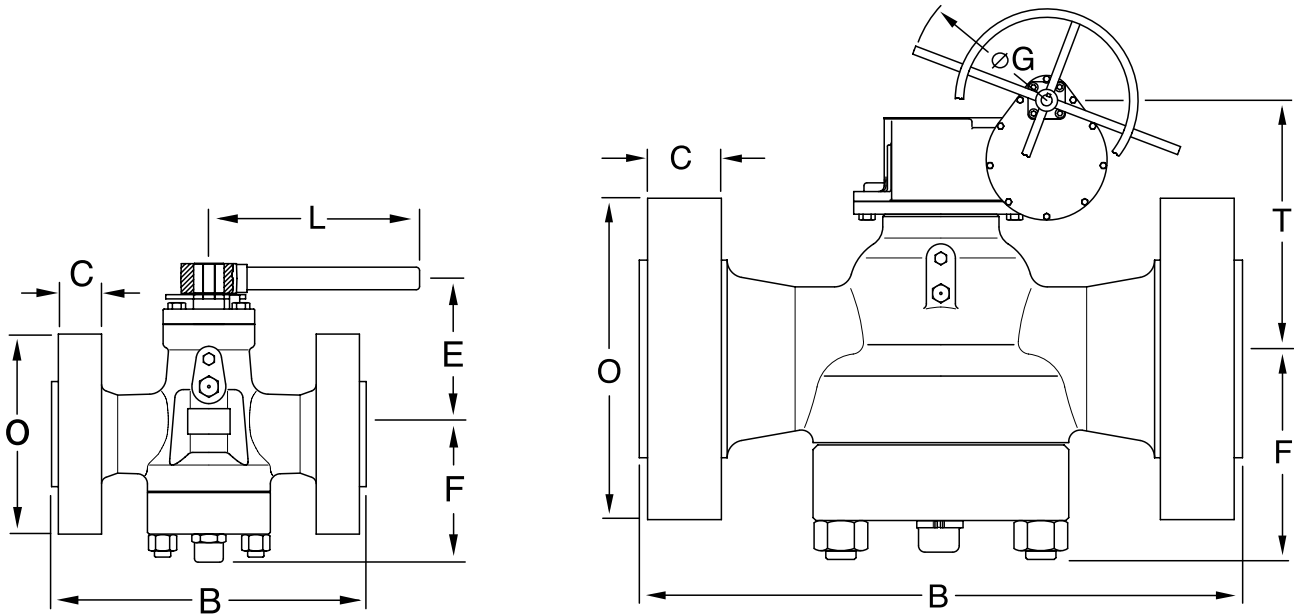


| Size | NPS DN | Regular Pattern | | | | Venturi Pattern | | | | | | | |
|-------------------------------------|-----------|-----------------|---------|----------|----------|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|--|
| | | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 | 14 350 | 16 400 | 20 500 | 24 600 | |
| Face To Face | | | | | | | | | | | | | |
| RF | B | 368 | 470 | 546 | 705 | 832 | 991 | 1130 | 1257 | 1384 | 1664 | 1943 | |
| RTJ | B | 371 | 473 | 549 | 711 | 841 | 1000 | 1146 | 1276 | 1406 | 1686 | 1972 | |
| BW | B | 368 | 470 | 546 | 705 | 832 | 991 | 1130 | 1257 | 1384 | 1664 | 1943 | |
| Flange Diameter | O | 216 | 267 | 311 | 394 | 483 | 584 | 673 | 749 | 825 | 984 | 1168 | |
| Flange Thickness | C | 38 | 48 | 54 | 83 | 92 | 108 | 124 | 133 | 146 | 178 | 203 | |
| Top of Stem to Center Line | E | 210 | 235 | - | - | - | - | - | - | - | - | - | |
| Body Cap to Center Line | F | 140 | 190 | 210 | 250 | 280 | 390 | 440 | 490 | 530 | 560 | 600 | |
| Center Line Valve to CL Operator | T | - | 235 | 270 | 270 | 370 | 400 | 530 | 580 | 610 | 640 | 670 | |
| Handwheel Diameter | G | - | - | 560 | 560 | 700 | 700 | 700 | 800 | 800 | 800 | 800 | |
| Length of Wrench | L | 750 | 1000 | - | - | - | - | - | - | - | - | - | |
| Weight RF/RTJ | kg | 50 | 95 | 170 | 305 | 590 | 950 | 1720 | 2050 | 2950 | 4500 | 5394 | |
| Weight BW | kg | 36 | 67 | 150 | 248 | 460 | 740 | 1260 | 1340 | 2350 | 3600 | 4550 | |

NOTES: NPS 6" up to 24" valves available in Regular Pattern.
 Handwheel dimension (G) is indicative only.
 The exact dimension depends of the maximum breakway force allowed.
 Face to Face of NPS 14" - 16" - 20" - 24" in accordance with ASME B16.10.



ANSI Class 2500 (PN 420)



Regular Pattern

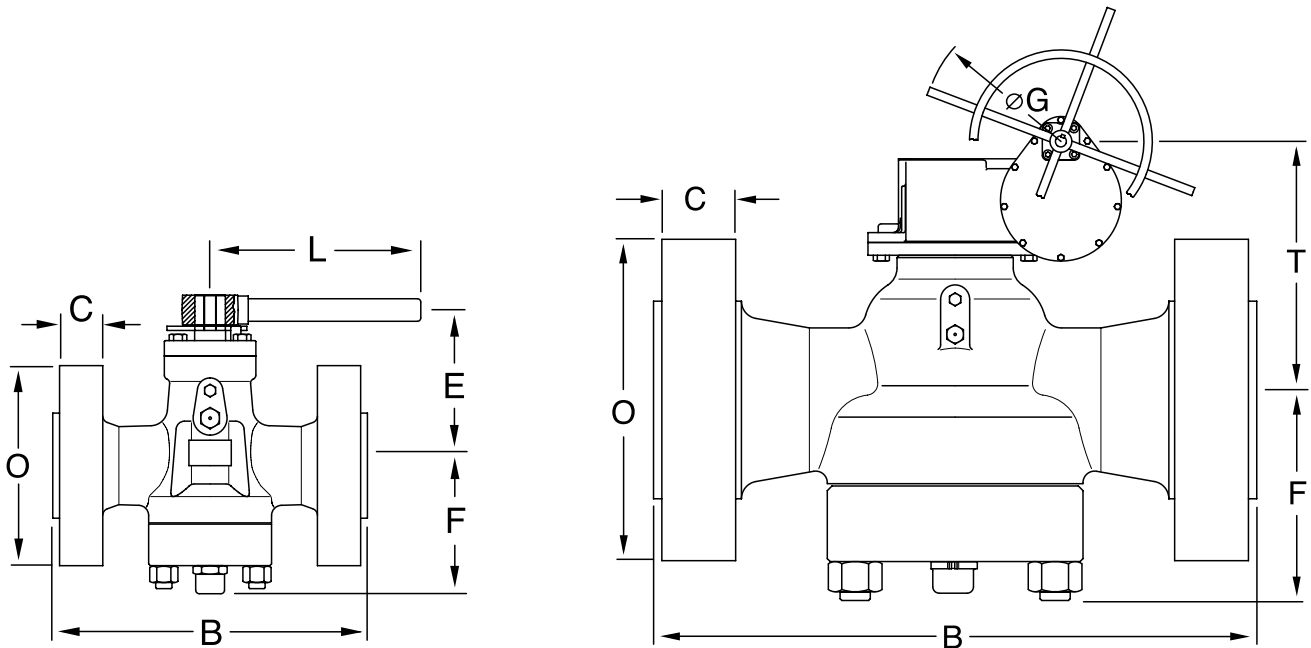
| Size | NPS DN | 2 50 | 3 80 | 4 100 | 6 150 | 8 200 | 10 250 | 12 300 |
|-------------------------------------|-----------|---------|---------|----------|----------|----------|-----------|-----------|
| Face To Face | | | | | | | | |
| RF | B | 451 | 578 | 673 | 914 | 1022 | 1270 | 1422 |
| RTJ | B | 454 | 584 | 683 | 927 | 1038 | 1292 | 1445 |
| BW | B | 451 | 578 | 673 | 914 | 1022 | 1270 | 1422 |
| Flange Diameter | O | 235 | 305 | 356 | 483 | 552 | 673 | 762 |
| Flange Thickness | C | 51 | 67 | 76 | 108 | 128 | 165 | 185 |
| Top of Stem to Center line | E | 200 | - | - | - | - | - | - |
| Body Cap to Center Line | F | 160 | 210 | 240 | 290 | 330 | 350 | 400 |
| Center Line Valve to CL Operator | T | - | 190 | 230 | 290 | 370 | 500 | 700 |
| Handwheel Diameter | G | - | 560 | 560 | 700 | 800 | 800 | 800 |
| Length of Wrench | L | 1000 | - | - | - | - | - | - |
| Weight RF/RTJ | kg | 72 | 140 | 240 | 600 | 1300 | 2100 | 3000 |
| Weight BW | kg | 48 | 89 | 150 | 420 | 980 | 1560 | 2150 |

NOTES: NPS 2" available wrench or gear operated.
 Handwheel dimension (G) is indicative only.
 The exact dimension depends of the maximum breakway force allowed.



Pressure Balanced Plug Valves

API 6A 2000-3000-5000-10000



| Size | NPS DN | API 2000 - Regular | | | | | API 3000 - Regular | | | | |
|------|-----------|--------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|
| | | 2 ¹ / ₁₆ 52 | 2 ⁹ / ₁₆ 65 | 3 ¹ / ₈ 79 | 4 ¹ / ₁₆ 103 | 7 ¹ / ₁₆ 179 | 2 ¹ / ₁₆ 52 | 2 ⁹ / ₁₆ 65 | 3 ¹ / ₈ 78 | 4 ¹ / ₁₆ 103 | 7 ¹ / ₁₆ 179 |

| | | | | | | | | | | | | |
|----------------------------------|-----------|-----|-----|------|-----|-----|-----|-----|------|-----|-----|--|
| Face To Face | | | | | | | | | | | | |
| RTJ | B | 295 | 333 | 359 | 435 | 562 | 371 | 422 | 384 | 460 | 613 | |
| Flange Diameter | O | 165 | 190 | 210 | 273 | 356 | 216 | 245 | 241 | 292 | 381 | |
| Flange Thickness | C | 26 | 29 | 32 | 38 | 48 | 38 | 42 | 38 | 45 | 56 | |
| Top of Stem to Center Line | E | 180 | 180 | 220 | - | - | 180 | 180 | 218 | - | - | |
| Body Cap to Center Line | F | 120 | 120 | 150 | 170 | 200 | 150 | 130 | 170 | 175 | 200 | |
| Center Line Valve to CL Operator | T | - | - | - | 270 | 280 | - | - | - | 270 | 260 | |
| Handwheel Diameter | G | - | - | - | 560 | 560 | - | - | - | 560 | 560 | |
| Length of Wrench | L | 500 | 750 | 1000 | - | - | 750 | 750 | 1000 | - | - | |
| Weight | kg | 28 | 35 | 47 | 81 | 175 | 50 | 58 | 80 | 145 | 220 | |

| Size | NPS DN | API 5000 - Regular | | | | | API 10000 - Full Bore | | | | | | |
|------|-----------|--------------------------------------|--------------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------------------------------------------|
| | | 2 ¹ / ₁₆ 52 | 2 ⁹ / ₁₆ 65 | 3 ¹ / ₈ 79 | 4 ¹ / ₁₆ 103 | 7 ¹ / ₁₆ 179 | 1 ¹³ / ₁₆ 46 | 2 ¹ / ₁₆ 52 | 2 ⁹ / ₁₆ 65 | 3 ¹ / ₁₆ 78 | 4 ¹ / ₁₆ 103 | 5 ¹ / ₈ 130 | 7 ¹ / ₁₆ x6 ³ / ₈ 179x162 |

| | | | | | | | | | | | | | | |
|----------------------------------|-----------|-----|------|-----|-----|-----|-----|-----|------|-----|-----|-----|------|------|
| Face To Face | | | | | | | | | | | | | | |
| RTJ | B | 371 | 422 | 473 | 549 | 711 | 464 | 521 | 565 | 619 | 670 | 737 | 889 | 899 |
| Flange Diameter | O | 216 | 245 | 267 | 311 | 394 | 188 | 200 | 232 | 270 | 316 | 357 | 480 | 480 |
| Flange Thickness | C | 38 | 42 | 48 | 54 | 83 | 37 | 38 | 45 | 51 | 62 | 70 | 92 | 92 |
| Top of Stem to Center Line | E | 180 | 210 | 218 | - | - | 190 | - | - | - | - | - | - | - |
| Body Cap to Center Line | F | 150 | 180 | 220 | 175 | 225 | - | 152 | 172 | 192 | 220 | 270 | 305 | 305 |
| Center Line Valve to CL Operator | T | - | - | 270 | 270 | 265 | 205 | 210 | 220 | 230 | 248 | 350 | 390 | 390 |
| Handwheel Diameter | G | - | - | 280 | 560 | 710 | - | - | - | 710 | 710 | 710 | 800 | 800 |
| Length of Wrench | L | 750 | 1000 | - | - | - | 450 | 750 | 1000 | - | - | - | - | - |
| Weight | kg | 55 | 65 | 105 | 205 | 330 | 52 | 94 | 169 | 305 | 550 | 950 | 1700 | 1800 |



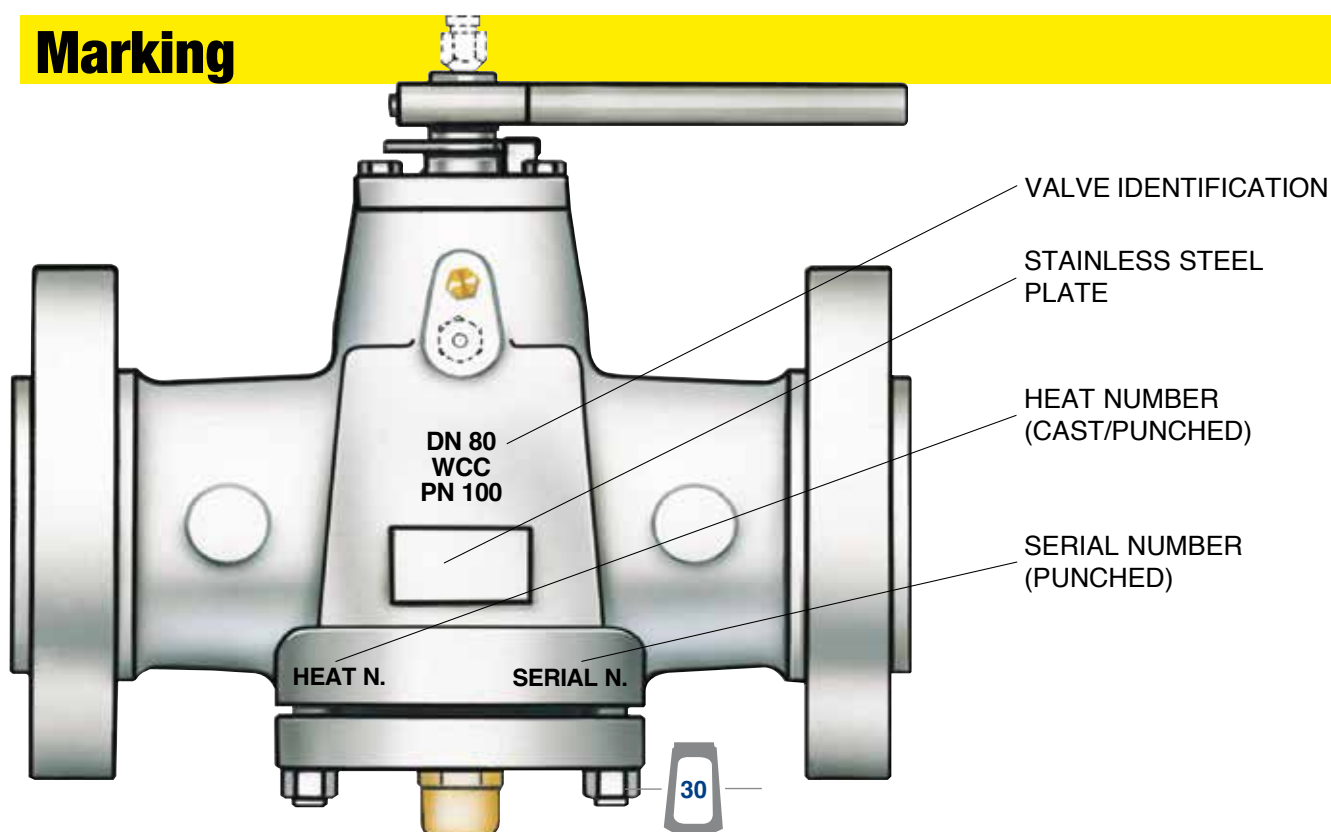
Hydraulic Pressure Test Duration *In accordance with API 6D and API 598*

| Valve Size | | Test Duration | | Valve Size | | Test Duration | |
|----------------|--------------|---------------|----------|---------------------------|--------------|---------------|----------|
| DN (mm) | NPS (Inches) | Shell | Seat (1) | DN (mm) | NPS (Inches) | Shell | Seat (1) |
| API 598 | | | | API 6D / ISO 14313 | | | |
| 15 - 50 | 1/2 - 2 | 15 sec. | 15 sec. | 15 - 100 | 1/2 - 4 | 2 min. | 2 min. |
| 65 - 150 | 2 1/2 - 6 | 60 sec. | 60 sec. | 150 - 250 | 6 - 10 | 5 min. | 5 min. |
| 200 - 300 | 8 - 12 | 120 sec. | 120 sec. | 300 - 450 | 12 - 18 | 15 min. | 5 min. |
| 350 and over | 14 and over | 300 sec. | 120 sec. | 500 and over | 20 and over | 30 min. | 5 min. |

(1) Duration applicable also for the pneumatic seat test (5.5 bar/80 psi).



Marking





Pressure Test Tables in Accordance with API 598 & API 6D

ASME B16.34 Group Material 1.1

(A 105; A 216 WCB; A 350 LF2)

Working Pressures by Classes, psig (Bar)

| | 150 PN20 | 300 PN50 | 600 PN100 | 900 PN150 | 1500 PN250 | 2500 PN420 |
|-------------------------|----------|-----------|------------|------------|------------|------------|
| Working pressure rating | 285 (20) | 740 (51) | 1480 (102) | 2220 (153) | 3705 (255) | 6170 (425) |
| Hydraulic body test | 450 (31) | 1125 (78) | 2225 (153) | 3350 (231) | 5575 (384) | 9275 (640) |
| Hydraulic seat test | 314 (22) | 814 (56) | 1628 (112) | 2442 (168) | 4076 (281) | 6787 (468) |

ASME B16.34 Group Material 1.2 and 2.8

(A 350 LF6; A 216 WCC; A 352 LCC; A182 F44/ F51; UNS S31803/S31254/S32750; A 351 Gr. CK3MCuN / CE8MN/ CD4MCu / CD3MWCuN)

Working Pressures by Classes, psig (Bar)

| | 150 PN20 | 300 PN50 | 600 PN100 | 900 PN150 | 1500 PN250 | 2500 PN420 |
|-------------------------|----------|-----------|------------|------------|------------|------------|
| Working pressure rating | 290 (20) | 750 (52) | 1500 (103) | 2250 (155) | 3750 (259) | 6250 (431) |
| Hydraulic body test | 450 (31) | 1125 (78) | 2250 (155) | 3375 (233) | 5625 (388) | 9375 (646) |
| Hydraulic seat test | 319 (22) | 825 (57) | 1650 (114) | 2475 (171) | 4125 (284) | 6875 (474) |

ASME B16.34 Group Material 1.3

(A 352 LCB)

Working Pressures by Classes, psig (Bar)

| | 150 PN20 | 300 PN50 | 600 PN100 | 900 PN150 | 1500 PN250 | 2500 PN420 |
|-------------------------|----------|-----------|------------|------------|------------|------------|
| Working pressure rating | 265 (18) | 695 (48) | 1390 (96) | 2085 (144) | 3470 (239) | 5785 (399) |
| Hydraulic body test | 400 (28) | 1050 (72) | 2100 (145) | 3150 (217) | 5225 (360) | 8700 (600) |
| Hydraulic seat test | 292 (20) | 765 (53) | 1529 (105) | 2294 (158) | 3817 (263) | 6364 (439) |

ASME B16.34 Group Material 2.1 and 2.2

(A 182 F304; A 479 Gr. 304; A 351 CF3; A 351 CF8; A 182 F316; A 479 Gr. 316; A 351 CF3M)

Working Pressures by Classes, psig (Bar)

| | 150 PN20 | 300 PN50 | 600 PN100 | 900 PN150 | 1500 PN250 | 2500 PN420 |
|-------------------------|----------|-----------|------------|------------|------------|------------|
| Working pressure rating | 275 (19) | 720 (50) | 1440 (99) | 2160 (149) | 3600 (248) | 6000 (414) |
| Hydraulic body test | 425 (29) | 1100 (76) | 2175 (150) | 3250 (224) | 5400 (372) | 9000 (621) |
| Hydraulic seat test | 303 (21) | 792 (55) | 1584 (109) | 2376 (164) | 3960 (273) | 6600 (455) |

ASME B16.34 Group Material 2.3

(A 182 F304/F316L; A 479 Gr. 304/316L)

Working Pressures by Classes, psig (Bar)

| | 150 PN20 | 300 PN50 | 600 PN100 | 900 PN150 | 1500 PN250 | 2500 PN420 |
|-------------------------|----------|----------|------------|------------|------------|------------|
| Working pressure rating | 230 (16) | 600 (41) | 1200 (83) | 1800 (124) | 3000 (207) | 5000 (345) |
| Hydraulic body test | 350 (24) | 900 (62) | 1800 (124) | 2700 (186) | 4500 (310) | 7500 (517) |
| Hydraulic seat test | 253 (17) | 660 (46) | 1320 (91) | 1980 (137) | 3300 (228) | 5500 (379) |

Pressure Test Tables in Accordance with API 6A

| Working Pressure Rating | Body | | | | | | Seat | High Pressure Gas Test Body & Seat | |
|-------------------------|---------------|------|-------|--------------|-------|------|-------|------------------------------------|-------|
| | Up to 13 5/8" | | | From 16 3/4" | | | | Bar | psi |
| Bar | psi | Bar | psi | Bar | psi | Bar | psi | Bar | psi |
| 138 | 2000 | 276 | 4000 | 207 | 3000 | 138 | 2000 | 138 | 2000 |
| 207 | 3000 | 415 | 6000 | 310 | 4500 | 207 | 3000 | 207 | 3000 |
| 345 | 5000 | 517 | 7500 | 517 | 7500 | 345 | 5000 | 345 | 5000 |
| 690 | 10000 | 1035 | 15000 | 1035 | 15000 | 690 | 10000 | 690 | 10000 |
| 1035 | 15000 | 1550 | 22500 | 1550 | 22500 | 1035 | 15000 | 1035 | 15000 |
| 1380 | 20000 | 2070 | 30000 | | | 1380 | 20000 | 1380 | 20000 |

Quality Assurance Programme

CERTIFICATE OF APPROVAL

This is to certify that the Occupational Health & Safety Management System of:

Galli & Cassina S.p.A.
Via Drizza, 30/32
20020 Solaro (Milano) - Italy

has been approved by Lloyd's Register Quality Assurance to the following standard:

OHSAS 18001:2007

The Occupational Health & Safety Management System is applicable to:

Design & manufacturing of plug valves of the after sales services, in carbon steel and exotic special alloys with DN from 6 to DN 900, up to class ANSI 2500 (PN 42) and with DN from 1" 3/16 to 11" up to class API 10000 P and flow indicators and gear operators.

Approval Certificate
No: LRC 6017612/OHS/U/EN



CERTIFICATE OF APPROVAL

This is to certify that the Environmental Management System of:

Galli & Cassina S.p.A.
Via Drizza, 30/32
20020 Solaro (Milano) - Italia

has been approved by Lloyd's Register Quality Assurance to the following Environmental Management System Standard:

ISO 14001:2004

The Environmental Management System is applicable to:

Design & manufacturing of plug valves, including the after sales services, in carbon steel, alloy steel and exotic special alloys with DN from 1/4" up to 36" (i.e. from DN 6 to DN 900), up to class ANSI 2500 (PN 42) and with DN from 1" 3/16 to 11" up to class API 10000 P and flow indicators and gear operators.

Original Approval: 18th March 2014

Approval Certificate
No: LRC 6017612/EMS/U/EN

Certificate of Authority to use the Official API Monogram

License Number: 6A-0520

The American Petroleum Institute hereby grants to

GALLI & CASSINA S.P.A.
Via Drizza, 30/32
Solaro, Milan
Italy

the right to use the Official API Monogram on manufactured products under the conditions in the official publications of the American Petroleum Institute entitled API Spec Q1[®] and API Spec 6A[®] and in accordance with the provisions of the License Agreement.

In all cases where the Official API Monogram is applied, the API Monogram should be used in conjunction with this certificate number: 6D-0049.1

The American Petroleum Institute reserves the right to revoke this authorization to use the Official API Monogram for any reason satisfactory to the Board of Directors of the American Petroleum Institute.

The scope of this license includes the following product: Plug Valves
QMS Exclusions: No Exclusions Identified as Applicable



American Petroleum Institute

American Petroleum Institute
John Madala
Director of Training and Certification Programs



Quality Assurance System

After 95 years of manufacturing experience and latest technology, **Galli&Cassina** Quality Assurance System has been assessed, approved and certified against the following quality assurance standards: ISO 9001-Vision 2000 and API Q1. Rigorous procedures and internal audits guarantee that the Quality System is implemented at all stages, starting from incoming raw materials, production, inspection, assembly, final test, packing and shipping.

Every product is designed and manufactured to conform to uniformly high standards. These standards are assured by a quality management system which includes ISO 9001 certification and testing of all products prior to shipment. Advanced design, durable construction materials and rigid manufacturing standard provide valves you can rely on for years of trouble-free performance. Since its beginning in



1919, **Galli&Cassina** has maintained its commitment to quality product and satisfied customers. Our focus on product variety, technical expertise and company support remains constant, from drawing board to user satisfaction, our commitment is continuous.

Quality Assurance Development

Galli&Cassina's Quality Assurance System ISO 9001-2008 - HSE ISO 14001 & ISO 18001 have been assessed, approved and certified by Lloyd's Register, while the API 6D and API 6A monograms have been certified by API (American Petroleum Institute): all the certificates are the result of **Galli&Cassina's** dedication towards the aim of good reputation in the world-wide valve market, since 95 years.

In addition **Galli&Cassina** Plug Valves are in compliance with CE Pressure Equipment Directive PED N. 97/23/EC and ATEX (N. 94/9/EC) for products intended for use in potentially explosive atmospheres.



Customer Service

Galli&Cassina's Customer Service is always willing to assist the customer with a prompt response to "service" requests. Full after sales services assistance can be offered either at our workshop or on site, spare parts supply. Training programs, on operation and safety.
**Cina - UAE - Kuwait
Saudi Arabia - Europe
India - U.S.A - Canada
Venezuela - Colombia
Brasil.**





Lubricants

Galli&Cassina Plug Valves can use different types of Climax lubricant grease suitable for various services. The operating conditions must be specified at enquiry stage enabling us to advise which type of sealant is suitable. The lubricant grease is available as a spare part item and can be ordered as:



- **Cartridges (suitable for hydraulic gun pump).**
- **Drums (suitable for pneumatic pump). For the selection of the correct lubricant, Galli&Cassina staff is always available at the customer's request to recommend the suitable lubricant.**

Climax Hydraulic Gun No.1699



This specially designed, high pressure handgun, light in weight (appr. 16lbs.) is more rugged than conventional types and meets exacting demands of plug valve sealants. Built for servicing plug valves, all parts are machined with minutye accuracy.

The polished hardened steel piston is perfectly fitted in the high pressure barrel to provide absolute smoothness of operation. The CLIMAX 1699 is self-priming and can be used in any position. Because of its hydraulic principle, this gun exerts more pressure than any other portable gun.

This gun is equipped with a CLIMAX 1699 Button Head Coupler for connection to the button head sealant fitting in the shank of the valve. This coupler has a built-in feature which locks it to fitting when the gun is under positive pressure.

The coupler cannot be connected to or separated from the fitting with the gun under pressure. This pressure may be relieved by a turn of the by-pass valve on the gun. The by-pass valve should not be closed to a point where it is jammed into its seat, nor should it be opened tight against the stop.



The valve should be closed firmly, but not tightly. It is not necessary to open the valve past one full turn. Due to "built-in" safety features, the CLIMAX 1699

provides the maximum safety to both the valve and the gun itself. The hydraulic system of the gun is equipped with a relief fitting to protect

the gun from injury if the operator were to continue to pump after the gun had been depleted of valve sealant.

Also, to prevent damage to the valve and sealant gun, in the event of sealant clogging the system or the operator pumping too fast, a CLIMAX 0 psi gauge is optional equipment.

This accessory indicates the point at which sufficient sealant pressure has been developed within the valve. The gauge also indicates valve adjustment and other services required.

The CLIMAX 0-15000 psi gauge is the highest quality, most reliable glycerin filled gauge available.

The one piece die cast brass case and heavy duty bourdon tube and movement enable the gauge to stand up to the shock and vibration encountered on the most demanding applications. The CLIMAX gauge also features a rubber gauge protector.

A carrying case for the CLIMAX Model 1699 is optional.

Refer to the part list for available options.

Note: Gun shown is a 1699-S model complete with hose assembly, gauge, tee and "Z" swivel.

Automatic Lubrication

Galli&Cassina Plug Valves can be provided with a special automatic lubricant pump to facilitate lubrication maintenance service.

The automatic pump model depends on the size of valve and its number of open/closed cycles enables

us to calculate the consumption of the lubricant grease during the operating service.

The automatic pumps are available either electric or pneumatic motor type at the following operating temperature range: -20 to 40°C.



Climax Lubricants

| Lubricant and No. | Type Available | Color | Temp. Range From To | Principal Services | Unsuitable For |
|-------------------|----------------|--------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------|
| 220 | Stick Bulk | Clear | -75 to 250 °F -59 to 121 °C | Very cold service for pipe lines, compressor stations, gasoline plants and crude oil production fields. For Liquid Service. | Aromatic, Solvents. |
| 262 | Stick | | -85 to 250 °F -65 to 121 °C | Same as above-Gas Service. | LPG |
| 400 | Stick Bulk | Red | -20 to 450 °F -29 to 232 °C | Acids and Caustics. | Liquid Hydrocarbons. |
| 600 | Stick Bulk | Tan Brown | -20 to 500 °F -29 to 260 °C | General gas and general Hydrocarbons service. | LPG |
| 650 | Stick Bulk | Blue-Green | -40 to 500 °F -40 to 260 °C | Hydrocarbon and L.P.G. service | Aromatic, Alkalies Solvents. |
| 711 | Stick Bulk | White | 32 to 400 °F 0 to 204 °C | Aviation gasoline, Jet fuel, fuel blends of Alkylate. | 100% Benzine. |
| 750 | Stick Bulk | Black | 0 to 600 °F -18 to 316 °C | Asphalt hot oil service Salt brine, high temperature steam. | Aromatic, Alkalies Solvents. |
| 800 | Stick Bulk | White | -20 to 450 °F -29 to 232 °C | Butane, Butadiene, Carbon Tetrachloride, Ethane, Propane. | Alkalies |
| 900 | Stick Bulk | Black | -20 to 650 °F -29 to 343 °C | Natural gas, petrochemical plants, rubber plants, and hot Hydrocarbons service. | Alkalies |
| 901 | Stick Bulk | Black | -30 to 300 °F -34 to 149 °C | Cold weather, Hydrocarbon lubricant. | Alkalies |
| 950 | Stick Bulk | Amber | -40 to 300 °F -40 to 149 °C | Propylenes, Benzenes Toulene, Butadiene, Xylenes, Styrene, Cumenes | Alkalies |
| 1034-MT | Stick Bulk | Cream | -20 to 400 °F -29 to 204 °C | Liquid and gaseous. Aliphatic hydrocarbon service. (Wet or dry natural gas) | Alkalies |



Routine Maintenance Instructions

Galli&Cassina valves are designed to require the minimum of maintenance. If a valve is operated infrequently or not at all, then it is good practice to exercise it occasionally by moving the plug even partially. To ensure maximum valve life and performance, Galli&Cassina recommend the occasional injection of plug lubricant. Periodic plug lubricant injection may be needed to keep the valve operating

torque from increasing and to maintain bubble tight sealing.

It is important to use only plug lubricant recommended by Galli&Cassina.

A wrong lubricant selection can:

- A) Cause valve leakage.
- B) Cause valve seizure.
- C) Require valve disassembling for lubricant removing and cleaning.

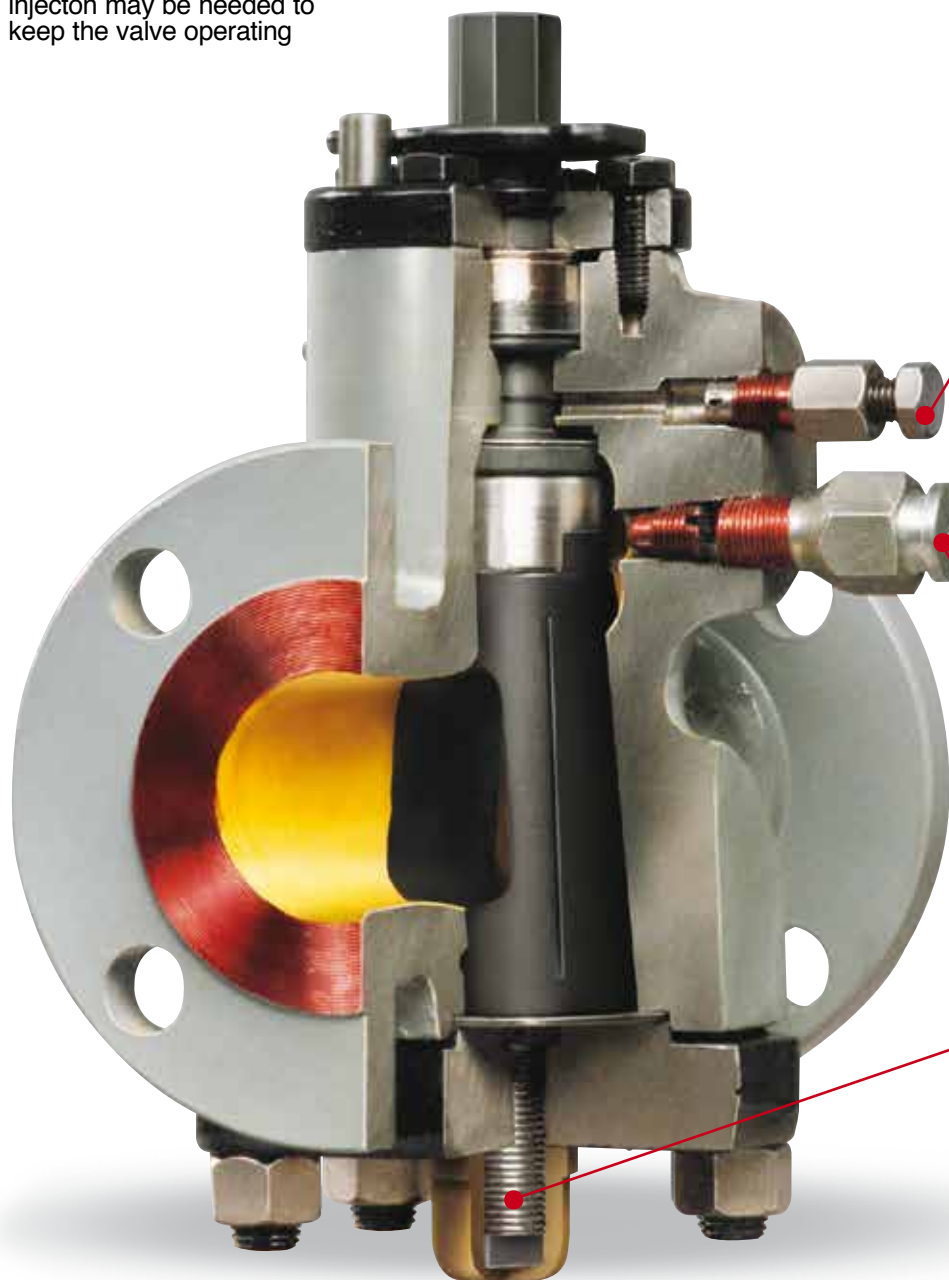
Frequency of Lubrication:

This depends on the frequency of valve operation, operating conditions and the mechanical condition of the valve.

The following lubrication schedule could be an useful guide:

- After a period of 12 months with valve kept in open/closed position.

- 10 to 100 operations per week: daily.
- Up to 10 operations per week: weekly.
- Up to 10 operations per year: monthly.
- Less frequently: twice annually.



Galli&Cassina Plug Valves usually do not require further mastic injection after workshop assembling. In the event of leakage to atmosphere occurring around the stem, it can be stopped by injecting stem sealing compound at the stem sealing injector.

Galli&Cassina recommend a periodic lubrication of the plug surface to keep low torque and bubble tight sealing. Lubricant injector, giant button head type, usually located on the side of the body valve, can in peculiar cases be placed on the top of the stem. The use of Climax hydraulic pump 1699 type is recommended.

The plug loading screw is normally set up during the assembling of the valve and it **must be always kept tightened** for all the operating time.

It is very important to lubricate periodically the valve using Climax lubricant or other lubricants approved by Galli&Cassina.

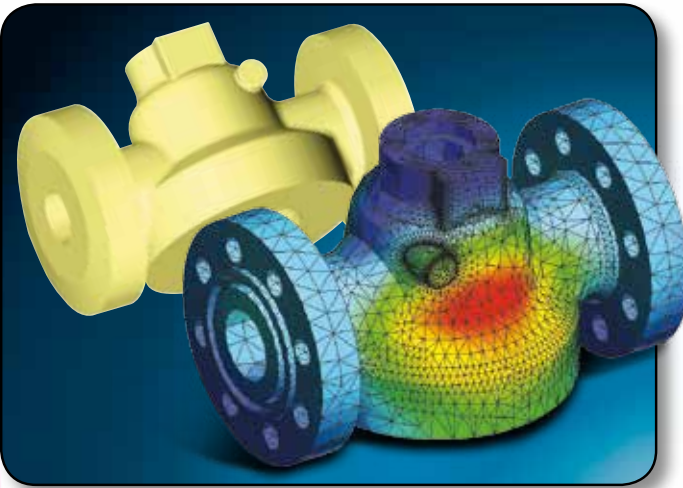
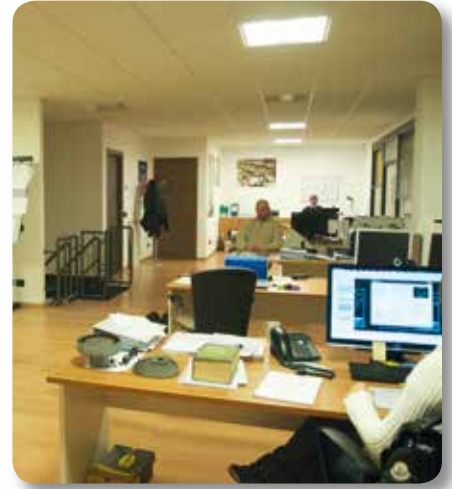


Engineering Data



Design

Galli&Cassina Plug Valves have been designed in accordance with International STD. norms.
ASME B16.34 - API 599 - API 6D - API 6A - BS 5353.
The stem is anti-blow-out design and incorporates three sealing system (two o-rings and one stem packing). Graphite gasket is provided to guarantee full accordance with Fire Safe API 6FA and BS 6755-Part 2 specification.
Fire Safe Test Certificate is available upon request.





Conversion Tables

To Convert Into Multipli by

A

| | | |
|------------|----------------------------|---------|
| Atmosphere | bar | 1,01325 |
| Atmosphere | cms. of mercury | 76.0 |
| Atmosphere | ft. of water (at 4°C) | 33.90 |
| Atmosphere | in. of mercury (at 0°C) | 29.92 |
| Atmosphere | kgs./sq. cm. | 1.0333 |
| Atmosphere | pounds/sq. in. | 14.70 |
| Atmosphere | pascal (N/m ²) | 98070 |

B

| | | |
|----------------------|-----------------|--------------------------|
| Bar | atmosphere | 1.0197 |
| Bar | psi | 14.505 |
| Bar | pascal | 105 |
| Barrels(U.S.,liquid) | gallons | 31.5 |
| Barrels (oil) | gallons (oil) | 42.0 |
| Btu | foot - lbs. | 778.3 |
| Btu | gram-calories | 252.0 |
| Btu | horsepower-hrs. | 3.931 x 10 ⁻⁴ |
| Btu/hr | kilowatt-hrs | 2.928 x 10 ⁻⁴ |
| Btu/hr | horsepower | 3.931 x 10 ⁻⁴ |
| Btu | Watts | 0.2931 |

C

| | | |
|------------------------|---------------------|---------------------------|
| Calories, gram (mean) | B.T.U. (mean) | 3.9685 x 10 ⁻³ |
| Centigrade | Fahrenheit | (C° 9/5)+32 |
| Centimeters | feet | 3.281 x 10 ⁻² |
| Centimeters | inches | 0.3937 |
| Centimeters | mils | 393.7 |
| Centimeters of mercury | atmospheres | 0.01316 |
| Centimeters of mercury | feet of water | 0.4461 |
| Centimeters of mercury | pounds/sq. in. | 0.1934 |
| Circumference | radians | 6.283 |
| Cubic centimeters | cu. feet | 3.531 x 10 ⁻⁵ |
| Cubic centimeters | cu. inches | 0.06102 |
| Cubic centimeters | gallons (U.S. liq.) | 2.642 x 10 ⁻⁴ |
| Cubic feet | cu. cms. | 28,320.0 |
| Cubic feet | cu. inches | 1,728.0 |
| Cubic feet | gallons (U.S. liq.) | 7.481 |
| Cubic feet | liters | 28.32 |
| Cubic feet/hour | cubic meters/hour | 0.02832 |
| Cubic feet/min. | gallons/sec. | 0.1247 |
| Cubic feet/min. | cubic meters/hour | 1.6990 |
| Cubic inches | cu. cms. | 16.39 |
| Cubic inches | gallons | 4.329 x 10 ⁻³ |
| Cubic inches | quarts (U.S. liq.) | 0.01732 |
| Cubic meters | cu. feet | 35.31 |
| Cubic meters | gallons (U.S. liq.) | 264.2 |
| Cubic meters/hour | cu. feet/min | 0.5886 |
| Cubic meters/hour | cu. feet/hour | 35.315 |
| Cubic meters/hour | gallons /hour | 264.17 |

D

| | | |
|-------------------------------|---------------------|---------|
| Degres (angle) | radians | 0.01745 |
| Drams | ounces (avoidupois) | 0.13714 |
| Drams (apothecaries' or troy) | ounces (troy) | 0.125 |
| Drams (U.S., fluid or apoth) | cubic cm. | 3.6967 |
| Drams | grams | 1.772 |
| Drams | grains | 27.3437 |
| Drams | ounces | 0.0625 |

F

| | | |
|---------------|----------------|--------------------------|
| Fahrenheit | centigrade | (F 32°) 5/9 |
| Feet | centimeters | 30.48 |
| Feet | kilometers | 3.048 x 10 ⁻⁴ |
| Feet | meters | 0.3048 |
| Feet | miles (naut.) | 1.645 x 10 ⁻⁴ |
| Feet | miles (stat.) | 1.894 x 10 ⁻⁴ |
| Feet of water | atmospheres | 0.02950 |
| Feet of water | in. of mercury | 0.8826 |
| Feet of water | kgs./sq. cm. | 0.03045 |
| Feet of water | kgs./sq. meter | 304.8 |
| Feet of water | pounds/sq.ft. | 62.43 |
| Feet of water | pounds/sq.in | 0.4335 |
| Foot-pounds | Btu | 1.286 x 10 ⁻³ |

To Convert Into Multipli by

| | | |
|------------------|---------------|--------------------------|
| Foot-pounds | gram-calories | 0.3238 |
| Foot-pounds | hp.-hrs. | 5.050 x 10 ⁻⁷ |
| Foot-pounds | kilowatt-hrs. | 3.766 x 10 ⁻⁷ |
| Foot-pounds/min. | Btu/min. | 1.286 x 10 ⁻³ |
| Foot-pounds/min. | horsepower | 3.030 x 10 ⁻⁵ |
| Foot-pounds/sec. | Btu/hr. | 4.6263 |
| Furlongs | miles (U.S.) | 0.125 |
| Furlongs | feet | 660.0 |

G

| | | |
|------------------------|---------------------|---------------------------|
| Gallons | cu.cms | 3.785.0 |
| Gallons | cu.feet | 0.1337 |
| Gallons | cu.inches | 231.0 |
| Gallons | cu.meters | 3.785 x 10 ⁻³ |
| Gallons | cu.yards | 4.951 x 10 ⁻³ |
| Gallons | liters | 3.785 |
| Gallons (liq. Br Imp.) | gallons (U.S. liq.) | 1.20095 |
| Gallons (U.S.) | gallons (Imp.) | 0.83267 |
| Gallons of water | pounds of water | 8.3453 |
| Gallons/min. | cu.ft./sec. | 2.228 x 10 ⁻³ |
| Gallons/min. | liters/sec. | 0.06308 |
| Gallons/min. | cu.ft./hr. | 8.0208 |
| Grains (troy) | grain (avdp.) | 1.0 |
| Grains (troy) | grams | 0.06480 |
| Grains (troy) | ounces (avdp.) | 2.286 x 10 ⁻³ |
| Grains (troy) | pennyweight (troy) | 0.04167 |
| Grains /U.S. gal. | parts/million | 17.118 |
| Grains /U.S. gal. | pounds/million gal. | 142.86 |
| Grains /Imp. gal. | parts/million | 14.286 |
| Grams | grains | 15.43 |
| Grams | ounces (avdp.) | 0.03527 |
| Grams | ounces (troy) | 0.03215 |
| Grams | poundals | 0.07093 |
| Grams | pounds | 2.205 x 10 ⁻³ |
| Gram/liter | parts/million | 1.000.0 |
| Gram-calories | Btu | 3.9683 x 10 ⁻³ |
| Gram-calories | foot-pounds | 3.0880 |
| Gram-calories | kilowatt-hrs. | 1.1630 x 10 ⁻⁶ |
| Gram-calories | watt-hrs. | 1.1630 x 10 ⁻³ |

H

| | | |
|--------------------------------|---------------------|------------------------|
| Horsepower | Btu/min. | 42.40 |
| Horsepower | foot-lbs./min. | 33.000 |
| Horsepower | foot-lbs./sec. | 550.0 |
| Horsepower (metric) | horsepower | 0.9863 |
| 542.5 ft. lb/sec.) | (550.5 ft. lb/sec.) | |
| Horsepower (550.5 ft. lb/sec.) | horsepower (metric) | 1.014 |
| Horsepower | (542.5 ft. lb/sec.) | |
| Horsepower | kilowatts | 0.7457 |
| Horsepower | watts | 745.7 |
| Horsepower (boiler) | Btu/hr | 33.520 |
| Horsepower (boiler) | kilowatts | 9.803 |
| Horsepower-hrs. | Btu | 2.547 |
| Horsepower-hrs. | foot-lbs. | 1.98 x 10 ⁶ |
| Horsepower-hrs. | kilowatts-hrs. | 0.7457 |

I

| | | |
|--------------------------|-------------------|--------------------------|
| Inches | centimeters | 2.540 |
| Inches | meters | 2.540 x 10 ⁻² |
| Inches | millimeters | 25.40 |
| Inches | yards | 2.778 x 10 ⁻² |
| Inches of mercury | atmospheres | 0.03342 |
| Inches of mercury | feet of water | 1.133 |
| Inches of mercury | kgs./sq. cm. | 0.03453 |
| Inches of mercury | kgs./sq. meter | 345.3 |
| Inches of mercury | pounds/sq. ft. | 70.73 |
| Inches of mercury | pounds/sq. in. | 0.4912 |
| Inches of water (at 4°C) | atmospheres | 2.458 x 10 ⁻³ |
| Inches of water (at 4°C) | inches of mercury | 0.07355 |
| Inches of water (at 4°C) | kgs./sq. cm. | 2.538 x 10 ⁻³ |
| Inches of water (at 4°C) | ounces/sq. in. | 0.5781 |
| Inches of water (at 4°C) | pounds/sq. ft. | 5.204 |
| Inches of water (at 4°C) | pounds/sq. in. | 0.03613 |

J

| | | |
|--------|-----|--------------------------|
| Joules | Btu | 9.480 x 10 ⁻⁴ |
|--------|-----|--------------------------|



Conversion Tables

| To Convert | Into | Multipl by |
|---------------------|-------------------|--------------------------|
| K | | |
| Kilograms | grams | 1,000.0 |
| Kilograms | pounds | 2.205 |
| Kilograms/cu. meter | pounds/cu. ft. | 0.06243 |
| Kilograms/cu. meter | pounds/cu. in. | 3.613 x 10 ⁻⁵ |
| Kilograms/sq. cm | atmosphere | 0.9678 |
| Kilograms/sq. cm | feet of water | 32.84 |
| Kilograms/sq. cm | inches of mercury | 28.96 |
| Kilograms/sq. cm. | pounds/sq. ft. | 2.048 |
| Kilograms/sq. cm. | pounds/sq. in. | 14.22 |
| Kilograms/sq. meter | atmosphere | 9.678 x 10 ⁻⁵ |
| Kilograms/sq. meter | feet of water | 3.281 x 10 ⁻³ |
| Kilograms/sq. meter | inches of mercury | 2.896 x 10 ⁻³ |
| Kilograms/sq. meter | pounds/sq. ft. | 0.2048 |
| Kilograms/sq. meter | pounds/sq. in. | 1.422 x 10 ⁻³ |
| Kilograms/sq. mm. | kgs./sq. meter | 106 |
| Kilograms-calories | Btu | 3.968 |
| Kilograms-calories | foot-pounds | 3.088 |
| Kilograms-calories | hp-hrs | 1.560 x 10 ⁻³ |
| Kilograms-calories | kilowatt-hrs | 1.163 x 10 ⁻³ |
| Kilograms meters | Btu | 9.294 x 10 ⁻³ |
| Kilometers | centimeters | 105 |
| Kilometers | feet | 3.281 |
| Kilometers | miles | 0.6214 |
| kilowatts | Btu/min. | 56.87 |
| kilowatts | foot-lbs./min. | 4.426 x 10 ⁴ |
| kilopascal | Bar | 0.01 |
| kilopascal | Pounds/sq.in | 0.145 |
| kilowatts | horsepower | 1.341 |
| kilowatts-hrs. | Btu | 3.413 |
| kilowatts-hrs. | foot-lbs. | 2.655 x 10 ⁶ |
| kilowatts-hrs. | horsepower-hrs. | 1.341 |
| knots | statute miles/hr. | 1.151 |

| To Convert | Into | Multipl by |
|------------|---------------------|------------|
| L | | |
| Liters | cu. cm. | 1,000.0 |
| Liters | cu. feet | 0.03531 |
| Liters | cu. inches | 61.02 |
| Liters | gallons (U.S. liq.) | 0.2642 |

| To Convert | Into | Multipl by |
|-----------------|-------------|--------------------------|
| M | | |
| Meters | centimeters | 100.0 |
| Meters | feet | 3.281 |
| Meters | inches | 39.37 |
| Meters | millimeters | 1,000.0 |
| Meters | yards | 1.094 |
| Microns | inches | 39.37 x 10 ⁻⁶ |
| Microns | meters | 1 x 10 ⁻⁶ |
| Miles (statute) | feet | 5,280 |
| Miles (statute) | kilometers | 1.609 |
| Miles/hr. | cms./sec. | 44.70 |
| Miles/hr. | feet/min. | 88. |
| Mils | inches | 0.001 |
| Mils | yards | 2.778 x 10 ⁻⁵ |

| To Convert | Into | Multipl by |
|------------|----------|------------|
| N | | |
| Nepers | decibels | 8.686 |

| To Convert | Into | Multipl by |
|----------------------|----------------|------------------|
| O | | |
| Ohms | megohms | 10 ⁻⁶ |
| Ohms | microhms | 10 ⁶ |
| Ounces (avoirdupois) | drams | 16.0 |
| Ounces (avoirdupois) | grains | 437.5 |
| Ounces (avoirdupois) | grams | 28.35 |
| Ounces (avoirdupois) | pounds | 0.0625 |
| Ounces (avoirdupois) | ounces (troy) | 0.9115 |
| Ounces (troy) | grains | 480.0 |
| Ounces (troy) | grams | 31.10 |
| Ounces (troy) | ounces (avdp.) | 1.09714 |
| Ounces (troy) | pounds (troy) | 0.08333 |

| To Convert | Into | Multipl by |
|----------------------------|----------------|---------------------------|
| P | | |
| Pound/sq in. | bar | 0.06894 |
| Pound/sq in. | pascal | 6894.14 |
| Pound/sq in. | pounds/sq foot | 144 |
| Pascal (N/m ²) | bar | 10 ⁻⁵ |
| Pascal (N/m ²) | pound/sq in. | 0.145 x 10 ⁻³ |
| Pascal (N/m ²) | atmosphere | 1.0197 x 10 ⁻⁵ |
| Pounds (avoirdupois) | ounces (troy) | 14.58 |
| Pounds (avoirdupois) | drams | 256. |

| To Convert | Into | Multipl by |
|----------------------|-------------------|--------------------------|
| P | | |
| Pounds (avoirdupois) | grains | 7,000 |
| Pounds (avoirdupois) | grams | 28.35 |
| Pounds (avoirdupois) | kilograms | 0.02835 |
| Pounds (avoirdupois) | ounces | 16.0 |
| Pounds (troy) | ounces (avdp.) | 13.1657 |
| Pounds of water | cu. feet | 0.01602 |
| Pounds of water | cu. inches | 27.68 |
| Pounds of water | gallons | 0.1198 |
| Pounds of water/min. | cu. ft./sec. | 2.670 x 10 ⁻⁴ |
| Pounds/cu. ft. | grams/cu. cm. | 0.01602 |
| Pounds/cu. ft. | kgs./cu. meter | 16.02 |
| Pounds/cu. ft. | pounds/cu. in. | 5.787 x 10 ⁻⁴ |
| Pounds/cu. in. | pounds/cu. ft. | 1.728 |
| Pounds/cu. in. | atmospheres | 4.725 x 10 ⁻⁴ |
| Pounds/sq. ft. | feet of water | 0.01602 |
| Pounds/sq. ft. | inches of mercury | 0.014414 |
| Pounds/sq. in. | atmospheres | 0.06804 |
| Pounds/sq. in. | feet of water | 2.307 |
| Pounds/sq. in. | inches of mercury | 2.036 |
| Pounds/sq. in. | kgs./sq. meter | 703.1 |
| Pounds/sq. in. | pounds/sq. ft. | 144.0 |

| To Convert | Into | Multipl by |
|-----------------|--------------|------------|
| R | | |
| Radians | degrees | 57.30 |
| Revolution/min. | degrees/sec. | 6.0 |
| Revolution/min. | radians/sec. | 0.1047 |
| Revolution/min. | rev./sec. | 0.01667 |

| To Convert | Into | Multipl by |
|--------------------|-----------------|--------------------------|
| S | | |
| Square centimeters | sq. feet | 1.076 x 10 ⁻³ |
| Square centimeters | sq. inches | 0.1550 |
| Square centimeters | sq. meters | 0.0001 |
| Square centimeters | sq. millimeters | 100.0 |
| Square feet | acres | 2.296 x 10 ⁻⁵ |
| Square feet | sq. cms. | 929.0 |
| Square feet | sq. inches | 144.0 |
| Square feet | sq. miles | 3.587 x 10 ⁻⁸ |
| Square feet | sq. cms. | 6.452 |
| Square inches | sq. feet | 6.944 x 10 ⁻³ |
| Square inches | sq. yards | 7.716 x 10 ⁻⁴ |
| Square inches | sq. feet | 10.76 |
| Square meters | sq. inches | 1.550 |
| Square meters | sq. millimeters | 106 |
| Square meters | sq. yards | 1.196 |
| Square millimeters | sq. inches | 1.550 x 10 ⁻³ |
| Square yards | sq. feet | 9.0 |
| Square yards | sq. inches | 1.296 |
| Square yards | sq. meters | 0.8361 |

| To Convert | Into | Multipl by |
|--------------------------|---------------------------|------------|
| T | | |
| Temperature (°C) + 273 | absolute temperature (°C) | 1.0 |
| Temperature (°C) + 17.78 | temperature (°F) | 1.8 |
| Temperature (°F) + 460 | absolute temperature (°F) | 1.0 |
| Temperature (°F) - 32° | temperature (°C) | 5/9 |
| Tons (long) | kilograms | 1,016 |
| Tons (long) | pounds | 2,240. |
| Tons (long) | ton (short) | 1.120 |
| Tons (metric) | kilograms | 1,000 |
| Tons (metric) | pounds | 2,205. |
| Tons (short) | kilograms | 907.2 |
| Tons (short) | pounds | 2,000 |
| Tons (short) | ton (long) | 0.89287 |
| Tons of water/24hrs | pounds of water | 83,333 |
| Tons of water/24hrs | gallons/min. | 0.16643 |
| Tons of water/24hrs | cu. ft./hr. | 1.3349 |

| To Convert | Into | Multipl by |
|------------|---------------------|--------------------------|
| W | | |
| Watts | Btu/hr. | 3.4129 |
| Watts | Btu/min. | 0.05688 |
| Watts | horsepower | 1.341 x 10 ⁻³ |
| Watts | horsepower (metric) | 1.360 x 10 ⁻³ |
| Watts | kilowatts | 0.001 |
| Watts | B.T.U. (mean)/min. | 0.056884 |
| Watts | Btu | 3.413 |
| Watts | horsepower-hrs. | 1.341 x 10 ⁻³ |

| To Convert | Into | Multipl by |
|------------|-------------|-------------------------|
| Y | | |
| Yards | centimeters | 91.44 |
| Yards | kilometers | 9.144 x10 ⁻⁴ |
| Yards | meters | 0.9144 |



Temperature Conversion Table

$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$$

$$^{\circ}\text{F} = \frac{9}{5} ^{\circ}\text{C} + 32$$

| $^{\circ}\text{C}$ | | $^{\circ}\text{F}$ | $^{\circ}\text{C}$ | | $^{\circ}\text{F}$ |
|--------------------|--------|--------------------|--------------------|------|--------------------|
| -273.0 | -459.4 | | 43.3 | 110 | 230.0 |
| -268.0 | -450 | | 46.1 | 115 | 239.0 |
| -240.0 | -400 | | 48.9 | 120 | 248.0 |
| -212.0 | -350 | | 54.4 | 130 | 266.0 |
| -184.0 | -300 | | 60.0 | 140 | 284.0 |
| -157.0 | -250 | -418.0 | 65.6 | 150 | 302.0 |
| -129.0 | -200 | -328.0 | 71.1 | 160 | 320.0 |
| -101.0 | -150 | -238.0 | 76.7 | 170 | 338.0 |
| - 73.0 | -100 | -148.0 | 82.2 | 180 | 356.0 |
| - 45.6 | - 50 | - 58.0 | 87.8 | 190 | 374.0 |
| - 42.8 | - 45 | - 49.0 | 93.3 | 200 | 392.0 |
| - 40.0 | - 40 | - 40.0 | 98.9 | 210 | 410.0 |
| - 37.2 | - 35 | - 31.0 | 104.4 | 220 | 428.0 |
| - 34.4 | - 30 | 22.0 | 110.0 | 230 | 446.0 |
| - 31.7 | - 25 | - 13.0 | 115.6 | 240 | 464.0 |
| - 28.9 | - 20 | - 4.0 | 121.0 | 250 | 482.0 |
| - 26.1 | - 15 | 5.0 | 149.0 | 300 | 572.0 |
| - 23.2 | - 10 | 14.0 | 177.0 | 350 | 662.0 |
| - 20.6 | - 5 | 23.0 | 204.0 | 400 | 752.0 |
| - 17.8 | 0 | 32.0 | 232.0 | 450 | 842.0 |
| - 15.0 | 5 | 41.0 | 260.0 | 500 | 932.0 |
| - 12.2 | 10 | 50.0 | 288.0 | 550 | 1022.0 |
| - 9.4 | 15 | 59.0 | 316.0 | 600 | 1112.0 |
| - 6.7 | 20 | 68.0 | 343.0 | 650 | 1202.0 |
| - 3.9 | 25 | 77.0 | 371.0 | 700 | 1292.0 |
| - 1.1 | 30 | 86.0 | 399.0 | 750 | 1382.0 |
| 0 | 32 | 89.6 | 427.0 | 800 | 1472.0 |
| 7.7 | 35 | 95.0 | 454.0 | 850 | 1562.0 |
| 4.4 | 40 | 104.0 | 482.0 | 900 | 1652.0 |
| 7.2 | 45 | 113.0 | 510.0 | 950 | 1742.0 |
| 10.0 | 50 | 122.0 | 538.0 | 1000 | 1832.0 |
| 12.8 | 55 | 131.0 | 566.0 | 1050 | 1922.0 |
| 15.6 | 60 | 140.0 | 593.0 | 1100 | 2012.0 |
| 18.3 | 65 | 149.0 | 621.0 | 1150 | 2102.0 |
| 21.1 | 70 | 158.0 | 649.0 | 1200 | 2192.0 |
| 23.9 | 75 | 167.0 | 677.0 | 1250 | 2282.0 |
| 26.7 | 80 | 176.0 | 704.0 | 1300 | 2372.0 |
| 29.4 | 85 | 185.0 | 732.0 | 1350 | 2462.0 |
| 32.2 | 90 | 194.0 | 762.0 | 1400 | 2552.0 |
| 35.0 | 95 | 203.0 | 788.0 | 1450 | 2642.0 |
| 37.8 | 100 | 212.0 | 816.0 | 1500 | 2732.0 |
| 40.6 | 105 | 221.0 | | | |

NOTES: The temperature to be converted is the figure in the yellow column.
To obtain a reading in $^{\circ}\text{C}$ use left column; for conversion to $^{\circ}\text{F}$ use the right column.



Pressure/Temperature Rating According to ASME B16.34-2013

Material: ASTM A 105, ASTM A 216 Gr. WCB, ASTM A 350 Gr. LF2 (Table 2-1.1)

| Temperature °F (°C) | Working Pressures by Classes, psig (Bar) | | | | | |
|------------------------|------------------------------------------|----------|-------------|-------------|-------------|-------------|
| | 150 | 300 | 600 | 900 | 1500 | 2500 |
| -20 to 10 (-29 to 38) | 285 (20) | 740 (51) | 1.480 (102) | 2.220 (153) | 3.705 (255) | 6.170 (425) |
| 200 (93) | 260 (18) | 680 (47) | 1.360 (94) | 2.035 (140) | 3.395 (234) | 5.655 (390) |
| 300 (149) | 230 (16) | 655 (45) | 1.310 (90) | 1.965 (135) | 3.270 (225) | 5.450 (376) |
| 400 (204) | 200 (14) | 635 (44) | 1.265 (87) | 1.900 (131) | 3.170 (219) | 5.280 (364) |
| 500 (260) | 170 (12) | 605 (42) | 1.205 (83) | 1.810 (125) | 3.015 (208) | 5.025 (346) |
| 600 (316) | 140 (10) | 570 (39) | 1.135 (78) | 1.705 (118) | 2.840 (196) | 4.730 (326) |
| 650 (343) | 125 (9) | 550 (38) | 1.100 (76) | 1.650 (114) | 2.745 (189) | 4.575 (315) |
| 700 (371) | 110 (8) | 530 (36) | 1.060 (73) | 1.590 (110) | 2.665 (184) | 4.425 (305) |

Material: ASTM A 216 Gr. WCC, ASTM A 352 Gr. LCC/LC2/LC3 (Table 2-1.2)

| Temperature °F (°C) | Working Pressures by Classes, psig (Bar) | | | | | |
|------------------------|------------------------------------------|----------|-------------|-------------|-------------|-------------|
| | 150 | 300 | 600 | 900 | 1500 | 2500 |
| -20 to 10 (-29 to 38) | 290 (20) | 750 (52) | 1.500 (103) | 2.250 (155) | 3.750 (259) | 6.250 (431) |
| 200 (93) | 260 (18) | 750 (52) | 1.500 (103) | 2.250 (155) | 3.750 (259) | 6.250 (431) |
| 300 (149) | 230 (16) | 730 (50) | 1.455 (100) | 2.185 (151) | 3.640 (251) | 6.070 (419) |
| 400 (204) | 200 (14) | 705 (49) | 1.405 (97) | 2.110 (145) | 3.520 (243) | 5.865 (404) |
| 500 (260) | 170 (12) | 665 (46) | 1.330 (92) | 1.995 (137) | 3.325 (229) | 5.540 (382) |
| 600 (316) | 140 (10) | 605 (42) | 1.210 (83) | 1.815 (125) | 3.025 (209) | 5.040 (348) |
| 650 (343) | 125 (9) | 590 (41) | 1.175 (81) | 1.765 (122) | 2.940 (203) | 4.905 (338) |
| 700 (371) | 110 (8) | 555 (38) | 1.110 (76) | 1.665 (115) | 2.775 (191) | 4.630 (319) |

Material: ASTM A 352 Gr. LCB (Table 2-1.3)

| Temperature °F (°C) | Working Pressures by Classes, psig (Bar) | | | | | |
|------------------------|------------------------------------------|----------|------------|-------------|-------------|-------------|
| | 150 | 300 | 600 | 900 | 1500 | 2500 |
| -20 to 10 (-29 to 38) | 265 (18) | 695 (48) | 1.395 (96) | 2.090 (144) | 3.480 (240) | 5.805 (400) |
| 200 (93) | 255 (17) | 660 (45) | 1.320 (91) | 1.980 (136) | 3.300 (227) | 5.505 (379) |
| 300 (149) | 230 (16) | 640 (44) | 1.275 (88) | 1.915 (132) | 3.190 (220) | 5.315 (366) |
| 400 (204) | 200 (14) | 615 (42) | 1.230 (85) | 1.845 (127) | 3.075 (212) | 5.125 (353) |
| 500 (260) | 170 (12) | 585 (40) | 1.175 (81) | 1.760 (121) | 2.930 (202) | 4.885 (337) |
| 600 (316) | 140 (10) | 550 (38) | 1.105 (76) | 1.655 (114) | 2.755 (190) | 4.595 (317) |
| 650 (343) | 125 (9) | 535 (37) | 1.065 (73) | 1.600 (110) | 2.665 (184) | 4.440 (306) |
| 700 (371) | 110 (8) | 510 (35) | 1.025 (71) | 1.535 (106) | 2.560 (176) | 4.270 (294) |

Material: ASTM A 182 Gr. F316/F316H, ASTM A 479 Gr. 316/316H, ASTM A 351Gr. CF3M/CF8M (Table 2-2.2)

| Temperature °F (°C) | Working Pressures by Classes, psig (Bar) | | | | | |
|------------------------|------------------------------------------|----------|------------|-------------|-------------|-------------|
| | 150 | 300 | 600 | 900 | 1500 | 2500 |
| -20 to 10 (-29 to 38) | 275 (19) | 720 (50) | 1.440 (99) | 2.160 (149) | 3.600 (248) | 6.000 (414) |
| 200 (93) | 235 (16) | 620 (43) | 1.240 (85) | 1.860 (128) | 3.095 (213) | 5.160 (356) |
| 300 (149) | 215 (15) | 560 (39) | 1.120 (77) | 1.680 (116) | 2.795 (193) | 4.660 (321) |
| 400 (204) | 195 (13) | 515 (36) | 1.025 (71) | 1.540 (106) | 2.570 (177) | 4.280 (295) |
| 500 (260) | 170 (12) | 480 (33) | 955 (66) | 1.435 (99) | 2.390 (165) | 3.980 (274) |
| 600 (316) | 140 (10) | 450 (31) | 900 (62) | 1.355 (93) | 2.255 (155) | 3.760 (259) |
| 650 (343) | 125 (9) | 440 (30) | 885 (61) | 1.325 (91) | 2.210 (152) | 3.680 (254) |
| 700 (371) | 110 (8) | 435 (30) | 870 (60) | 1.305 (90) | 2.170 (150) | 3.620 (250) |



Chemical and Mechanical Requirements - Forged / bar

| Composition % (Maximum Percent Unless Range is Given) | | | | | | | | | |
|-------------------------------------------------------|------------------------------------|------------------------|---------------------|-----------|------------|---------|-----------|-----------|------|
| | ASTM Standard (UNS designation) | Nominal Composition | C | Mn | P | S | Si | | |
| Carbon Steel | A 105 (1) (2) (3) | | 0,35 | 0,60-1,05 | 0,035 | 0,040 | 0,10-0,35 | | |
| | A 350 LF1 (2) (3) | | 0,30 | 0,60-1,35 | 0,035 | 0,040 | 0,15-0,30 | | |
| | A 350 LF2 (2) (3) | | 0,30 | 0,60-1,35 | 0,035 | 0,040 | 0,15-0,30 | | |
| Low Alloy | A 350 LF3 (3) | | 0,20 | 0,90 | 0,035 | 0,040 | 0,20-0,35 | | |
| | A 29 Gr.4140 | | 0,38-0,43 | 0,75-1,00 | 0,035 | 0,040 | 0,15-0,35 | | |
| | A 29 Gr.4340 | | 0,38-0,43 | 0,60-0,80 | 0,035 | 0,040 | 0,15-0,35 | | |
| | A 182 F1 | (UNS K12822) | C-Mo | 0,28 | 0,60-0,90 | 0,045 | 0,045 | 0,15-0,35 | |
| | A 182 F2 | (UNS K12122) | 0,5Cr-0,5Mo | 0,05-0,21 | 0,30-0,80 | 0,040 | 0,040 | 0,10-0,60 | |
| | A 182 F5a | (UNS K42544) | 5Cr | 0,25 | 0,60 | 0,040 | 0,030 | 0,50 | |
| | A 182 F9 | (UNS K90941) | 9Cr | 0,15 | 0,30-0,60 | 0,030 | 0,030 | 0,50-1,00 | |
| | A 182 F11 CL.3 | (UNS K11572) | 1,25Cr-0,5Mo | 0,10-0,20 | 0,30-0,80 | 0,040 | 0,040 | 0,50-1,00 | |
| | A 182 F12 CL.2 | (UNS K11564) | 1Cr-0,5Mo | 0,10-0,20 | 0,30-0,80 | 0,040 | 0,040 | 0,10-0,60 | |
| | A 182 F22 CL.3 | (UNS K21590) | Cr-Mo | 0,05-0,15 | 0,30-0,60 | 0,040 | 0,040 | 0,50 | |
| | Martensitic | A182 F6a CL.2 | (UNS S41000) | 13Cr | 0,15 | 1,00 | 0,040 | 0,030 | 1,00 |
| | | A 182 F6NM | (UNS S41500) | 13Cr-4Ni | 0,05 | 0,5-1,0 | 0,030 | 0,030 | 0,60 |
| Austenitic Stainless Steel | A 182 F304 (4) | (UNS S30400) | 18Cr-8Ni | 0,08 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F304H (4) | (UNS S30409) | 18Cr-8Ni | 0,04-0,10 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F304L (4) | (UNS S30403) | 18Cr-8Ni | 0,035 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F316 (4) | (UNS S31600) | 18Cr-10Ni-Mo | 0,08 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F316H (4) | (UNS S31609) | 18Cr-10Ni-Mo | 0,04-0,10 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F316L (4) | (UNS S31603) | 18Cr-10Ni-Mo | 0,030 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F310 | (UNS S31000) | 25Cr-20Ni | 0,25 | 2,00 | 0,045 | 0,030 | 1,00 | |
| | A 182 F44 | (UNS S31254) | 20Cr-18Ni-6Mo | 0,020 | 1,00 | 0,030 | 0,010 | 0,80 | |
| | B 462- UNS N08020 | (ALLOY 20) | 29Ni-20Ni-3Cu-2Mo | 0,07 | 2,00 | 0,045 | 0,035 | 1,00 | |
| Austenitic Ferritic Stainless Steel | A 182 F51 | (UNS S31803) | 22Cr-5Ni | 0,030 | 2,00 | 0,030 | 0,020 | 1,00 | |
| | A 182 F53 | (UNS S32750) | 25Cr-7Ni-4Mo | 0,030 | 1,20 | 0,035 | 0,020 | 0,80 | |
| | A 182 F55 | (UNS S32760) (5) | 25Cr-7Ni-3,5Mo | 0,030 | 1,00 | 0,030 | 0,010 | 1,00 | |
| Age hardened SS | A 564 Gr 630 H900 | (UNS S17400) | 16Cr-4Ni-4Cu | 0,07 | 1,00 | 0,040 | 0,030 | 1,00 | |
| | A 564 Gr 630 H1150M | (UNS S17400) | 16Cr-4Ni-4Cu | 0,07 | 1,00 | 0,040 | 0,030 | 1,00 | |
| Titanium | B 348 Gr.3 | (Unalloyed Titanium) | Ti | 0,08 | Ti=Balance | H=0,015 | Fe=0,30 | O=0,35 | |
| | B 348 Gr.5 | (Titanium Alloy) | 6Al-4V | 0,08 | Ti=Balance | H=0,015 | Fe=0,40 | O=0,20 | |
| Nickel Alloy | B 564-UNS N06625 | (INCONEL 625) | 60Ni-22Cr-9Mo-3,5Cb | 0,10 | 0,5 | 0,015 | 0,015 | 0,5 | |
| | B 564-UNS N08825 | (INCONEL 825) | | 0,05 | 1,0 | | 0,03 | 0,5 | |

- (1) For each reduction of 0,01% below the specified maximum carbon content, an increase of 0,06% Mn above the specified maximum will be permitted up to a maximum of 1,35%.
- (2) $Cu + Ni + Cr + Mo \leq 1,00\%$



Materials for Body, Plug, Cover and Stem Components

| | | | | | | Mechanical Properties | | | |
|-------------|-----------|-------------|-----------------|-------------|-----------------|---------------------------------|-------------------------------|-----------------|------------------------|
| Cr | Mo | Ni | Cu | V | Others Elements | Tensile Strength min, ksi (MPa) | Yield Strength min, ksi (MPa) | Elongation min% | Reduction of area min% |
| 0,30 | 0,12 | 0,40 | 0,40 | 0,08 | Cb = 0,02 | 70 (485) | 36 (250) | 22 | 30 |
| 0,30 | 0,12 | 0,40 | 0,40 | 0,08 | Cb=0,02 | 60 (415) | 30 (205) | 25 | 38 |
| 0,30 | 0,12 | 0,40 | 0,40 | 0,08 | Cb=0,02 | 70 (485) | 36 (250) | 22 | 30 |
| 0,30 | 0,12 | 3,3-3,7 | 0,40 | 0,03 | Cb=0,02 | 70 (485) | 37,5 (260) | 22 | 35 |
| 0,80-1,10 | 0,15-0,25 | - | - | - | - | 100 (690) | 75 (520) | 20 | 50 |
| 0,70-0,90 | 0,20-0,30 | 1,65-2,00 | - | - | - | 115 (790) | 96 (660) | 16 | 45 |
| - | 0,44-0,65 | - | - | - | - | 70 (485) | 40 (275) | 20 | 30 |
| 0,50-0,81 | 0,44-0,65 | - | - | - | - | 70 (485) | 40 (275) | 20 | 30 |
| 4,0-6,0 | 0,44-0,65 | 0,50 | - | - | - | 90 (620) | 65 (450) | 22 | 50 |
| 8,0-10,0 | 0,90-1,10 | - | - | - | - | 85 (585) | 55 (380) | 20 | 40 |
| 1,00-1,50 | 0,44-0,65 | - | - | - | - | 75 (515) | 45 (310) | 20 | 30 |
| 0,80-1,25 | 0,44-0,65 | - | - | - | - | 70 (485) | 40 (275) | 20 | 30 |
| 2,00-2,50 | 0,87-1,13 | - | - | - | - | 75 (515) | 45 (310) | 20 | 30 |
| 11,5-13,5 | - | 0,50 | - | - | - | 85 (585) | 55 (380) | 18 | 35 |
| 11,5-14,0 | 0,5-1,0 | 3,5-5,5 | - | - | - | 115 (790) | 90 (620) | 15 | 45 |
| 18,0-20,0 | - | 8,0-11,0 | - | - | - | 75 (515) | 30 (205) | 30 | 50 |
| 18,0-20,0 | - | 8,0-11,0 | - | - | - | 75 (515) | 30 (205) | 30 | 50 |
| 18,0-20,0 | - | 8,0-13,0 | - | - | - | 70 (485) | 25 (170) | 30 | 50 |
| 16,0-18,0 | 2,00-3,00 | 10,0-14,0 | - | - | - | 75 (515) | 30 (205) | 30 | 50 |
| 16,0-18,0 | 2,00-3,00 | 10,0-14,0 | - | - | - | 75 (515) | 30 (205) | 30 | 50 |
| 16,0-18,0 | 2,00-3,00 | 10,0-15,0 | - | - | - | 70 (485) | 25 (170) | 30 | 50 |
| 19,0-22,0 | - | 24,0-26,0 | - | - | - | 75 (515) | 30 (205) | 30 | 50 |
| 19,5-20,5 | 6,0-6,5 | 17,5-18,5 | 0,5-1,0 | - | N=0,18-0,22 | 94 (650) | 44 (300) | 35 | 50 |
| 19,00-21,00 | 2,00-3,00 | 32,00-38,00 | 3,00-4,00 | - | - | 80 (551) | 35 (241) | 30 | 50 |
| 21,0-23,0 | 2,5-3,5 | 4,5-6,5 | - | - | N=0,08-0,20 | 90 (620) | 65 (450) | 25 | 45 |
| 24,0-26,0 | 3,0-5,0 | 6,0-8,0 | 0,5 | - | N=0,24-0,32 | 116 (800) | 80 (550) | 15 | - |
| 24,0-26,0 | 3,0-4,0 | 6,0-8,0 | 0,50-1,00 | N=0,20-0,30 | W=0,50-1,00 | 109 (750) | 80 (550) | 25 | 45 |
| 15,0-17,5 | - | 3,00-5,00 | 3,00-5,00 | - | - | 190 (1.310) | 170 (1.170) | 10 | 40 |
| 15,0-17,5 | - | 3,00-5,00 | 3,00-5,00 | - | - | 115 (795) | 75 (515) | 18 | 55 |
| - | - | - | - | - | N=0,05 | 65 (450) | 55 (380) | 18 | 30 |
| Al=5,5-6,75 | - | - | - | 3,5-4,5 | N=0,05 | 130 (895) | 120 (828) | 10 | 25 |
| 20,0-23,0 | 8,0-10,0 | 58,0Min | Ta+Cb=3,15-4,15 | Ti=0,4 | Fe=5,0Al=0,4 | 110 (758) | 50 (345) | 25 | - |
| 19,5-23,5 | 2,5-3,5 | 38,0-46,0 | 1,5-3,0 | Ti=0,6-1,2 | Fe=22,0Al=0,2 | 85 (586) | 35 (241) | 30 | - |

(3) $Cr + Mo \leq 0,32\%$

(4) Maximum nitrogen content of 0,10%

(5) Pitting Resistance Equivalent Number (PREN) = $Cr + 3,3Mo + 16N \leq 40$.



Chemical and Mechanical Requirements - Cast Materials

| Composition % (Maximum Percent Unless Range is Given) | | | | | | | |
|----------------------------------------------------------|------------------------------------|------------------------|-----------|-----------|-------|-------|------|
| | ASTM Standard (UNS designation) | Nominal Composition | C | Mn | P | S | Si |
| Carbon Steel | A 216 WCB (2) | | 0,30 | 1,00 | 0,035 | 0,035 | 0,60 |
| | A 216 WCC (2) | | 0,25 | 1,20 | 0,035 | 0,035 | 0,60 |
| | A 352 LCB (UNS J03003) (2) | | 0,30 | 1,00 | 0,040 | 0,045 | 0,60 |
| | A 352 LCC (UNS J02505) (2) | | 0,25 | 1,20 | 0,040 | 0,045 | 0,60 |
| | A 352 LC3 (UNS J31550) | 3,5Ni | 0,15 | 0,50-0,80 | 0,040 | 0,045 | 0,60 |
| | A 487 Gr4Q 4-C | Ni-Cr-Mo | 0,030 | 1,00 | 0,040 | 0,045 | 0,80 |
| Low Alloy | A 217 WC1 | C-Mo | 0,25 | 0,50-0,80 | 0,040 | 0,045 | 0,60 |
| | A 217 WC6 | Cr-Mo | 0,05-0,20 | 0,50-0,80 | 0,035 | 0,035 | 0,60 |
| | A 217 WC9 | Cr-Mo | 0,05-0,18 | 0,40-0,70 | 0,035 | 0,035 | 0,60 |
| | A 217 C5 | Cr-Mo | 0,20 | 0,40-0,70 | 0,040 | 0,045 | 0,75 |
| | A 217 C12 | Cr-Mo | 0,20 | 0,35-0,65 | 0,035 | 0,035 | 1,00 |
| Martensitic | A 217 CA15 (UNS J91150) | 13Cr | 0,15 | 1,00 | 0,040 | 0,025 | 1,50 |
| | A 487 CA6NM (UNS J91540) | 13Cr-4Ni | 0,06 | 1,00 | 0,040 | 0,030 | 1,00 |
| Austenitic Stainless Steel | A 351 CF3 (UNS J92500) | 18Cr-8Ni | 0,03 | 1,50 | 0,040 | 0,040 | 2,00 |
| | A 351 CF3M (UNS J92800) | 16Cr-12Ni-2Mo | 0,03 | 1,50 | 0,040 | 0,040 | 1,50 |
| | A 351 CF8 (UNS J92600) | 18Cr-8Ni | 0,08 | 1,50 | 0,040 | 0,040 | 2,00 |
| | A 351 CF8C (UNS 92710) (1) | 18Cr-10Ni-2Co | 0,08 | 1,50 | 0,040 | 0,040 | 2,00 |
| | A 351 CF8M (UNS J92900) | 16Cr-12Ni-2Mo | 0,08 | 1,50 | 0,040 | 0,040 | 1,50 |
| | A 351 CN7M (UNS N08007) | 29Ni-20Cr-3Cu-2Mo | 0,07 | 1,50 | 0,040 | 0,040 | 1,50 |
| | A 351 CK3MCuN (UNS J93254) (3) | 20Cr-18Ni-6Mo-N | 0,025 | 1,20 | 0,045 | 0,010 | 1,00 |
| Cast Austenitic Ferritic (Duplex) Stainless Steel | A 890 CD3MN (UNS J92205) | 22Cr-5Ni-Mo-N | 0,03 | 1,50 | 0,040 | 0,020 | 1,00 |
| | A 890 CE3MN (UNS J93404) (3) | 25Cr-7Ni-Mo-N | 0,03 | 1,50 | 0,040 | 0,040 | 1,00 |
| | A 890 CD3MWCuN (UNS J93380)(3) | 25Cr-7Ni-Mo-N | 0,03 | 1,00 | 0,030 | 0,025 | 1,00 |

Chemical and Mechanical Requirements Bolting Materials

| | | | | | | | |
|-------------|----------------------|---------------|-----------|-----------|-------|-------|-----------|
| Stud | A 193 B7 and B7M (5) | Cr-Mo | 0,38-0,48 | 0,75-1,00 | 0,035 | 0,040 | 0,15-0,35 |
| | A 193 B16 | Cr-Mo-V | 0,36-0,47 | 0,45-0,70 | 0,035 | 0,040 | 0,15-0,35 |
| | A 193 B8M CL.2 | 18Cr-10Ni-2Mo | 0,08 | 2,00 | 0,045 | 0,030 | 1,00 |
| | A 320 L43 | Ni-Cr-Mo | 0,38-0,43 | 0,60-0,85 | 0,035 | 0,040 | 0,15-0,35 |
| | A 320 L7 and L7M (5) | Cr-Mo | 0,38-0,48 | 0,75-1,00 | 0,035 | 0,040 | 0,15-0,35 |
| | A 453 Gr 660A | | 0,08 | 2,00 | 0,040 | 0,030 | 1,00 |
| Nut | A 194 2H/2HM | C | min 0,40 | 1,00 | 0,040 | 0,050 | 0,40 |
| | A 194 4 | C-Mo | 0,40-0,50 | 0,70-0,90 | 0,035 | 0,040 | 0,15-0,35 |
| | A 194 7/7M | Cr-Mo | 0,38-0,48 | 0,75-1,00 | 0,035 | 0,040 | 0,15-0,35 |
| | A 194 8M | 18Cr-10Ni-2Mo | 0,08 | 2,00 | 0,045 | 0,030 | 1,00 |

- (1) Grade CF8C shall have a columbium content of not less than 8 times the carbon content but not over 1,00%
 (2) For each reduction of 0,01% below the specified maximum carbon content, and increase of 0,04% Mn above the specified maximum will be permitted up to a maximum of: 1,28% for WCB and LCB; 1,40% for WCC and LCC.



for Body, Plug and Cover Components

Mechanical Properties

| Cr | Mo | Ni | Cu | V | W | Tensile Strength min, ksi (MPa) | Yield Strength min, ksi (MPa) | Elongation min% | Reduction of area min% |
|-------------|-----------|------------|-----------|------|-------------|---------------------------------|-------------------------------|-----------------|------------------------|
| 0,50 | 0,20 | 0,50 | 0,30 | 0,03 | - | 70 (485) | 36 (250) | 22 | 35 |
| 0,50 | 0,20 | 0,50 | 0,30 | 0,03 | - | 70 (485) | 40 (275) | 22 | 35 |
| 0,50 | 0,20 | 0,50 | 0,30 | 0,03 | - | 65 (450) | 35 (240) | 24 | 35 |
| 0,50 | 0,20 | 0,50 | - | 0,03 | - | 70 (485) | 40 (275) | 22 | 35 |
| - | - | 3,00-4,00 | - | - | - | 70 (485) | 40 (275) | 24 | 35 |
| 0,40-0,80 | 0,15-0,30 | 0,4-0,80 | 0,50 | 0,03 | 0,10 | 90 (620) | 60 (415) | 18 | 35 |
| 0,35 | 0,45-0,65 | - | 0,50 | - | 0,10 | 65 (450) | 35 (240) | 24 | 35 |
| 1,00-1,50 | 0,45-0,65 | 0,50 | 0,50 | - | 0,10 | 70 (485) | 40 (275) | 20 | 35 |
| 2,00-2,75 | 0,90-1,20 | 0,50 | 0,50 | - | 0,10 | 70 (485) | 40 (275) | 20 | 35 |
| 4,00-6,50 | 0,45-0,65 | 0,50 | 0,50 | - | 0,10 | 90 (620) | 60 (415) | 18 | 35 |
| 8,00-10,00 | 0,90-1,20 | 0,50 | 0,50 | - | 0,10 | 90 (620) | 60 (415) | 18 | 35 |
| 11,50-14,00 | 0,50 | 1,00 | - | - | - | 90 (620) | 65 (450) | 18 | 30 |
| 11,5-14,0 | 0,4-1,0 | 3,5-4,5 | 0,50 | 0,05 | 0,10 | 100 (690) | 75 (515) | 17 | 35 |
| 17,00-21,00 | 0,50 | 8,00-12,00 | - | - | - | 70 (485) | 30 (206) | 35 | - |
| 17,00-21,00 | 2,00-3,00 | 9,00-13,00 | - | - | - | 70 (485) | 30 (206) | 30 | - |
| 18,00-21,00 | 0,50 | 8,00-11,00 | - | - | - | 70 (485) | 30 (206) | 35 | - |
| 18,00-21,00 | 0,50 | 9,00-12,00 | - | - | - | 70 (485) | 30 (206) | 30 | - |
| 18,00-21,00 | 2,00-3,00 | 9,00-12,00 | - | - | - | 70 (485) | 30 (206) | 30 | - |
| 19,0-22,0 | 2,0-3,0 | 27,5-30,5 | 3,0-4,0 | - | - | 62 (425) | 25 (170) | 35 | - |
| 19,5-20,5 | 6,0-7,0 | 17,5-19,5 | 0,50-1,00 | - | N=0,18-0,24 | 80 (550) | 38 (260) | 35 | - |
| 21,0-23,5 | 2,5-3,5 | 4,5-6,5 | 1,00 | - | N=0,10-0,30 | 90 (620) | 60 (415) | 25 | - |
| 24,0-26,0 | 4,0-5,0 | 6,0-8,0 | - | - | N=0,10-0,30 | 100 (690) | 75 (515) | 18 | - |
| 24,0-26,0 | 3,0-4,0 | 6,5-8,5 | 0,5-1,0 | - | N=0,20-0,30 | 100 (690) | 65 (450) | 25 | - |

(Body / Plug)

| | | | | | | | | | |
|-----------|-----------|-----------|---|-----------|------------------------------|-------------------|------------------|-------|----|
| 0,75-1,20 | 0,15-0,25 | - | - | - | - | 125/100 (860/690) | 105/80 (720/550) | 16/18 | 50 |
| 0,80-1,15 | 0,50-0,65 | - | - | 0,25-0,35 | Al=0,015 | 125 (860) | 105 (725) | 18 | 50 |
| 16,0-18,0 | 2,00-3,00 | 10,0-14,0 | - | - | - | 110 (760) | 95 (655) | 15 | 45 |
| 0,70-0,90 | 0,20-0,30 | 1,65-2,00 | - | - | - | 125 (860) | 105 (725) | 16 | 50 |
| 0,80-1,10 | 0,15-0,25 | - | - | - | - | 125/100 (860/690) | 105/80 (725/550) | 16/18 | 50 |
| 13,5-16,0 | 1,00-1,50 | 24,0-27,0 | - | 0,10-0,50 | B=0,001-0,01 Ti=1,90-2,35 | 130 (895) | 85 (585) | 15 | 18 |
| - | - | - | - | - | - | -- | -- | - | - |
| - | 0,20-0,30 | - | - | - | - | -- | -- | - | - |
| 0,8-1,10 | 0,15-0,25 | - | - | - | - | -- | -- | - | - |
| 16,0-18,0 | 2,00-3,00 | 10,0-14,0 | - | - | - | -- | -- | - | - |

(3) Pitting Resistance Equivalent Number (PREN) = Cr + 3,3Mo + 16N ≤ 40.

(4) For 3/4" (M20) and under: 110/(760), 95/(655) 15; over 3/4" (M20) up to 1" (M24): 100/(690), 80/(550), 20 over 1" M24 up to 1.25" (M30) 95/(655), 65/(450), 25 over 1.25" (M30) up to 1.5" (M36): 90/(620), 50/(345), 30.

(5) For B7M and L7M grades, a minimum carbon content of 0,28% is permitted, provided that the required tensile properties are met in the section size involved.



Plug Valve Dimensions According to API Std. 6D/ISO14313

Face to Face (A) and End to End (B - C) dimensions in mm.

| NPS (DN) | Short Welding End | | | Reduced (Regular) Welding End | | | Venturi Welding End | | | Round-Port, Full Bore Ring Joint | | |
|--------------------------|-------------------|-------------|------------|-------------------------------|-------------|------------|---------------------|-------------|------------|----------------------------------|-------------|------------|
| | Raised Face | Welding End | Ring Joint | Raised Face | Welding End | Ring Joint | Raised Face | Welding End | Ring Joint | Raised Face | Welding End | Ring Joint |
| 1 Inch/mm | 2 A | 3 B | 4 C | 5 A | 6 B | 7 C | 8 A | 9 B | 10 C | 11 A | 12 B | 13 C |
| CLASS 150 (PN 20) | | | | | | | | | | | | |
| 2 (50) | 178 | 267 | 191 | - | - | - | - | - | - | 267 | - | 279 |
| 2 1/2 (65) | 191 | 305 | 203 | - | - | - | - | - | - | 298 | - | 311 |
| 3 (80) | 203 | 330 | 216 | - | - | - | - | - | - | 343 | - | 356 |
| 4 (100) | 229 | 356 | 241 | - | - | - | - | - | - | 432 | - | 445 |
| 6 (150) | 267 | 457 | 279 | 394 | - | 406 | - | - | - | 546 | - | 559 |
| 8 (200) | 292 | 521 | 305 | 457 | - | 470 | - | - | - | 622 | - | 635 |
| 10 (250) | 330 | 559 | 343 | 533 | - | 546 | 533 | 559 | 546 | 660 | - | 673 |
| 12 (300) | 356 | 635 | 368 | 610 | - | 622 | 610 | 635 | 622 | 762 | - | 775 |
| 14 (350) | - | - | - | - | - | - | 686 | 686 | 699 | - | - | - |
| 16 (400) | - | - | - | - | - | - | 762 | 762 | 775 | - | - | - |
| 18 (450) | - | - | - | - | - | - | 864 | 864 | 876 | - | - | - |
| 20 (500) | - | - | - | - | - | - | 914 | 914 | 927 | - | - | - |
| 24 (600) | - | - | - | - | - | - | 1067 | 1067 | 1080 | - | - | - |
| CLASS 300 (PN50) | | | | | | | | | | | | |
| 2 (50) | 216 | 267 | 232 | - | - | - | - | - | - | 283 | 283 | 298 |
| 2 1/2 (65) | 241 | 305 | 257 | - | - | - | - | - | - | 330 | 330 | 346 |
| 3 (80) | 283 | 330 | 298 | - | - | - | - | - | - | 387 | 387 | 403 |
| 4 (100) | 305 | 356 | 321 | - | - | - | - | - | - | 457 | 457 | 473 |
| 6 (150) | 403 | 457 | 419 | 403 | - | 419 | 403 | 457 | 419 | 559 | 559 | 575 |
| 8 (200) | 419 | 521 | 435 | 502 | - | 518 | 419 | 521 | 435 | 686 | 686 | 702 |
| 10 (250) | 457 | 559 | 473 | 568 | - | 584 | 457 | 559 | 473 | 826 | 826 | 841 |
| 12 (300) | 502 | 635 | 518 | - | - | - | 502 | 635 | 518 | 965 | 965 | 981 |
| 14 (350) | - | - | - | - | - | - | 762 | 762 | 778 | - | - | - |
| 16 (400) | - | - | - | - | - | - | 838 | 838 | 854 | - | - | - |
| 18 (450) | - | - | - | 914 | - | 930 | 914 | 914 | 930 | - | - | - |
| 20 (500) | - | - | - | 991 | - | 1010 | 991 | 991 | 1010 | - | - | - |
| 22 (550) | - | - | - | 1092 | - | 1114 | 1092 | 1092 | 1114 | - | - | - |
| 24 (600) | - | - | - | 1143 | - | 1165 | 1143 | 1143 | 1165 | - | - | - |
| 26 (650) | - | - | - | 1245 | - | 1270 | 1245 | 1245 | 1270 | - | - | - |
| 28 (700) | - | - | - | 1346 | - | 1372 | 1346 | 1346 | 1372 | - | - | - |
| 30 (750) | - | - | - | 1397 | - | 1422 | 1397 | 1397 | 1422 | - | - | - |
| 32 (800) | - | - | - | 1524 | - | 1553 | 1524 | 1524 | 1553 | - | - | - |
| 34 (850) | - | - | - | 1626 | - | 1654 | 1626 | 1626 | 1654 | - | - | - |
| 36 (900) | - | - | - | 1727 | - | 1756 | 1727 | 1727 | 1756 | - | - | - |
| CLASS 400 (PN 64) | | | | | | | | | | | | |
| 2 (50) | - | - | - | 292 | 292 | 295 | - | - | - | 330 | - | 333 |
| 2 1/2 (65) | - | - | - | 330 | 330 | 333 | - | - | - | 381 | - | 384 |
| 3 (80) | - | - | - | 356 | 356 | 359 | - | - | - | 445 | - | 448 |
| 4 (100) | - | - | - | 406 | 406 | 410 | - | - | - | 483 | 559 | 486 |
| 6 (200) | - | - | - | 495 | 495 | 498 | 495 | 495 | 498 | 610 | 711 | 613 |
| 8 (200) | - | - | - | 597 | 597 | 600 | 597 | 597 | 600 | 737 | 845 | 740 |
| 10 (250) | - | - | - | 673 | 673 | 676 | 673 | 673 | 676 | 889 | 889 | 892 |
| 12 (300) | - | - | - | 762 | 762 | 765 | 762 | 762 | 765 | 1016 | 1016 | 1019 |
| 14 (350) | - | - | - | - | - | - | 826 | 826 | 829 | - | - | - |
| 16 (400) | - | - | - | - | - | - | 902 | 902 | 905 | - | - | - |
| 18 (450) | - | - | - | - | - | - | 978 | 978 | 981 | - | - | - |
| 20 (500) | - | - | - | - | - | - | 1054 | 1054 | 1060 | - | - | - |
| 22 (550) | - | - | - | - | - | - | 1143 | 1143 | 1153 | - | - | - |
| 24 (600) | - | - | - | - | - | - | 1232 | 1232 | 1241 | - | - | - |
| 26 (650) | - | - | - | - | - | - | 1308 | 1308 | 1321 | - | - | - |
| 28 (700) | - | - | - | - | - | - | 1397 | 1397 | 1410 | - | - | - |
| 30 (750) | - | - | - | - | - | - | 1524 | 1524 | 1537 | - | - | - |
| 32 (800) | - | - | - | - | - | - | 1651 | 1651 | 1667 | - | - | - |
| 34 (850) | - | - | - | - | - | - | 1778 | 1778 | 1794 | - | - | - |
| 36 (900) | - | - | - | - | - | - | 1880 | 1880 | 1895 | - | - | - |

Tolerance: +/-2 mm. on sizes 10 in. (DN250) and smaller. +/-3 mm on sizes 12 in. (DN300) and larger.



Plug Valve Dimensions According to API Std. 6D/ISO14313

Face to Face (A) and End to End dimensions in mm.

| NPS (DN) | Reduced (Regular) | | | Venturi | | | Round-Port , Full Bore | | |
|----------------------------|-------------------|-------------|------------|-------------|-------------|------------|------------------------|-------------|------------|
| | Raised Face | Welding End | Ring Joint | Raised Face | Welding End | Ring Joint | Raised Face | Welding End | Ring Joint |
| 1 Inch/mm | 2 A | 3 B | 4 C | 5 A | 6 B | 7 C | 8 A | 9 B | 10 C |
| CLASS 600 (PN 100) | | | | | | | | | |
| 2 (50) | 292 | 292 | 295 | - | - | - | 330 | - | 333 |
| 2½ (65) | 330 | 330 | 333 | - | - | - | 381 | - | 384 |
| 3 (80) | 356 | 356 | 359 | - | - | - | 445 | - | 448 |
| 4 (100) | 432 | 432 | 435 | - | - | - | 508 | 559 | 511 |
| 6 (150) | 559 | 559 | 562 | 559 | 559 | 562 | 660 | 711 | 664 |
| 8 (200) | 660 | 660 | 664 | 660 | 660 | 664 | 794 | 845 | 797 |
| 10 (250) | 787 | 787 | 791 | 787 | 787 | 791 | 940 | 1016 | 943 |
| 12 (300) | - | - | - | 838 | 838 | 841 | 1067 | 1067 | 1070 |
| 14 (350) | - | - | - | 889 | 889 | 892 | - | - | - |
| 16 (400) | - | - | - | 991 | 991 | 994 | - | - | - |
| 18 (450) | - | - | - | 1092 | 1092 | 1095 | - | - | - |
| 20 (500) | - | - | - | 1194 | 1194 | 1200 | - | - | - |
| 22 (550) | - | - | - | 1295 | 1295 | 1305 | - | - | - |
| 24 (600) | - | - | - | 1397 | 1397 | 1407 | - | - | - |
| 26 (650) | - | - | - | 1448 | 1448 | 1461 | - | - | - |
| 30 (750) | - | - | - | 1651 | 1651 | 1664 | - | - | - |
| 32 (800) | - | - | - | 1778 | 1778 | 1794 | - | - | - |
| 34 (850) | - | - | - | 1930 | 1930 | 1946 | - | - | - |
| 36 (900) | - | - | - | 2083 | 2083 | 2099 | - | - | - |
| CLASS 900 (PN 150) | | | | | | | | | |
| 2 (50) | 368 | - | 371 | - | - | - | 381 | - | 384 |
| 2½ (65) | 419 | - | 422 | - | - | - | 432 | - | 435 |
| 3 (80) | 381 | 381 | 384 | - | - | - | 470 | - | 473 |
| 4 (100) | 457 | 457 | 460 | - | - | - | 559 | - | 562 |
| 6 (150) | 610 | 610 | 613 | 610 | 610 | 613 | 737 | - | 740 |
| 8 (200) | 737 | 737 | 740 | 737 | 737 | 740 | 813 | - | 816 |
| 10 (250) | 838 | 838 | 841 | 838 | 838 | 841 | 965 | - | 968 |
| 12 (300) | - | - | - | 965 | 965 | 968 | 1118 | - | 1121 |
| 16 (400) | - | - | - | 1130 | 1130 | 1140 | - | - | - |
| CLASS 1500 (PN 250) | | | | | | | | | |
| 2 (50) | 368 | - | 371 | - | - | - | 391 | - | 394 |
| 2½ (65) | 419 | - | 422 | - | - | - | 454 | - | 457 |
| 3 (80) | 470 | 470 | 473 | - | - | - | 524 | - | 527 |
| 4 (100) | 546 | 546 | 549 | - | - | - | 625 | - | 629 |
| 6 (150) | 705 | 705 | 711 | 705 | 705 | 711 | 787 | - | 794 |
| 8 (200) | 832 | 832 | 841 | 832 | 832 | 841 | 889 | - | 899 |
| 10 (250) | 991 | 991 | 1000 | 991 | 991 | 1000 | 1067 | - | 1076 |
| 12 (300) | 1130 | 1130 | 1146 | 1130 | 1130 | 1146 | 1219 | - | 1235 |
| CLASS 2500 (PN 420) | | | | | | | | | |
| 2 (50) | 451 | - | 454 | - | - | - | - | - | - |
| 2½ (65) | 508 | - | 514 | - | - | - | - | - | - |
| 3 (80) | 578 | - | 584 | - | - | - | - | - | - |
| 4 (100) | 673 | - | 683 | - | - | - | - | - | - |
| 6 (150) | 914 | - | 927 | - | - | - | - | - | - |
| 8 (200) | 1022 | - | 1038 | - | - | - | - | - | - |
| 10 (250) | 1270 | - | 1292 | - | - | - | - | - | - |
| 12 (300) | 1422 | - | 1445 | - | - | - | - | - | - |



Plug Valve Dimensions According to API Std. 6A/ISO 10423

| Face to Face | | | |
|------------------------------|------------------------------|------------------------------------|---------------------------------------------------|
| NPS (DN) | Reduced (Regular) Ring Joint | Round - Port, Full Bore Ring Joint | Round - Port, Full Bore - Long Pattern Ring Joint |
| API 2000 (13.8 MPa) | | | |
| 2 1/16" x 1 13/16" (52x46) | 295 | - | - |
| 2 1/16" (52) | 295 | 333 | - |
| 2 9/16" (65) | 333 | 384 | - |
| 3 1/8" (78) | 359 | 448 | - |
| 4 1/16" (103) | 435 | 511 | - |
| 5 1/8" (130) | - | 638 | - |
| 7 1/16" x 6" (179x152) | 562 | 727 | - |
| 7 1/16" (179) | - | 740 | - |
| API 3000 (20.7 MPa) | | | |
| 2 1/16" x 1 13/16" (52x46) | 371 | - | - |
| 2 1/16" (52) | 371 | 384 | - |
| 2 9/16" (65) | 422 | 435 | - |
| 3 1/8" (78) | 384 | 473 | - |
| 4 1/16" (103) | 460 | 562 | - |
| 5 1/8" (130) | - | 664 | - |
| 7 1/16" x 6" (179x152) | 613 | 765 | - |
| 7 1/16" (179) | - | 803 | - |
| API 5000 (34.5 MPa) | | | |
| 2 1/16" x 1 13/16" (52x46) | 371 | - | - |
| 2 1/16" (52) | 371 | 394 | - |
| 2 9/16" (65) | 422 | 457 | - |
| 3 1/8" (78) | 473 | 527 | - |
| 4 1/16" (103) | 549 | 629 | - |
| 7 1/16" x 6" (179x152) | 711 | - | - |
| 7 1/16" (179) | - | 978 | - |
| API 10000 (69.0 MPa) | | | |
| 1 13/16" (46) | - | 464 | - |
| 2 1/16" (52) | - | 521 | - |
| 2 9/16" (65) | - | 565 | - |
| 3 1/16" (78) | - | 619 | - |
| 4 1/16" (103) | - | 670 | - |
| 5 1/16" (130) | - | 737 | - |
| 7 1/16" x 6 3/8" (179x162) | - | 889 | - |
| 7 1/16" (179) | - | 889 | - |
| API 15000 (103.4 MPa) | | | |
| 1 13/16" (46) | - | 457 | - |
| 2 1/16" (52) | - | 483 | 597 |
| 2 9/16" (65) | - | 533 | 635 |
| 3 1/16" (78) | - | 598 | - |
| 4 1/16" (103) | - | 737 | - |
| 5 1/8" (130) | - | 889 | - |

Tolerance: +/-2 mm.



Qualification of other Size Valves - API 6FA

| Size of Test Valve | | | |
|-----------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| NPS | DN | NPS | DN |
| 2 API 6D 1 ^{13/16} - 2 ^{1/16} API 6A | 50 | 2 - 2 ^{1/2} - 3 - 4 API 6D 1 ^{13/16} - 2 ^{1/16} - 2 ^{9/16} - 3 ^{1/8} - 4 ^{1/16} API 6A | 50 - 65 80 - 100 |
| 2 ^{9/16} API 6A 2 ^{1/2} API 6D | 65 | 2 ^{9/16} - 3 ^{1/8} - 4 ^{1/16} - 5 ^{1/8} API 6A 2 ^{1/2} - 3 - 4 API 6D | 65 - 80 100 - 125 |
| 3 API 6D 3 ^{9/16} API 6A | 80 | 3 - 4 - 6 API 6D 3 ^{1/8} - 4 ^{1/16} - 5 ^{1/8} - 7 ^{1/16} API 6A | 80 - 100 125 - 150 |
| 4 API 6D 4 ^{1/16} API 6A | 100 | 4 - 6 - 8 API 6D 4 ^{1/16} - 5 ^{1/8} - 7 ^{1/16} API 6A | 100 - 125 150 - 200 |
| 6 API 6D 7 ^{1/16} API 6A | 150 | 6 - 8 - 10 - 12 API 6D 7 ^{1/16} - 9 - 11 API 6A | 150 - 200 250 - 300 |
| 8 API 6D | 200 | 8 - 10 - 12 - 14 - 16 API 6D 9 - 11 API 6A | 200 - 250 300 - 350 - 400 |
| 10 API 6D | 250 | 10 through 20 API 6D - 11 API 6A | 250 through 500 |
| 12 API 6D | 300 | 12 through 24 API 6D | 300 through 600 |
| 14 API 6D | 350 | 14 through 28 API 6D | 350 through 700 |
| 16 API 6D | 400 | 16 and larger 24 API 6D | 400 and larger |

Qualification of other Pressure Rating Valves

| Rating of Test Valve | | | | | |
|----------------------|-----|-----|------------------------------------------|------------------|--------------------|
| Class | PN | Bar | Class | PN | Bar |
| 150 API 6D | 20 | N/A | 150 - 300 API 6D | 20 - 50 | N/A |
| 300 API 6D | 50 | N/A | 300 - 400 - 600 API 6D | 50 - 64 - 110 | N/A |
| 400 API 6D | 64 | N/A | 400 - 600 API 6D | 64 - 110 | N/A |
| 600 API 6D | 110 | N/A | 600 - 900 API 6D 2000 - 3000 API 6A | 110 - 150 N/A | N/A 138 - 207 |
| 900 API 6D | 150 | N/A | 900 - 1500 API 6D 3000 API 6A | 150 - 260 N/A | N/A 207 |
| 1500 API 6D | 260 | N/A | 1500 - 2500 API 6D 5000 API 6A | 260 - 420 N/A | N/A 345 |
| 2500 API 6D | 420 | N/A | 2500 API 6D 10000 API 6A | 420 N/A | N/A 690 |
| 2000 API 6A | - | 138 | 2000 - 3000 API 6A 900 - 1500 API 6D | N/A 150 - 260 | 138 - 207 N/A |
| 3000 API 6A | - | 207 | 3000 - 5000 API 6A 1500 - 2500 API 6D | N/A 260 - 420 | 207 - 345 N/A |
| 5000 API 6A | - | 345 | 5000 - 10000 API 6A 2500 API 6D | N/A 420 | 345 - 690 N/A |
| 10000 API 6A | - | 690 | 10000 - 15000 20000 API 6A | N/A | 690 - 1034 1379 |



Plug Valves Application

GAS PIPELINES & COMPRESSOR - STATION

OFF SHORE



Client: SAUDI ARAMCO
Location: Saudi Arabia Pipeline Project EWG-1 (East West Gas Pipeline)
Supply of sales gas from ABQAIQ-YANBU, Km.1170
Valves: 30" Class 600 RF

Client: SAIPEM - Italy
LGTS - Green Stream Gas Pipeline
Project Subsea Pig Launcher - Receiver
Valves: DN 31/8" API 5000.



Client: SOFRESID SAIPEM France
Location: Russia Pig Launcher "Beregovaya Compressor Station"
Valves: DN 2" - 4" - 8" - ANSI 2500.

Client: Egyptian Natural Gas Co.
Gas Pipeline
Location: Egypt
Valves: 12" Class 600 RF

Client: SASOL - Nigel
High Integrity Pressure Protection Station
Valve: 16" Class 300

Morinville, Alberta, Canada
Compression Station
Valves: 8"-12" ANSI 900.

Client: SNAMPROGETTI
Location: LOSTORF (CH)
Valve: 20" Cl. 600 Venturi with Stem Extension.





GALLI&CASSINA in the World:

Our products are being used in the most important Plants and Gas Pipelines all over the world.

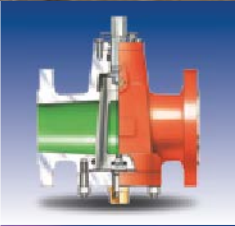
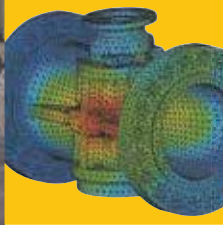
Galli&Cassina Plug Valves are used in the most important hydrocarbon plants and gas pipelines all over the world.

For over 70 years Galli&Cassina has been committed to provide service to the end-users with a full range of products ensuring total customer's satisfaction.

Galli&Cassina is represented by sales offices worldwide and you are requested to contact our main office in Italy for more details.







AdverTime-MI

G&C B10-2014



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SINCE 1919

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