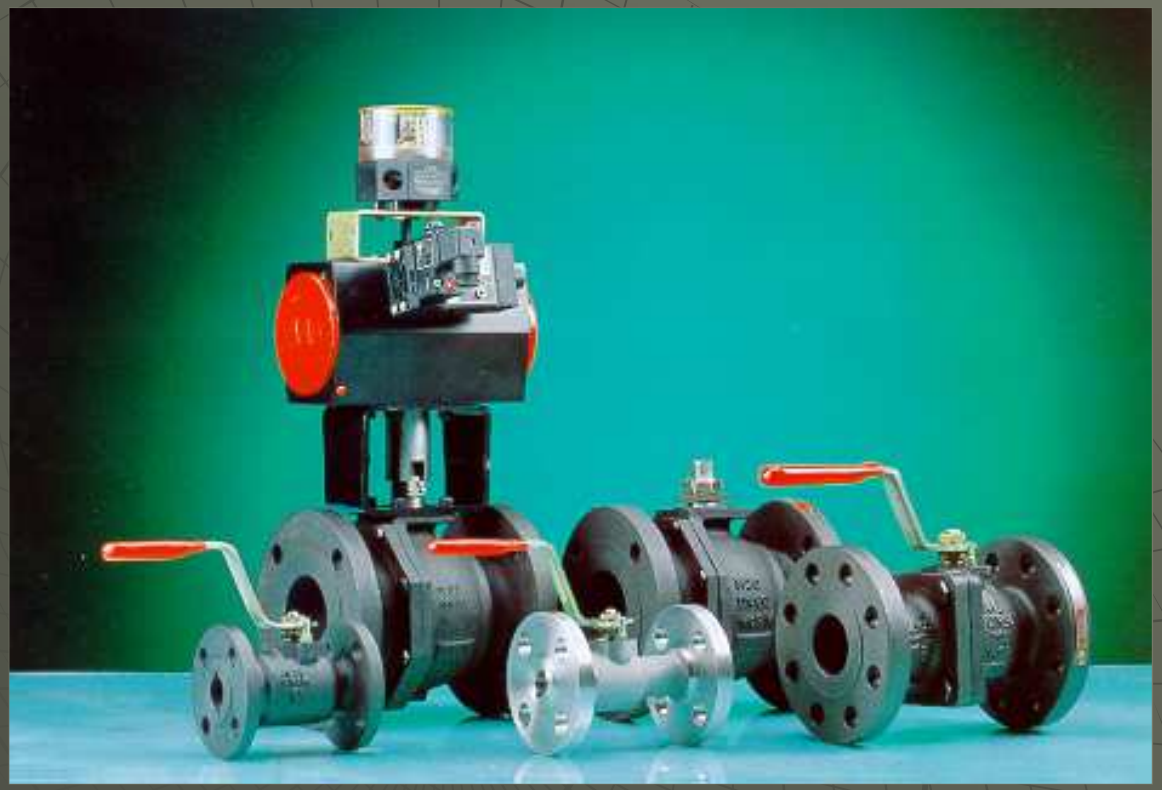
VALVES



Valve:

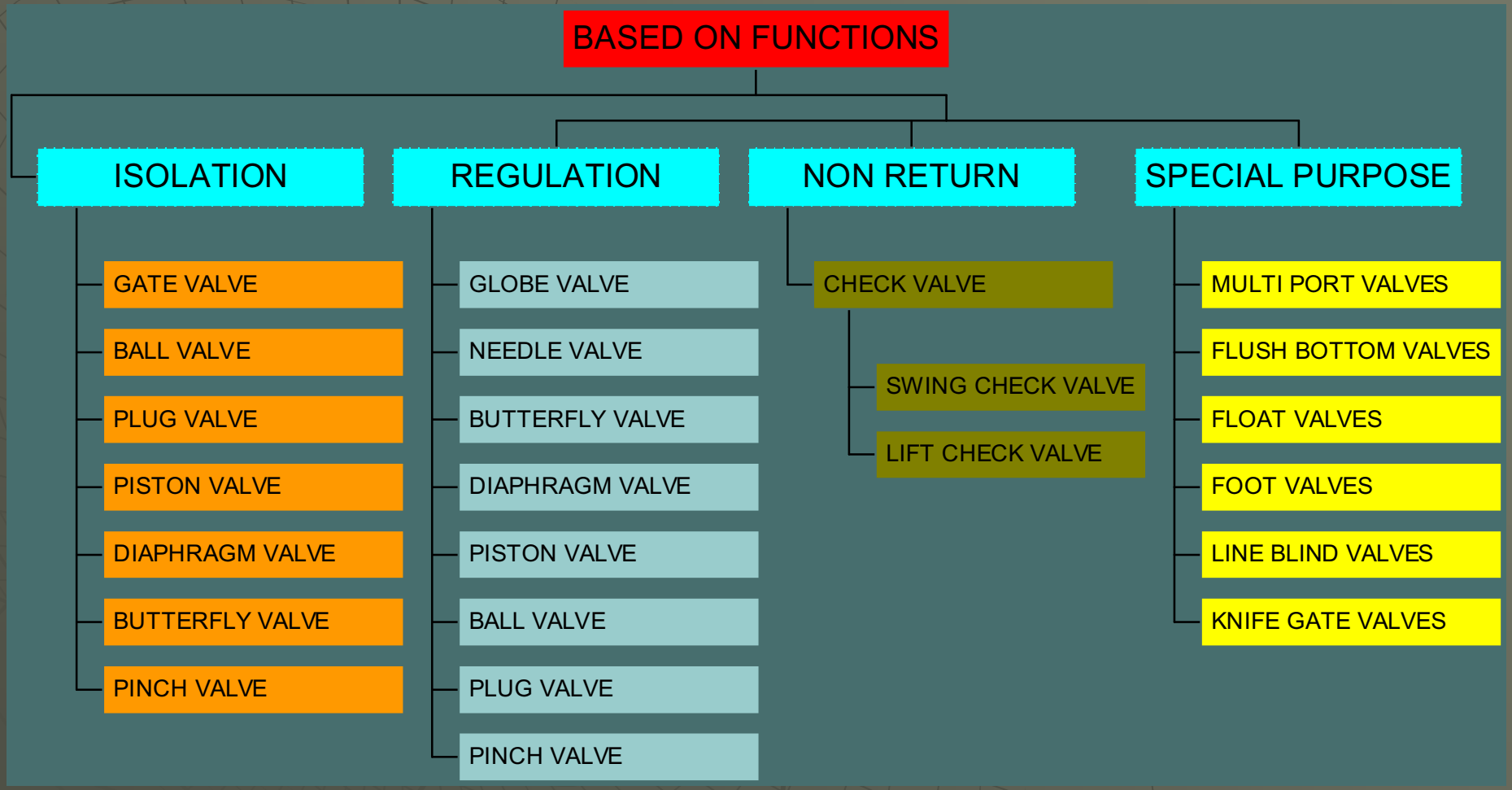
Any Device for closing or modifying the passage through a pipe, outlet, inlet or likely to stop, allow or control the flow of a media.

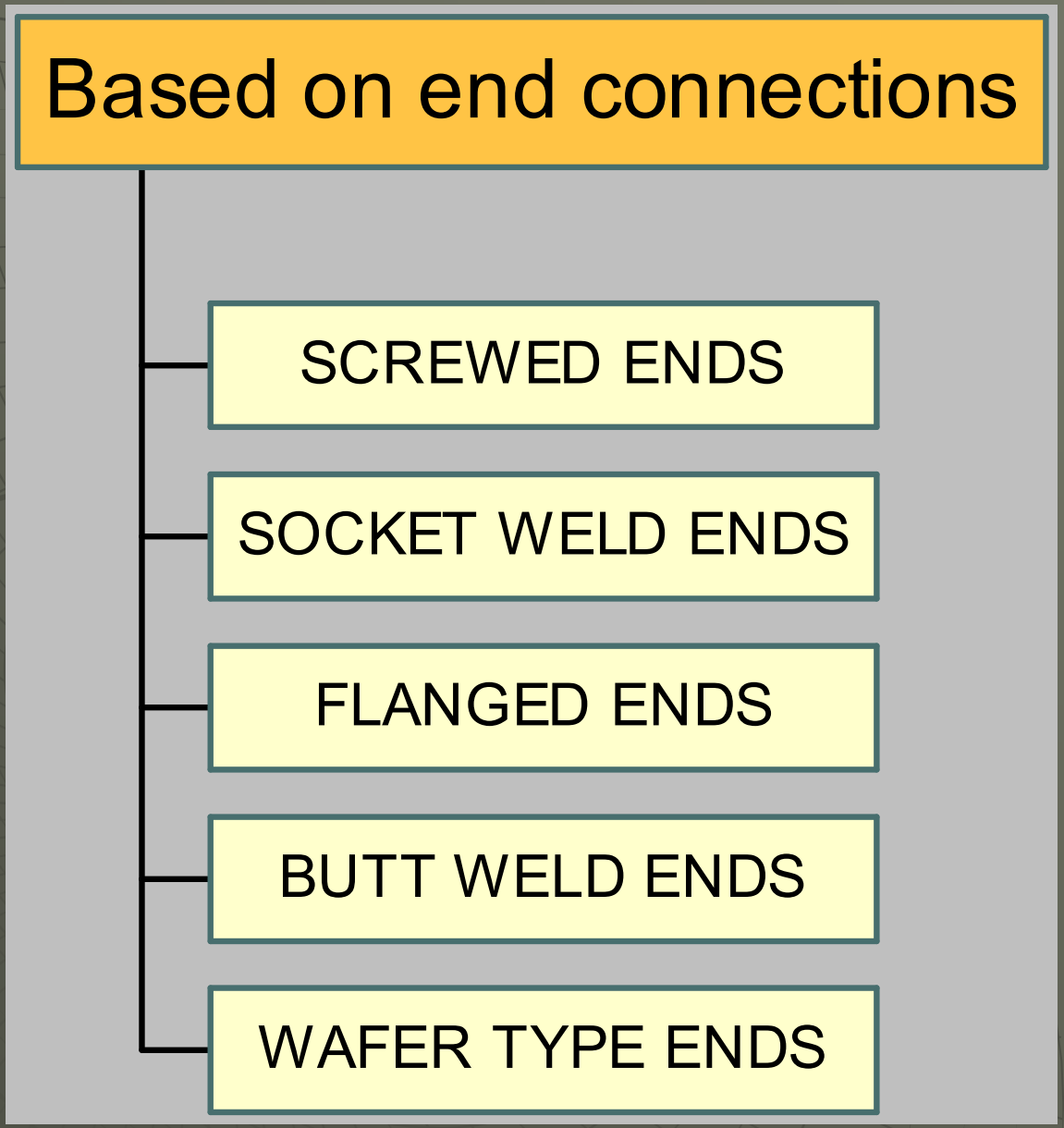
- *Valve cost is upto 20 to 30% of the piping cost* for a plant, depending on the process; and the cost of a given type and size of valve can vary 100%, depending on its construction.

- Thus the *selection of valves is extremely important to the economics, as well as operation*, of process plants.

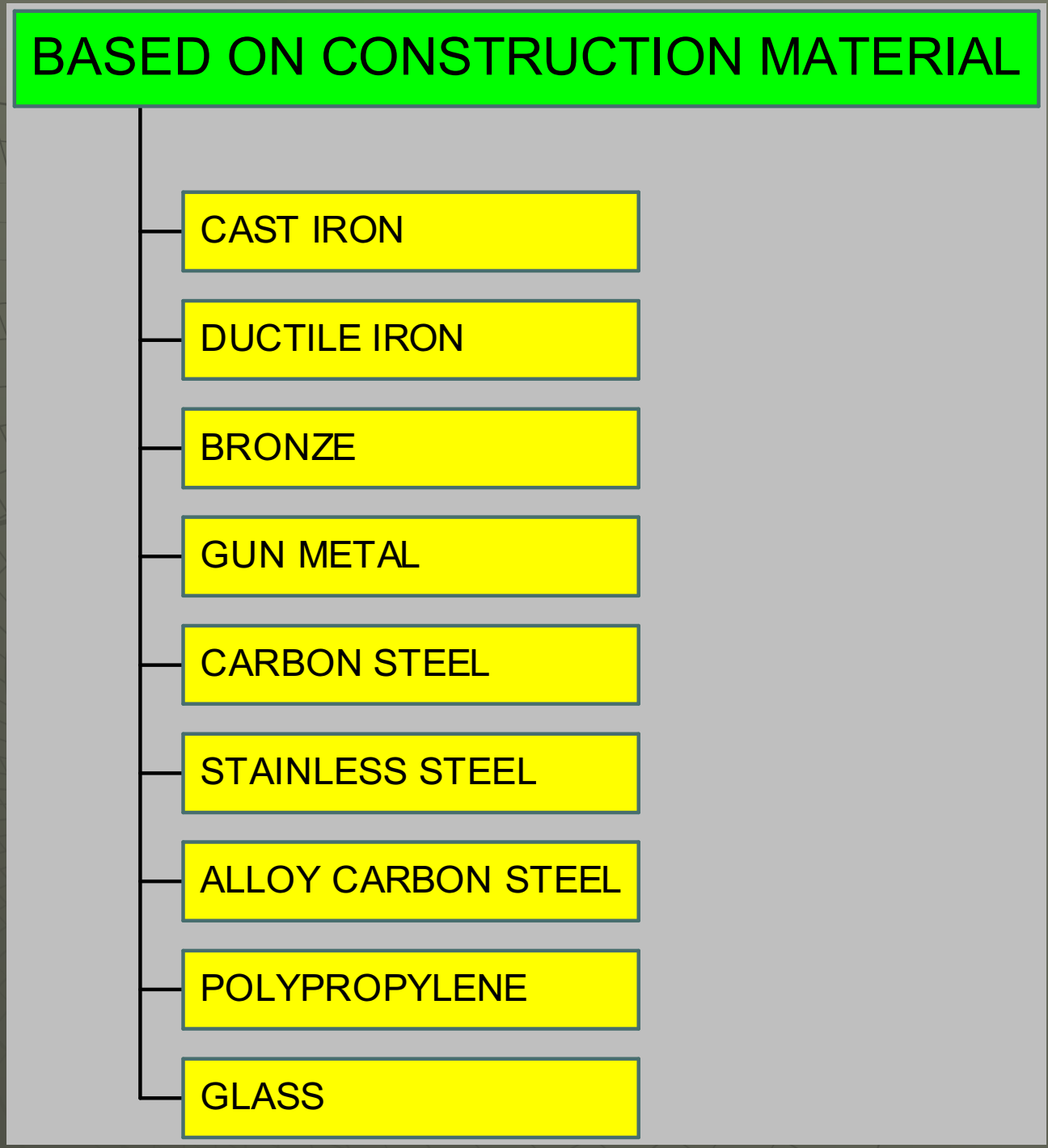
- The size of a valve is mainly determined by the size of its ends, which connect to the pipe.

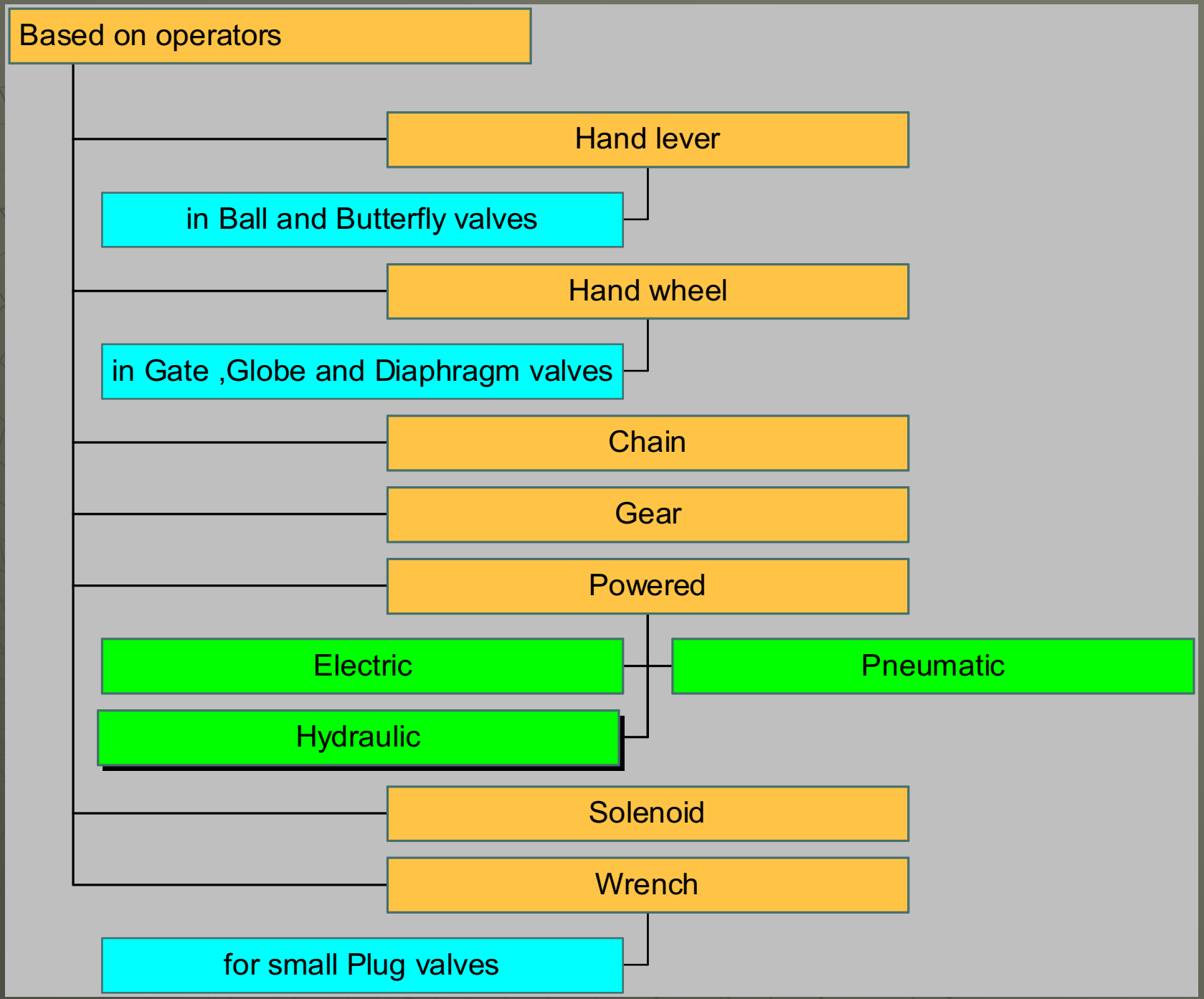
CLASSIFICATION OF VALVES




Based on end connections
SCREWED ENDS
SOCKET WELD ENDS
FLANGED ENDS
BUTT WELD ENDS
WAFER TYPE ENDS

BASED ON CONSTRUCTION MATERIAL



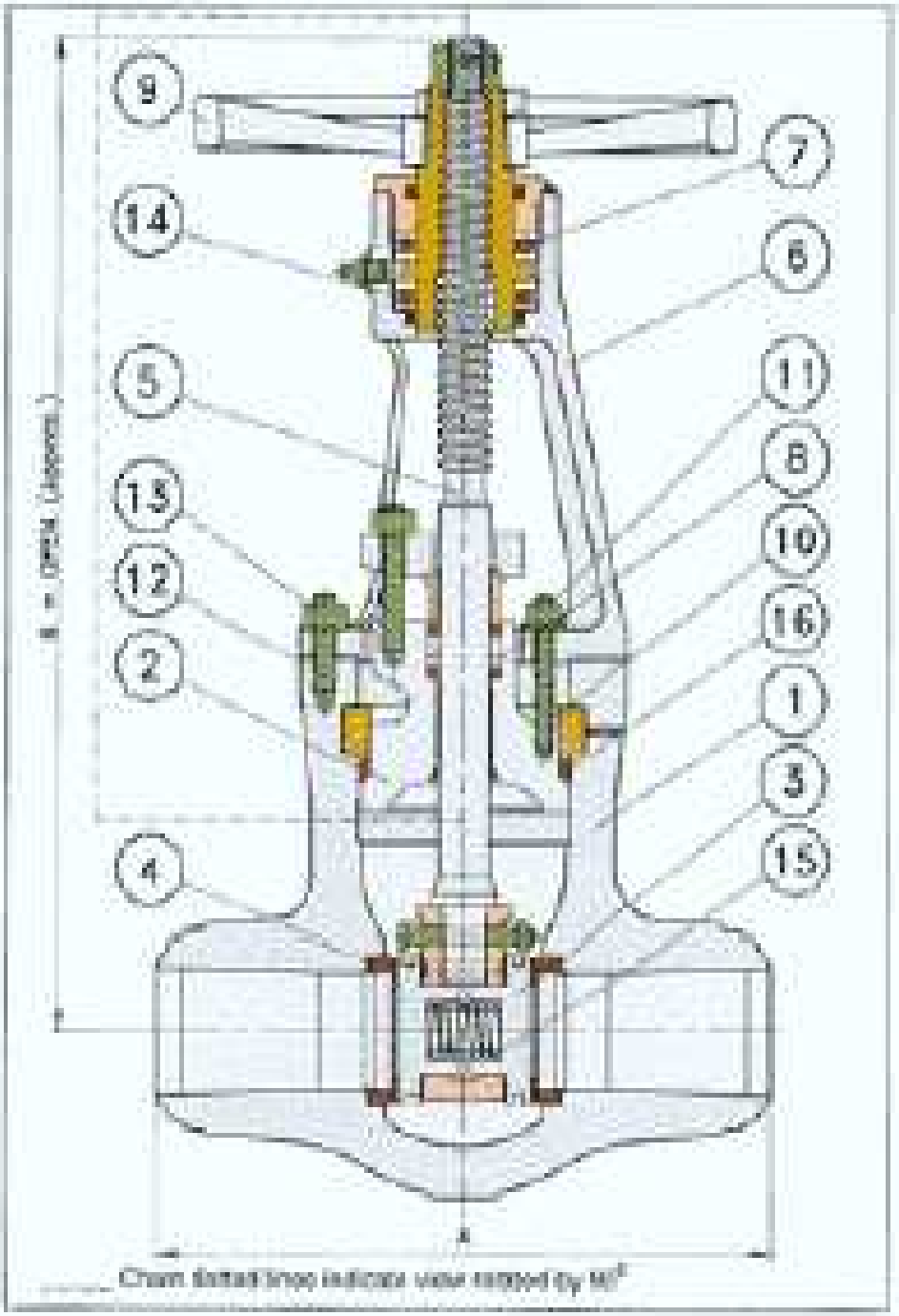

Based on operators
Hand lever
in Ball and Butterfly valves
Hand wheel
in Gate ,Globe and Diaphragm valves
Chain
Gear
Powered
Electric
Pneumatic
Hydraulic
Solenoid
Wrench
for small Plug valves

VALVES:

Basic Parts:

1. Body
2. Bonnet
3. Stem
4. Disc
5. Seat
6. Port
7. Seal (includes Gasket, Metal Bellows)

GATE VALVE



MATERIAL SPECIFICATION

Name of Part	Specification		
1. Body 2. Bonnet	ASTM A 216 Gr. WCB	ASTM A 217 Gr. WC6	ASTM A 217 Gr. WC9
3. Disc 4. Body ring	ASTM A 216 Gr.WCB - Stellited	ASTM A 217 Gr. WC6 - Stellited	ASTM A 217 Gr. WC9 - Stellited
5. Stem	AISI 410		
6. Yoke	ASTM A 216 Gr. WCB		
7. Yoke Sleeve	ASTM A 439 Type D2		
8. Packing	Graphite with braidot and rings		
9. Hand wheel	Steel or Malleable Iron or SG Iron		
10/12. Stud	ASTM A 193 Gr. B7		
11/13. Nut	ASTM A 194 Gr. 2H		
14. Thrust Ball Bearing	Steel		
15. Spring	Alloy Steel		
16. Gasket	Graphite		

Wherever more than one material of construction is specified for a component, the choice of using any one of them is at our option

Body:

--The Body & Bonnet houses the stem.

-- Selection of the material to fabricate the interior of the wall body is important if the valve is used for the process of chemical.

--Some Valves may be obtained with the entire interior of the **body lined with corrosion resistant material.**

Bonnet:

- The Bonnet is a part which is attached with the body of the valve. The Bonnet is classified on the type of attachment as Bolted, Bellow, Sealed, Screwed-on, Welded, Union, Pressure Sealed etc.,

Stem:

- The Stem moves the disc.
- In some valves the fluid under pressure does the work of the stem.

--There are two categories of screwed stem.

(a) Rising Stem:

Hand wheel can either rise with the stem, or stem can rise through the stationary hand wheel.

(b) Non-Rising Stem:

- The Hand Wheel and the stem are in the same position weather the valve is opened or closed.
- In this case, the screw is inside the Bonnet and in contact with the fluid.

DISC, SEAT & PORT:

- The part directly affecting the flow is termed as Disc regardless of its shape.
- The Non-moving part the body bears is termed as seat.
- The port is the maximum internal opening for flow.

SEAL:BETWEEN STEM AND BONNET:

-- Gasket is used in between a bolted bonnet and valve body.

-- Metal Bellows where high vaccum or corrosive, flammable fluids are to be handled.

-- Flanged Valves use gasket to seal against the line flanges.

-- Butterfly Valves may extend the resilient seat to also serves as line gaskets .

Based on the shape of the port these valves can be classified into,

(1)Regular pattern:

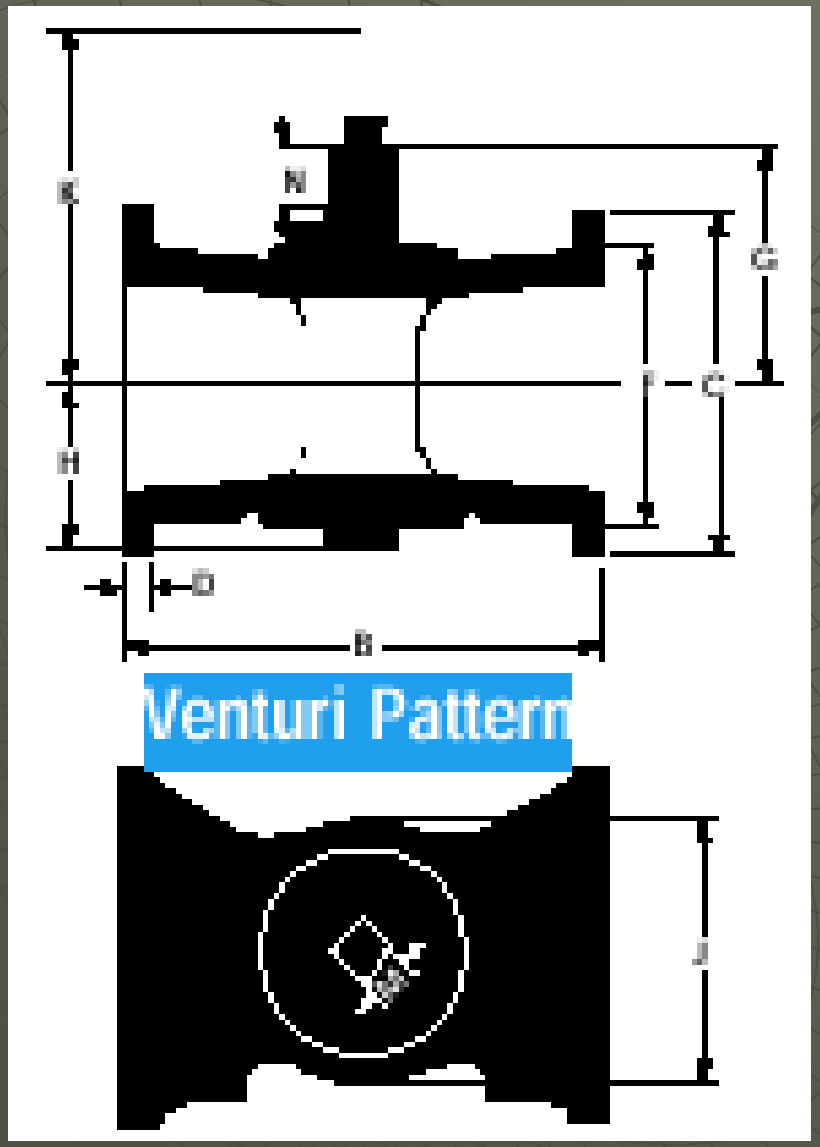
- They have plug ports generally rectangular in section and have area substantially equal to full bore of the pipe.

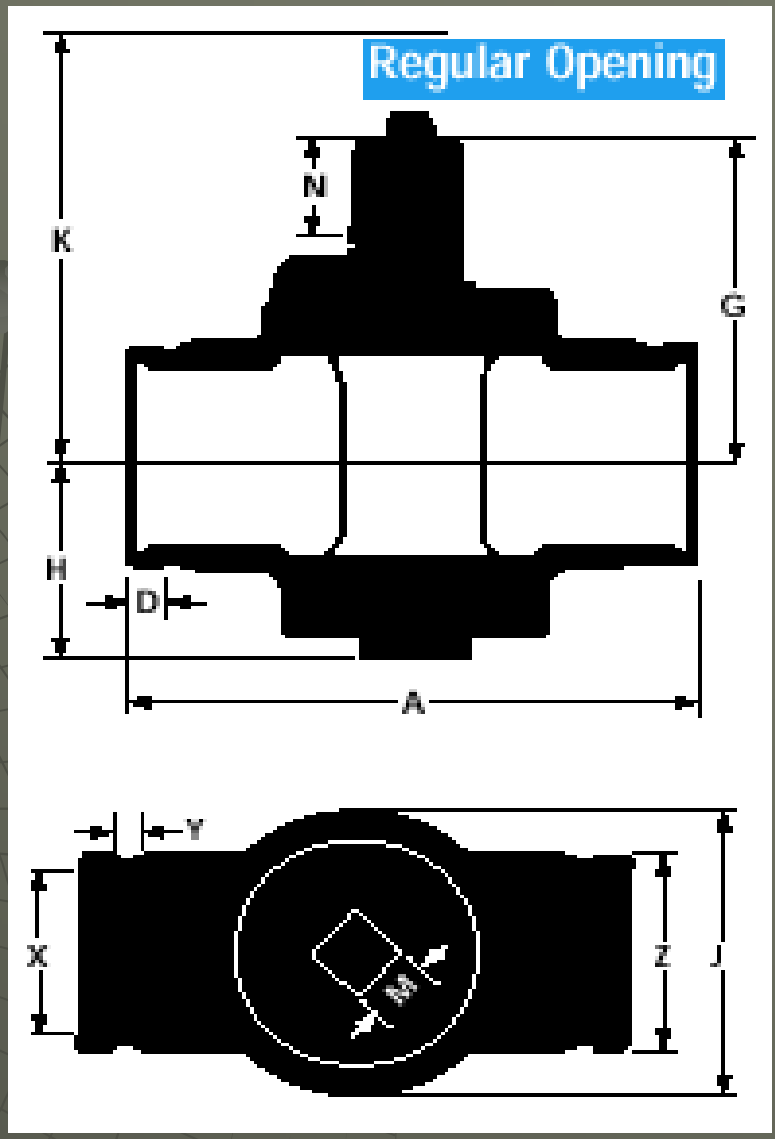
(2) Short pattern:

- Face to face dimensions corresponding to gate valves.

(3) Venturi pattern:

- They have reduced port area.Thus producing a venturi effect to restore a large percentage of velocity head loss through the valve and produce a resultant total pressure drop of relatively low order.


K
N
G
F
C
H
D
B
Venturi Pattern
J


Regular Opening
K
N
G
H
D
A
Y
X
Z
J

- ***Operator:*** This is a device, which opens or closes a valve. Different devices are available.

MANUAL OPERATORS

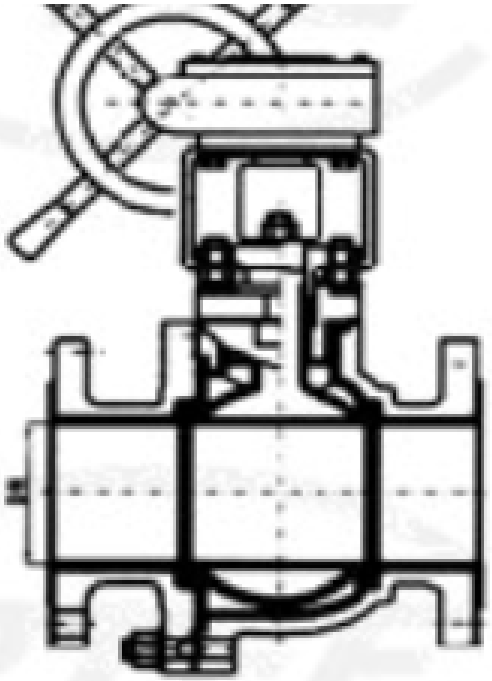
(1) Hand lever: It is used to actuate the stems of small butterfly, ball, plug valves and cocks. Wrench operation is used for cocks and small plug valves.

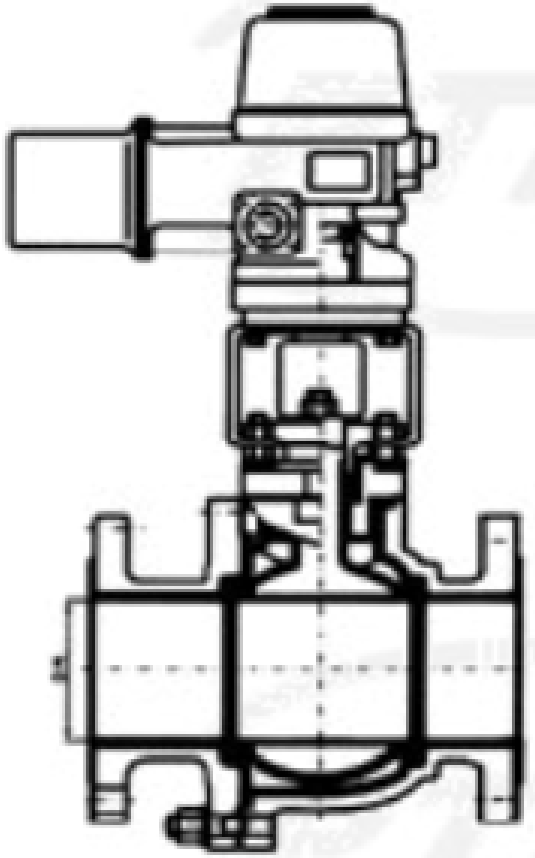
- ***(2) Hand Wheel:*** It is the most common means of rotating the stem on the majority of popular smaller valves such as gate, globe and diaphragm. Hammer blow or impact hand wheels that may be substituted for normal hand wheels, if easier operation is needed but where gearing is unnecessary offer additional operating torque for gate and globe valves.

ELECTRIC

GEAR OPERATED

HAND LEVER





(3) Chain: It is used where a hand wheel would be out of reach.

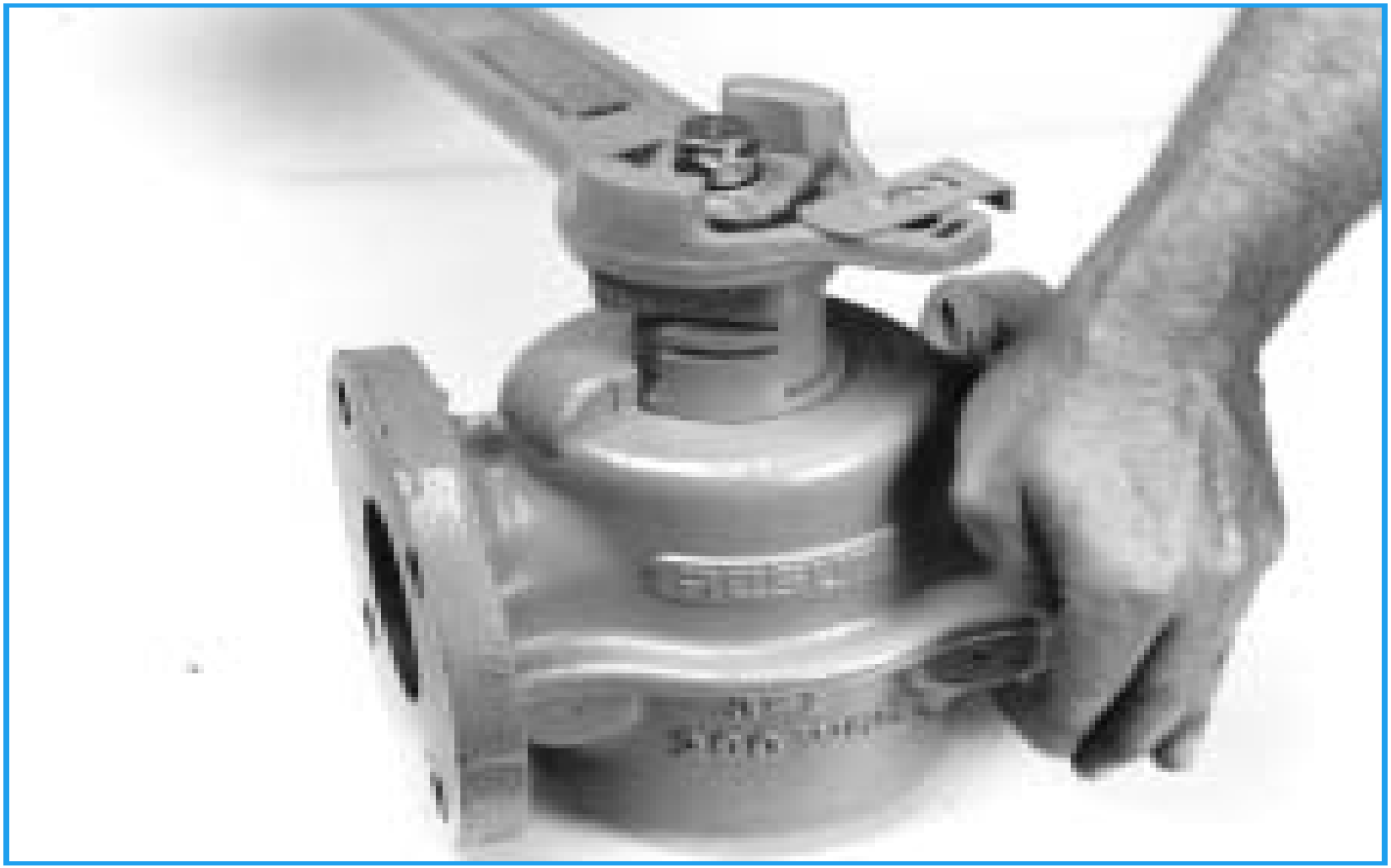
- The stem is fitted with a chain wheel or wrench (for lever operated valves) and loop of the chain is brought within one meter of working floor level.

(4)Gear : These are used to reduce the operating torque. For manual operation, it consists of a hand wheel operated gear train actuating the valve stem.

- As a thumb rule, gear operators should be considered for valves of 350 mm NB and larger upto 300#, 200 mm NB and larger upto 600#, 150 mm NB and larger upto 1500# and 100 mm NB and larger for higher ratings.

CHAIN

WRENCH



- § ***Pneumatic and Hydraulic:*** These may be used where flammable vapour is likely to be present. They are of following forms:

- § Cylinder with double acting piston driven by air, water, oil or other liquid, which usually actuates the stem directly.

- § Air motor, which actuates the stem through gearing. These motors are commonly piston and cylinder radial type.

- § A double acting vane with limited rotary movement in a sector casing, actuating the stem directly.

POWERED OPERATORS:

- Electric Geared Motor: Geared Motor moves the valve stem. This is useful for operating large valves in remote areas.

- Solenoid: These can be used for fast acting check valves, and with on/off valves in light-duty instrumentation applications.

VALVES IN DETAIL:

Gate valve:

- They function as block valves.
- 75% of all valves in process industries are gate valves.
- Gate valves are not suitable to throttle flow because it will pass maximum flow when it is partially open.
- The end flanges can be integrally cast into the body.(ref:ANSI B16.5 for flanged connections).

- Also for welded connections(ref:ANSI B16.11 for weld/screw connections).

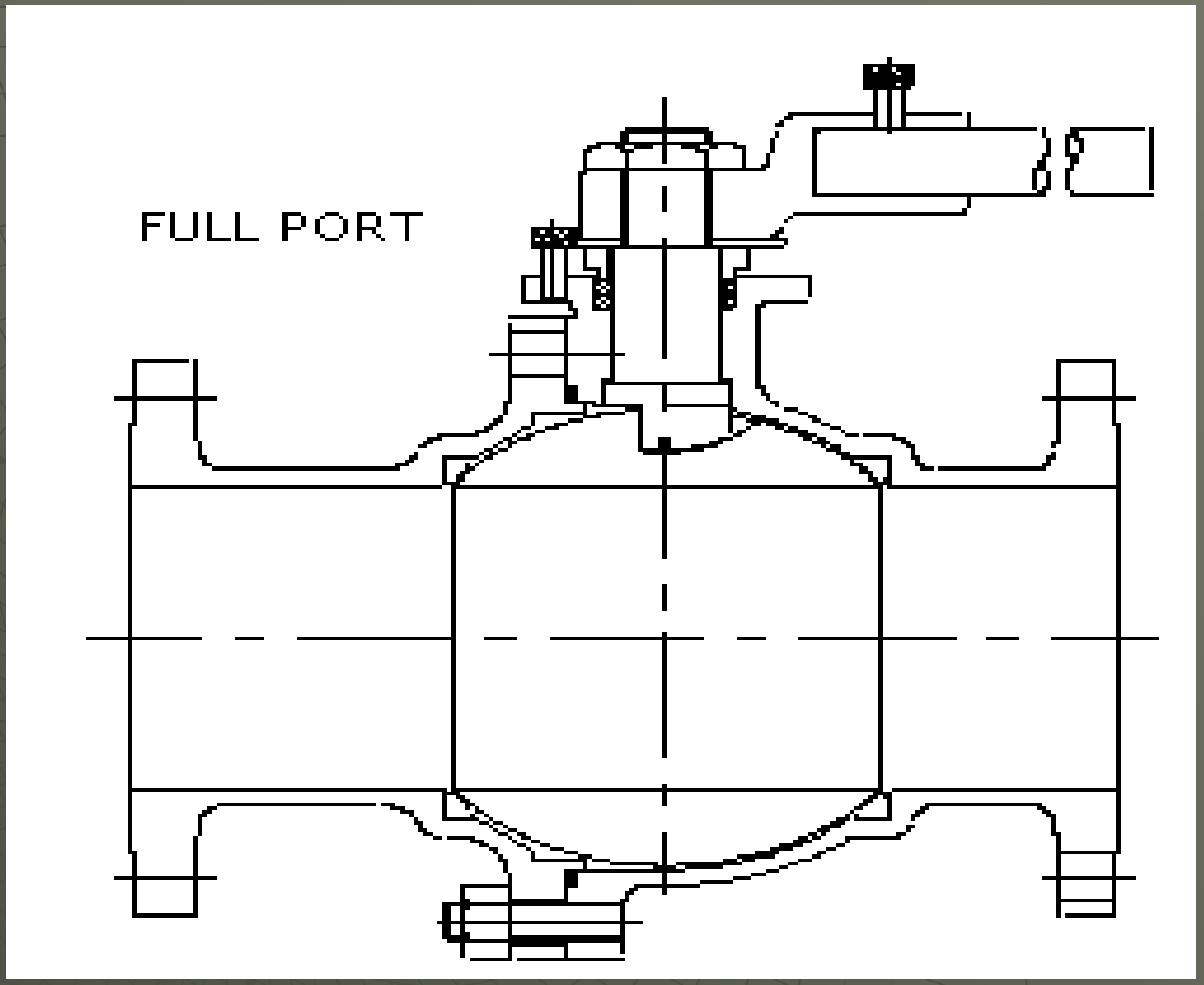
- There are two types of port designs

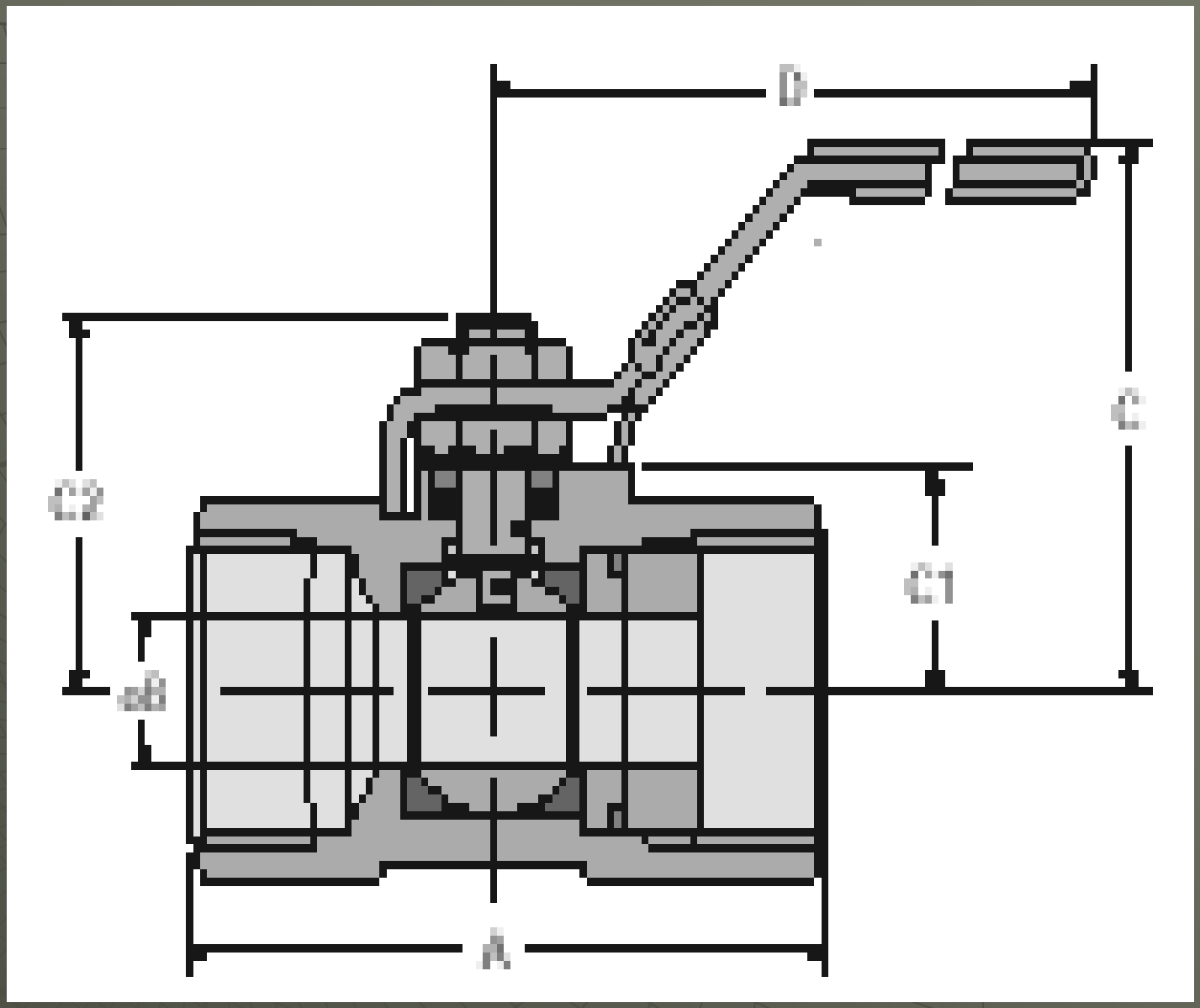
(1) **Full port design:**

The net area of the bore through the seat is as nearly as equal to the pipe size.

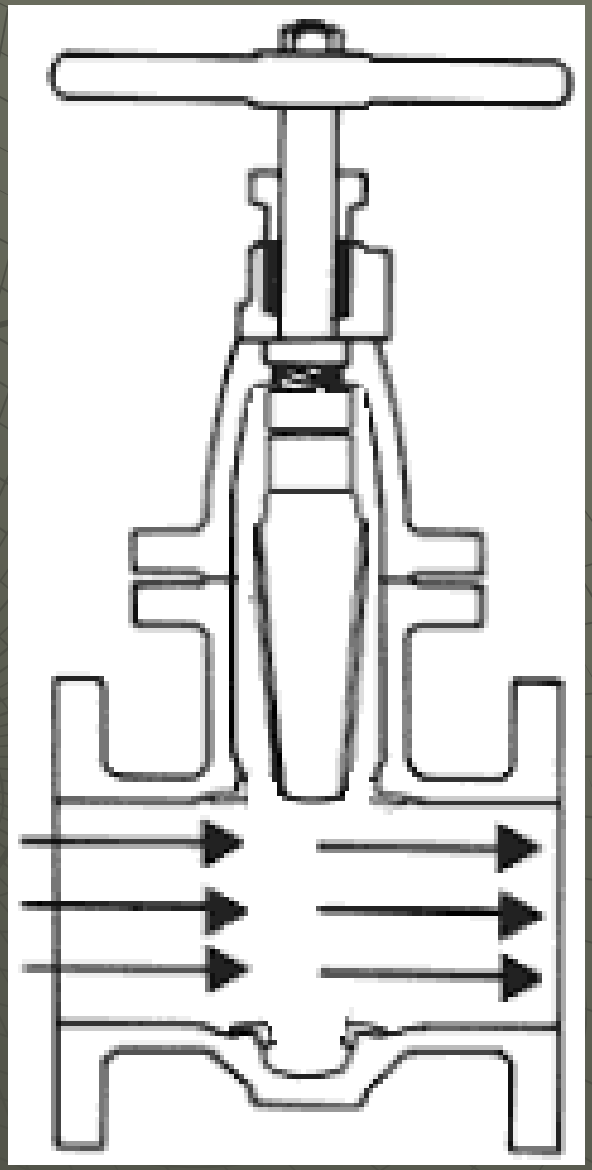
(2) **Reduced port design:**

The port diameter is normally one size less than the size of the pipe.


FULL PORT


D
C
C2
C1
B
A

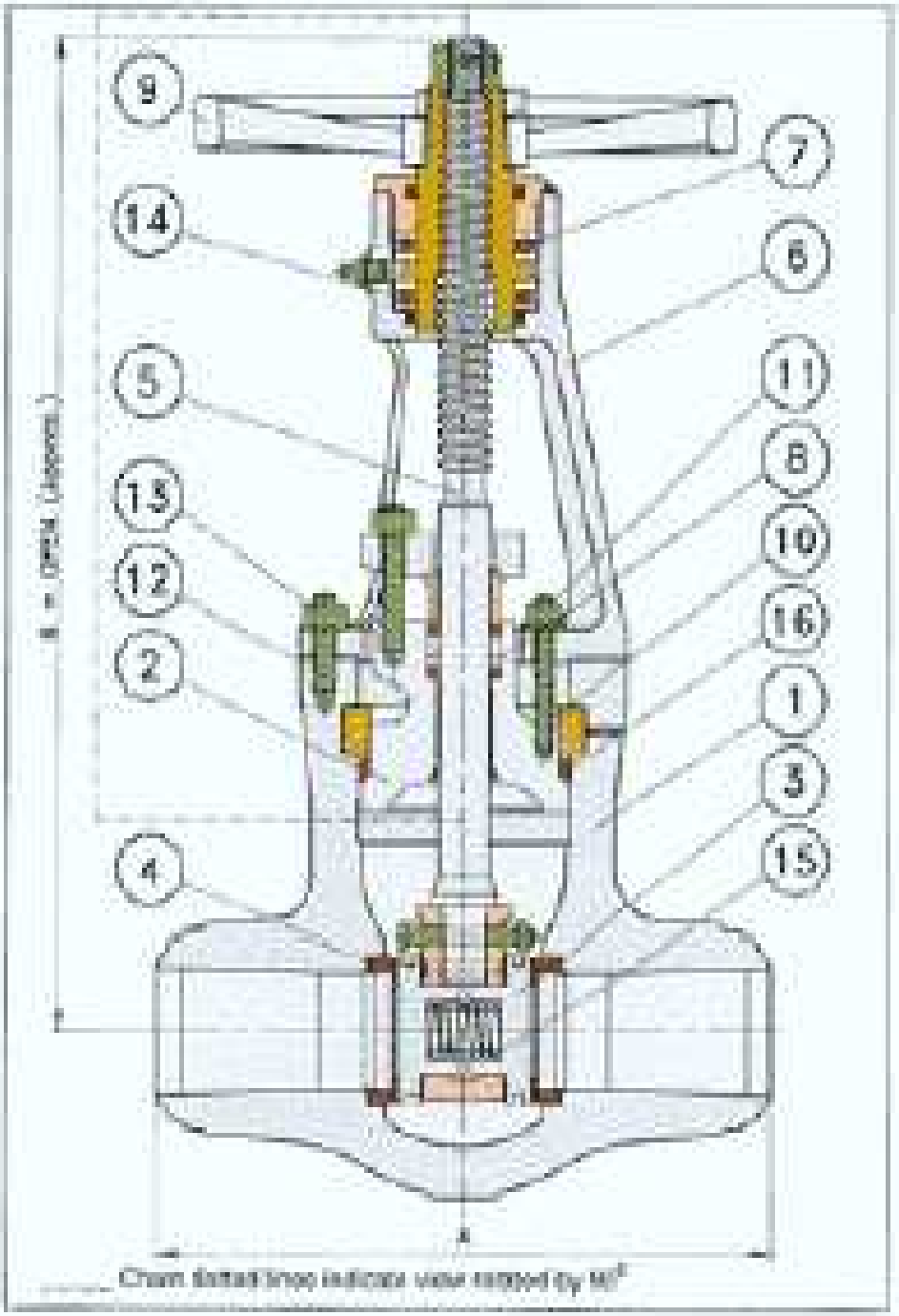
Gate valve



Flow in

Flow out

GATE VALVE



MATERIAL SPECIFICATION

Name of Part	Specification		
1. Body 2. Bonnet	ASTM A 216 Gr. WCB	ASTM A 217 Gr. WC6	ASTM A 217 Gr. WC9
3. Disc 4. Body ring	ASTM A 216 Gr.WCB - Stellited	ASTM A 217 Gr. WC6 - Stellited	ASTM A 217 Gr. WC9 - Stellited
5. Stem	AISI 410		
6. Yoke	ASTM A 216 Gr. WCB		
7. Yoke Sleeve	ASTM A 439 Type D2		
8. Packing	Graphite with braidot and rings		
9. Hand wheel	Steel or Malleable Iron or SG Iron		
10/12. Stud	ASTM A 193 Gr. B7		
11/13. Nut	ASTM A 194 Gr. 2H		
14. Thrust Ball Bearing	Steel		
15. Spring	Alloy Steel		
16. Gasket	Graphite		

Wherever more than one material of construction is specified for a component, the choice of using any one of them is at our option

GATE VALVE
BOLTED BONNET
FLEX WEDGE

GATE VALVE
PRESSURE-SEAL BONNET

Part Name	MATERIAL										
Body	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A315 CF8	A351 CF8M	A351 CF3	A351 CF3M
Seat Ring	A105	A350 LF2	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316	A182 F304L	A182 F316
Wedge	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Stem	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316
Bonnet Bolt	A193 B7	A320 L7	A193.B7	A193.B16	A193.B16	A193.B16	A193.B16	A193.B7	A193.B7	A193.B7	A193.B7
Bonnet Nut	A194 2H	A1944	A194.2H	A193.2H	A194.2H	A194.2H	A194.2H	A194 2H	A194.2H	A194.2H	A194.2H
Gasket	Stainless steel and graphite spiral wound										
Bonnet	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Backseat Bushing	A182. F6	A182. F304	A182.F6	A182.F6	A182.F304	A182.F6	A182.F6	A182.F304	A182.F316	A182.F304L	A182.F316
Stem Packing	Graphite										
Lantern	A182 F6	A182 F6	A182.F6	A182 F6	F182 F304	F182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316
Pin	Carbon steel										
Gland	A182 F6	A182 F6	A182 F6	A182 F6	A182 F6	A182 F6	A182 F6	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Gland Flange	A105	A350 LF2	A105	A105	A105	A105	A105	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Gland Eyebolt	A307 B	A307 L7	A193 B7	A193 B7	A193 B7	A193 B7	A193 B7	A193 B8	A193 B8	A193 B8	A193 B8
Gland Nut	A194 2H	A1944	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A1948	A1948	A1948	A1948

Stem Nut	C63000 or A439 D2
Retaining Nut	Carbon Steel
Hand wheel	Ductilelion or Steel
H.W. Lock Nut	Carbon Steel
York	A216 WCB
Nipple	Carbon steel

BALL VALVE:

- Ball valves function as both block valves and flow regulating(special design) valves.
- Quarter turn positive shut off valves.
- Suited for conditions where quick on-off and/or bubble tight shut off is required.
- Soft seats are usually used only for low temperature services.
- Metal seated ball valves are used for high temperature services.

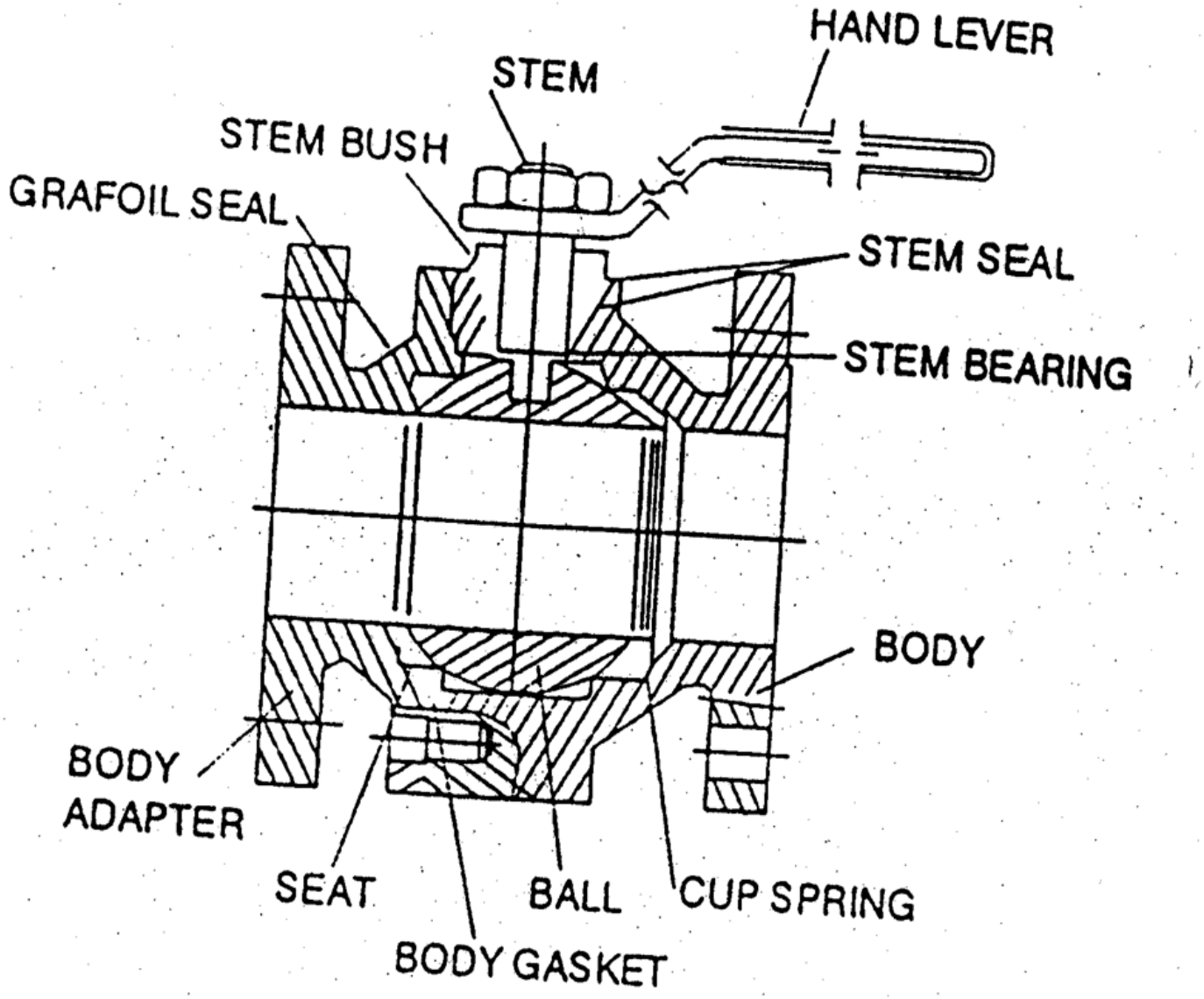
- **Soft seats are not normally used for throttling because of erosion or distortion/displacement caused by fluid.**

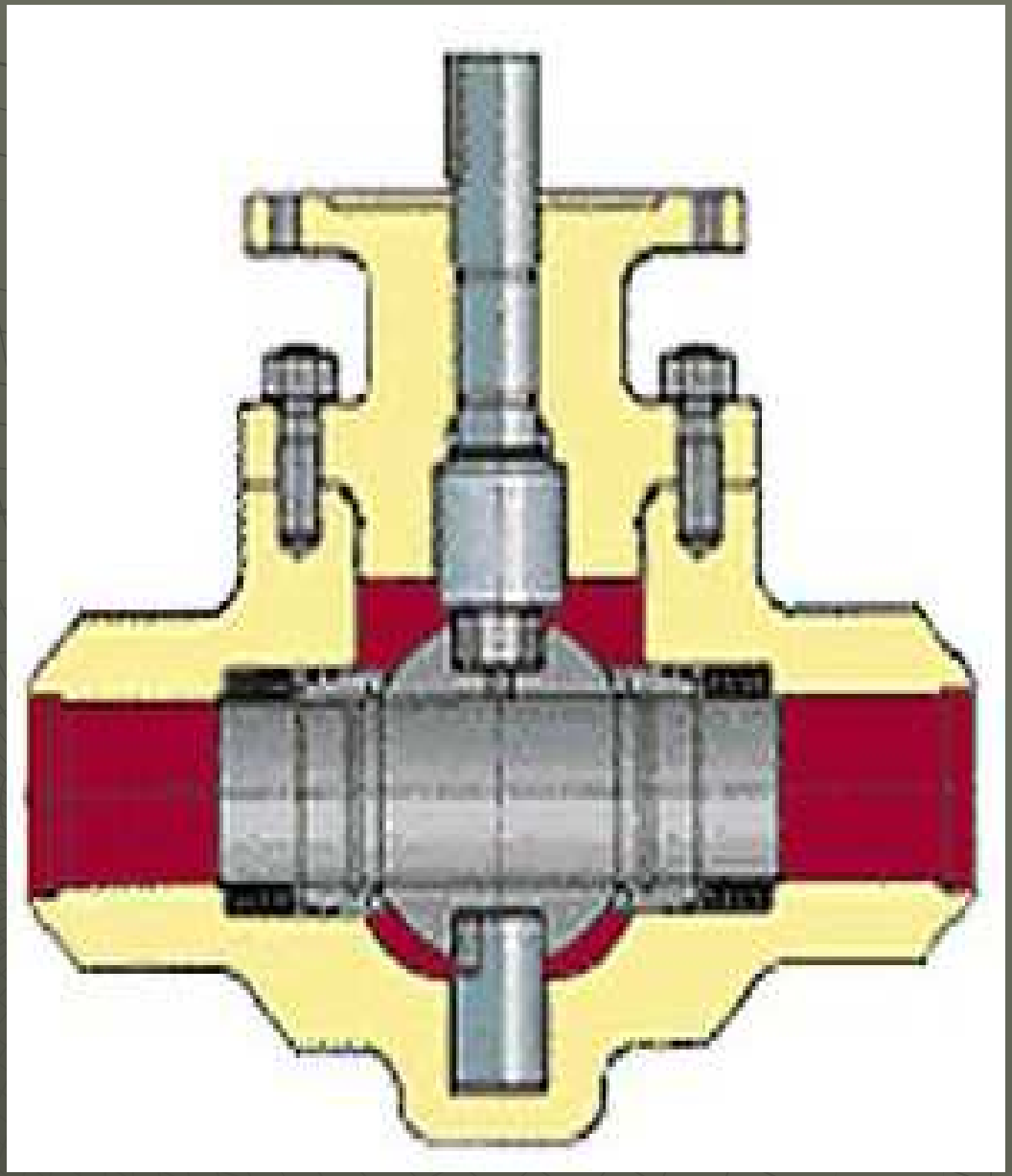
- **The Pressure – Temperature ratings are established based on the seating material.**

- **Offers minimum resistance to flow.**

Advantages:

- Easy Operation.
- Low torque.
- Low Pressure Drop.
- Economical.
- Excellent Sealing.(Used in Vacuum Services)


HAND LEVER
STEM
STEM BUSH
GRAFOIL SEAL
STEM SEAL
STEM BEARING
BODY
BODY ADAPTER
SEAT
BALL
CUP SPRING
BODY GASKET



-- Two designs are available.

(1) Regular port design:

The port diameter will be smaller than the pipe inside diameter. Normally the port diameter is one size less than the pipe diameter.

(2) Full port Design:

The port diameter of the valve will be the same as that of the pipe inside diameter.

PLUG VALVE:

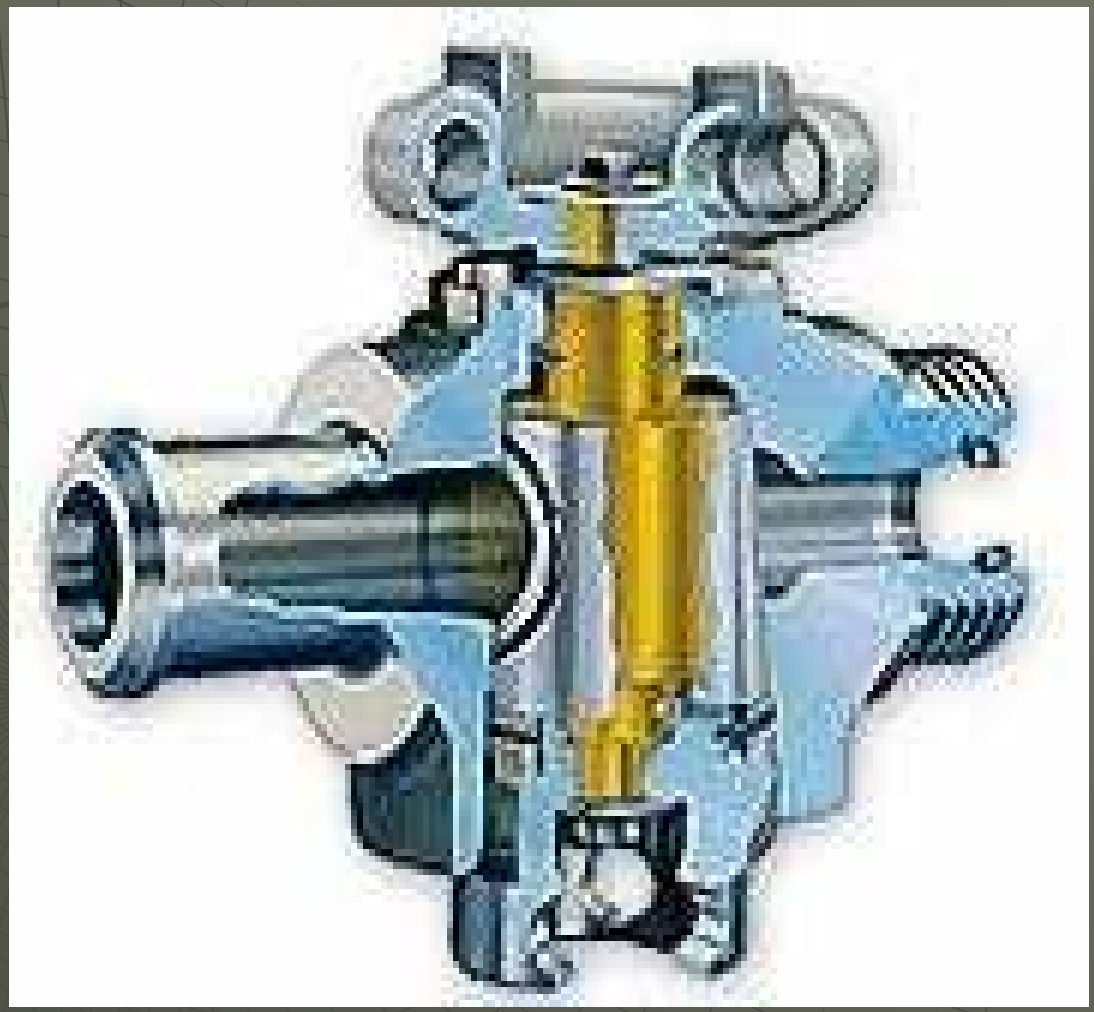
- Plug valves are quarter turn positive shut off valves.
- Well suited for quick ON/OFF, AND/OR bubble tight shut off.
- Not normally used for throttling, because soft seats are subjected to erosion.
- Lesser resultant total pressure drop across the valve.
- In certain designs,a low friction Poly Tetra Fluro Ethylene (PTFE) is impregnated on the surface structure of the valve plug.

Based on sealing,

Lubricated metal seated plug valves:

- The lubrication of the seating surfaces is by means of lubricant,which is fed into the operating surfaces.

Cross Section of a Plug Valve:

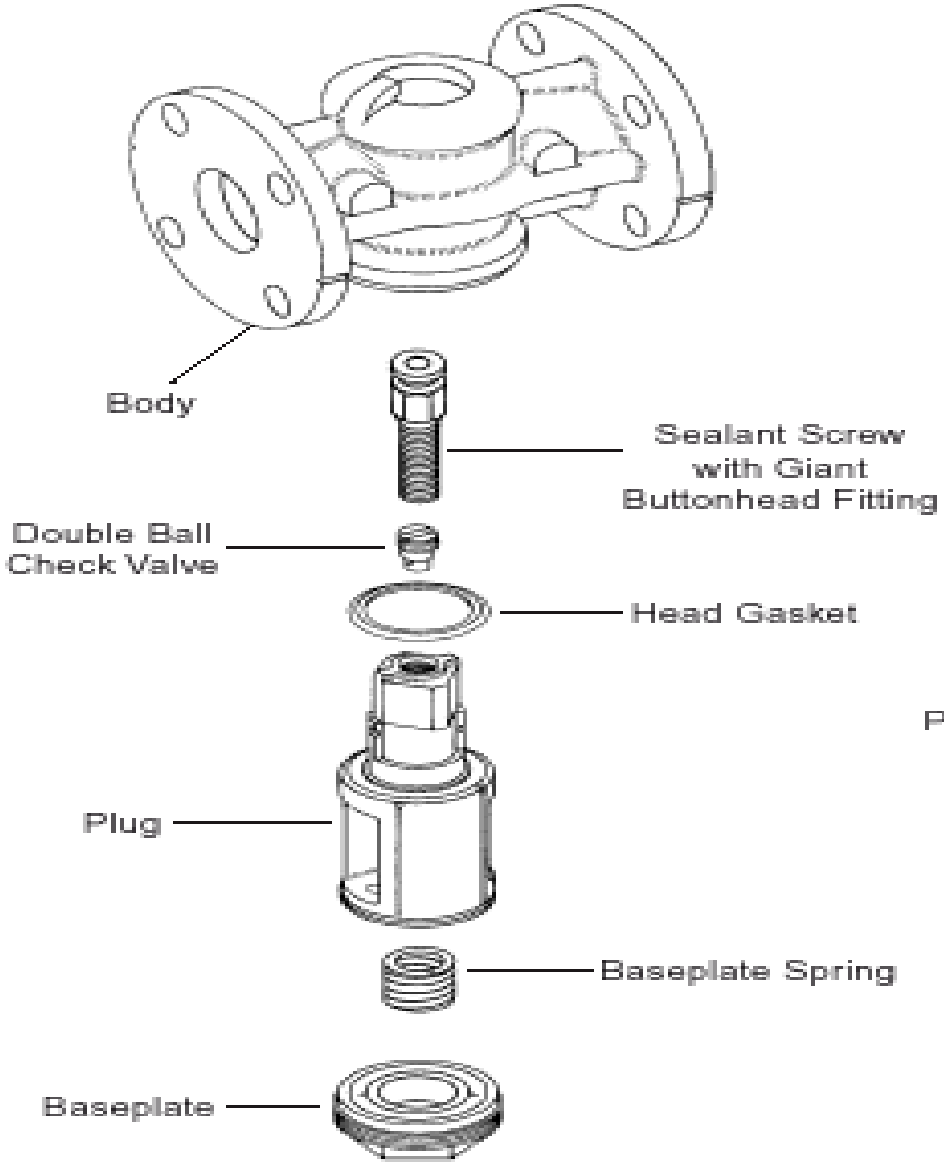


ADVANTAGES OF PLUG VALVE:

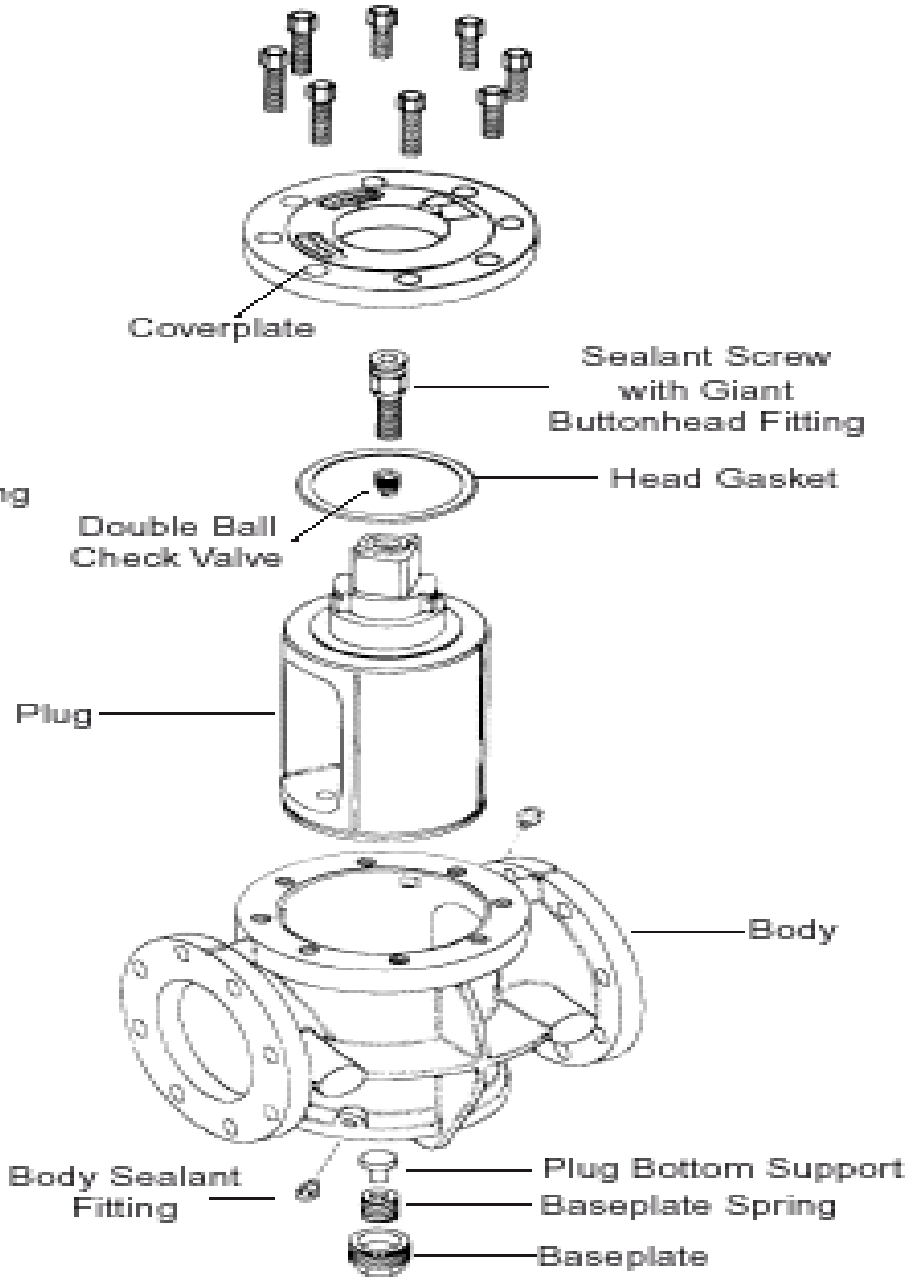
- Used in Oil & Gas Industries.
- Fly Ash Applications.
- Plug & Body Seating Surfaces which are lapped & matched aren't exposed to the line fluid, which reduce the corrosion and Erosion loses.
- Fire Safety.
- Reduced torque.
- Online Maintenance.

PLUG VALVE

Bottom-Entry Components

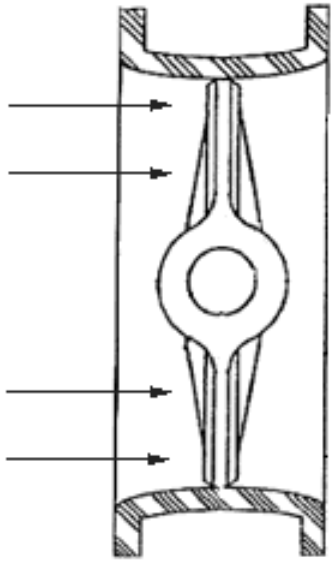


Top-Entry Components

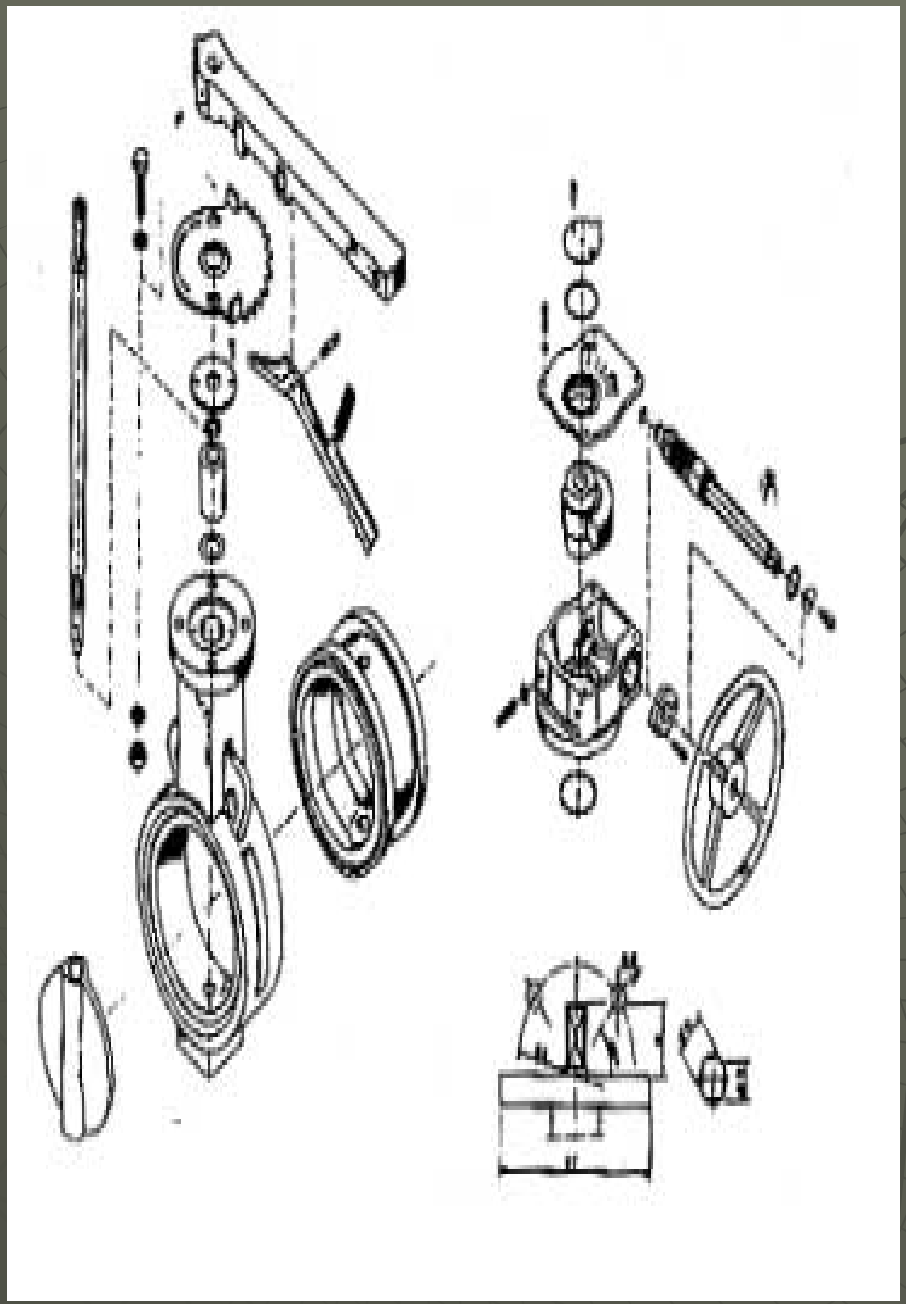


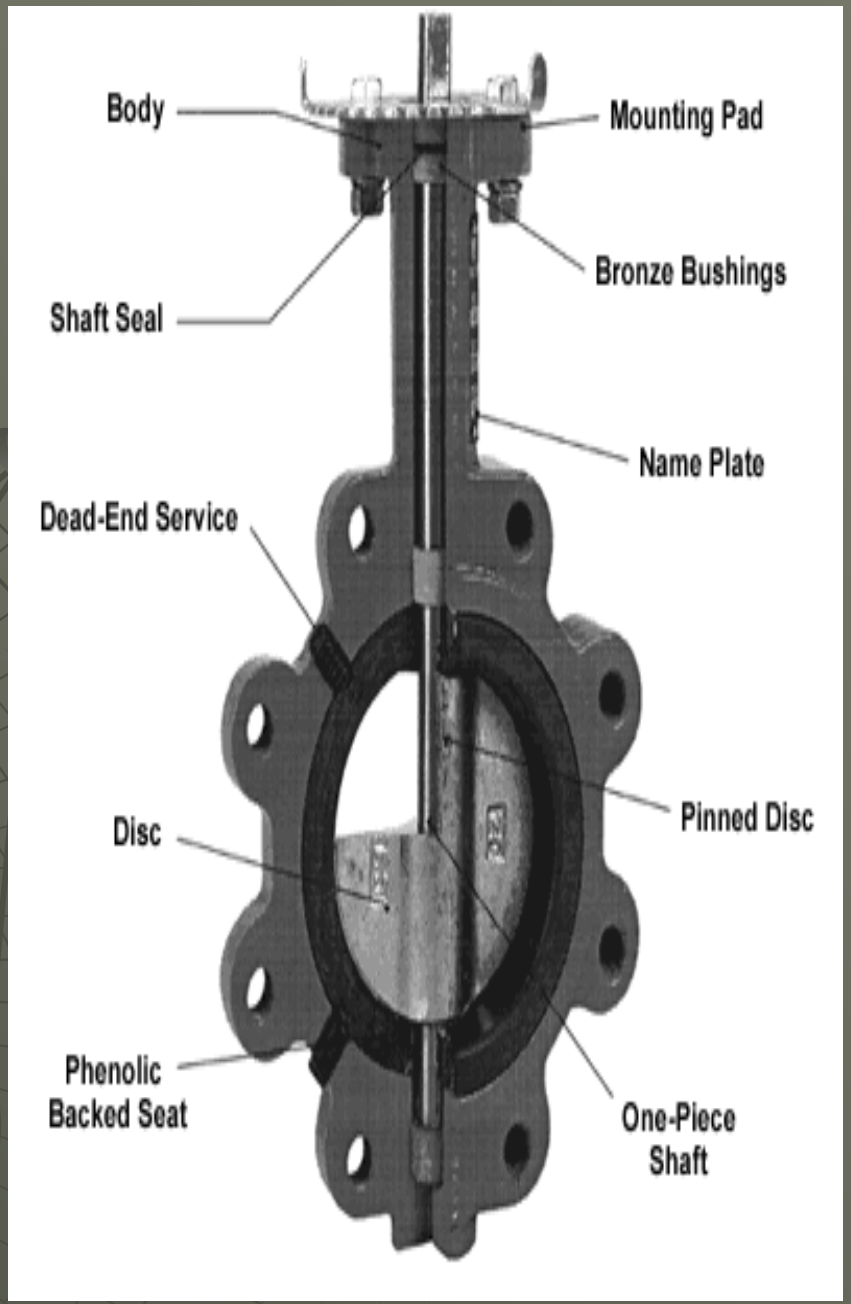
Butterfly valve:

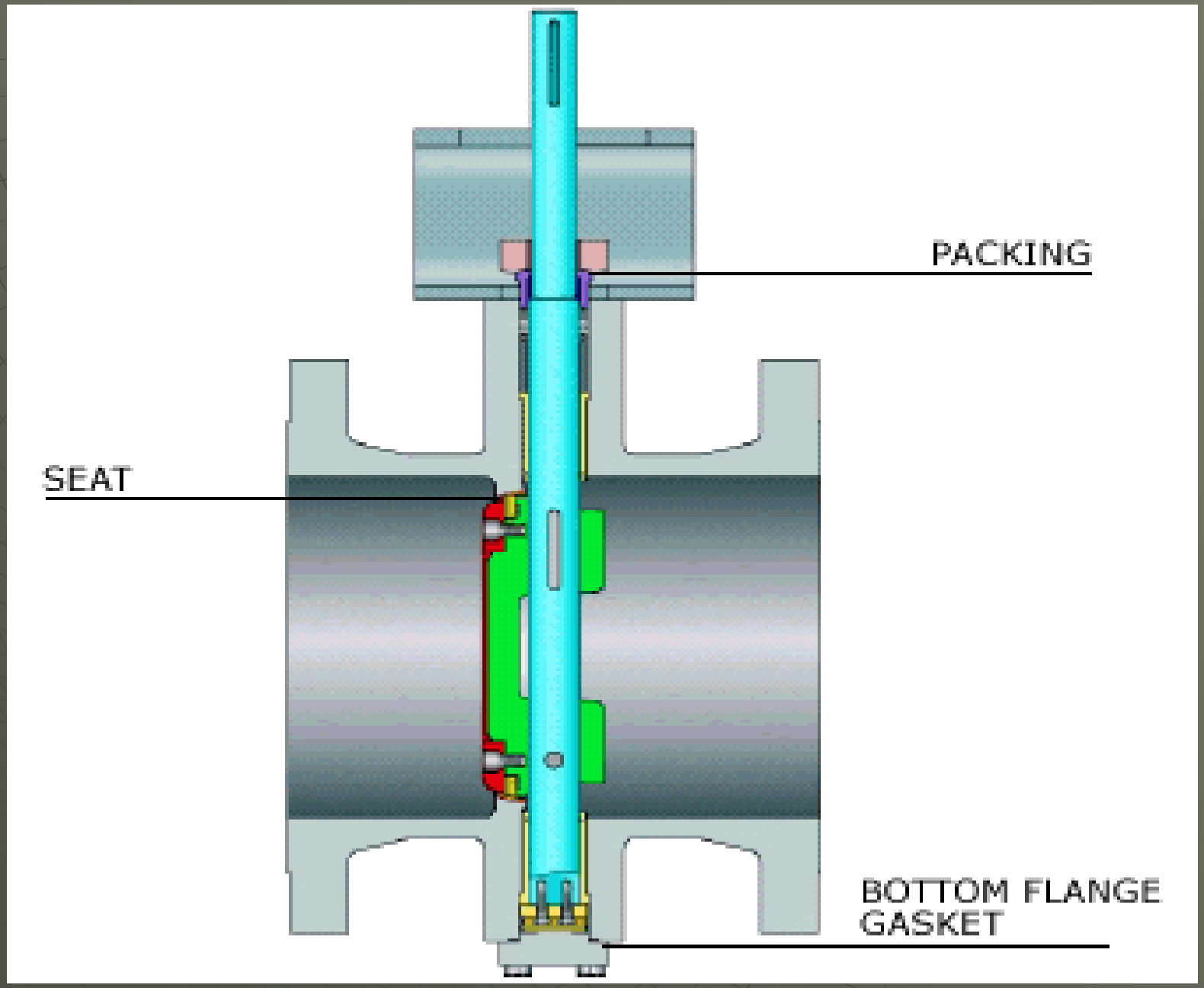
-- They are quarter turn positive shut off valve.
-- Seats are made of PTFE with certain reinforcement.
-- Valves up to 12” are operated with lever.
-- Higher diameter valves are provided with gear unit and hand wheel.
-- These valves are wear resistant.
-- Elastomers have higher life expectancy than conventional metallic seated valves when used in high density mineral slurry services.
-- Generally used for line sizes >8”.



Cross Sectional Top View




Body
Mounting Pad
Bronze Bushings
Shaft Seal
Name Plate
Dead-End Service
Pinned Disc
Disc
Phenolic
Backed Seat
One-Piece
Shaft


PACKING
SEAT
BOTTOM FLANGE
GASKET

WRENCH CONTROLED
WAFER TYPE
BUTTERFLY VALVE

HAND WHEEL CONTROLED
BUTTERFLY VALVES

GLOBE VALVE:

-- Globe valves are mainly used to throttle the fluid flow.

-- Smaller sizes are hand controlled.

-- Application of larger size valves are limited to bypass control valve stations.

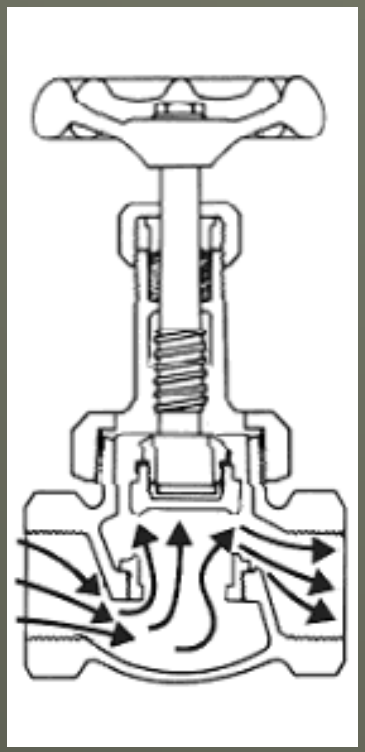
-- Provide relatively tight shut off.

-- Valve patterns involve change in flow directions.

-- The discs of globe valves shall be flat-faced type, plug type,ball type,needle type,port type.

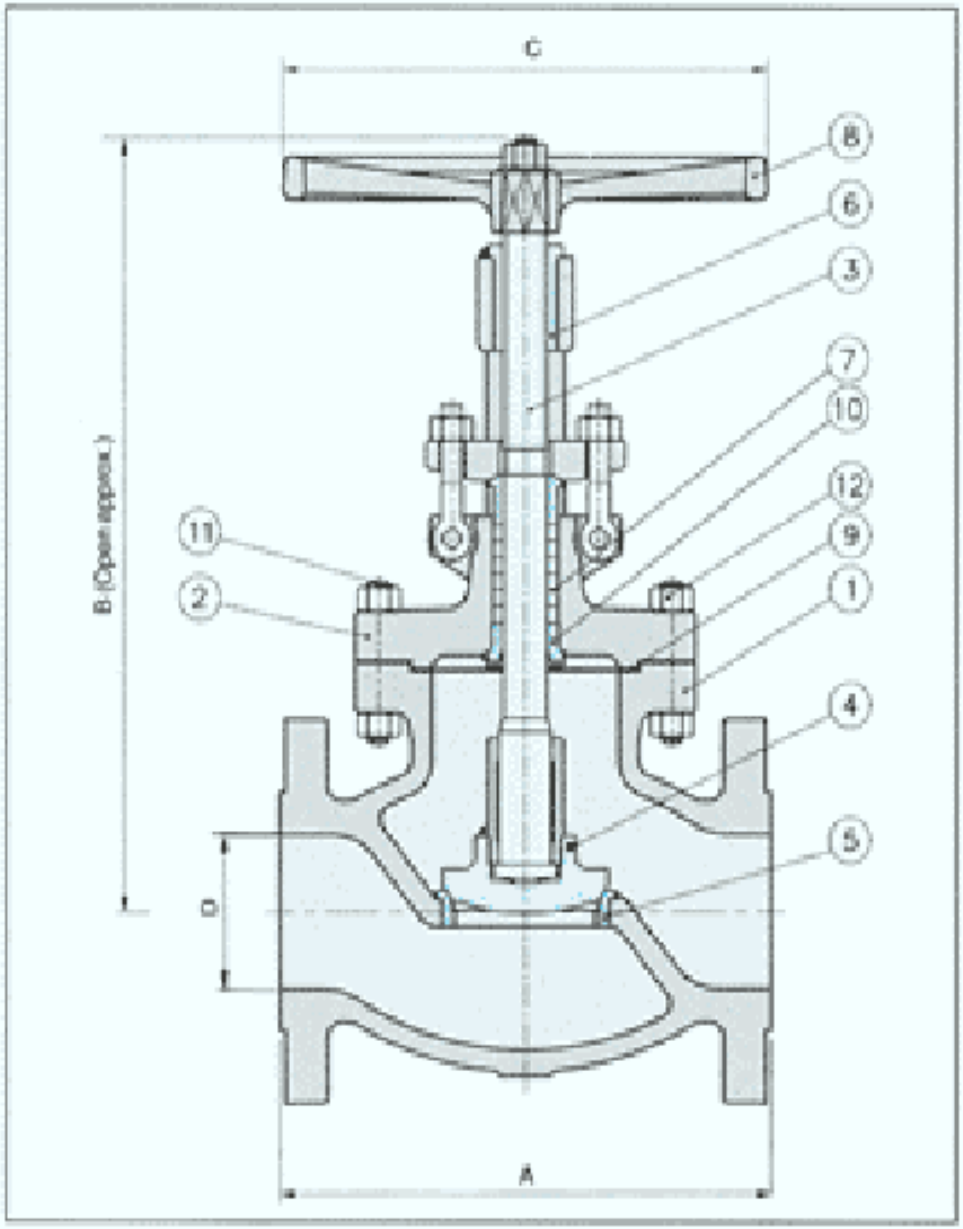
-- Commonly used for pipe sizes up to 8”

-- High pressure drop across valve.



Name of Part	Specification
1. Body 2. Bonnet	ASTM A216 Gr. WCB
3. Stem	ASTM A182 Gr. F6a
4. Disc	ASTM A182 Gr. F6a or ASTM A216 Gr. WCB or CA15 with suitable seating surface.
5. Body Seat Ring	ASTM A182 Gr. F6a or AISI 410 with suitable seating surface
6. Yoke Bush	ASTM A439 Type D2
7. Stem Packing	Braided Asbestos
8. Handwheel	SG Iron or Malleable Iron or Steel
9. Gasket	Corrugated Soft Steel
10. Back Seat Bushing	AISI 410/420
11. Studs	ASTM A193 Gr. B7
12. Stud Nuts	ASTM A194 Gr. 2H

Wherever more than one material of construction is specified for a component, the choice of using any one of them is at our option.

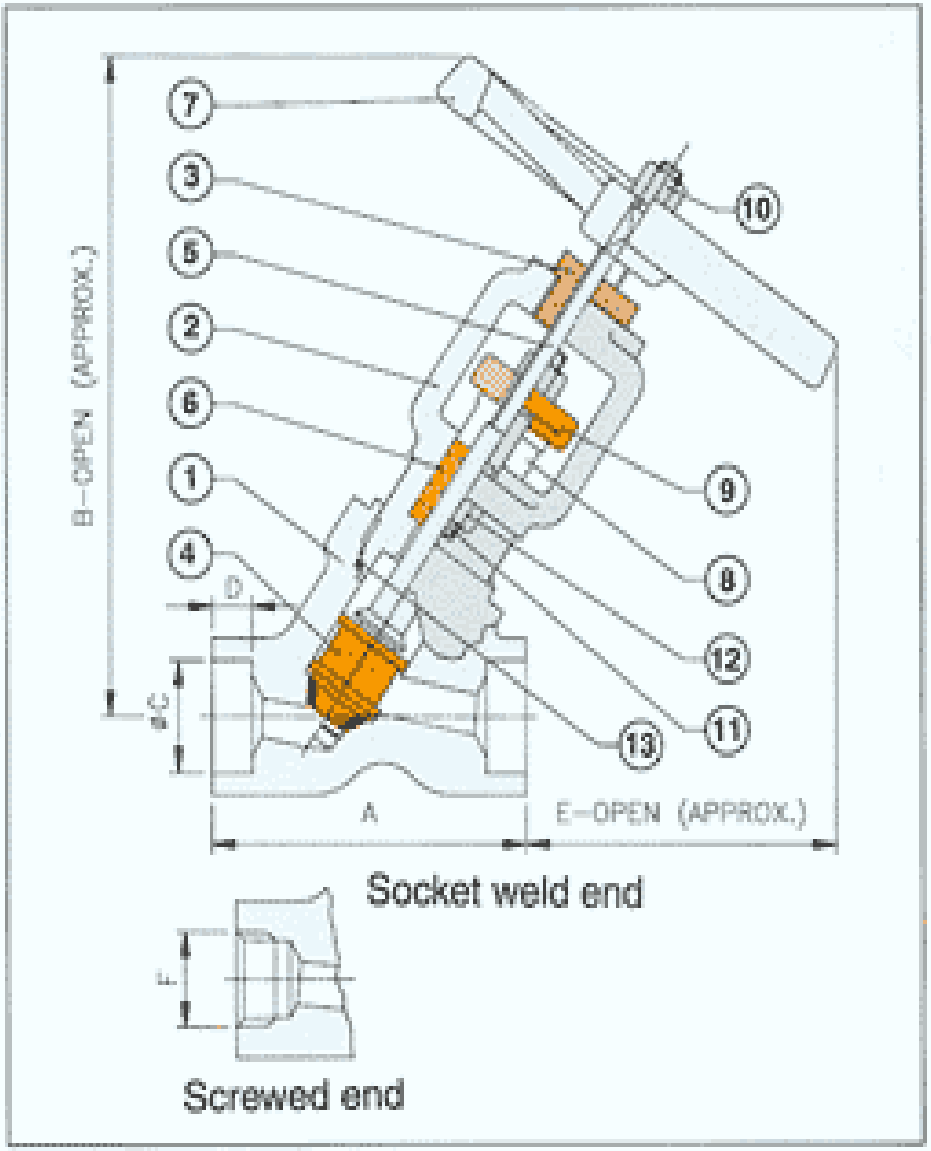


Valves with "U" trim will have plug type disc.

GLOBE VALVE

MATERIAL SPECIFICATION

Name of part	Specification	
	Carbon Steel	Alloy Steel
1 Body 2 Bonnet	ASTM A105 Seat hard faced with Stellite # 6 or equivalent	ASTM A182 Gr. F22 Seat hard faced with Stellite # 6 or equivalent
3 Yoke Bush	ASTM A439 Type D2	
4 Disc	AISI 410 - Seat hard faced with Stellite # 6 or equivalent	
5 Stem	AISI 410	
6 Packing	Graphite with Braided end rings	
7 Hand Wheel	Steel or Ductile Iron or Malleable Iron	
8 Gland	AISI 410	
9 Gland Flange	BS 970:709 M40 COND R	
10 Hand Wheel Nut	ASTM A307 Gr. B	
11 Gland Stud	ASTM A193 Gr. B7	
12 Gland Stud Nut	ASTM A194 Gr. 2H	
13 Gasket	Graphite	



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» Standard Material Specifications

Part Name	MATERIAL										
Body	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A315 CF8	A351 CF8M	A351 CF3	A351 CF3M
Seat Ring	A105	A350 LF2	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316	A182 F304L	A182 F316L
Disc	A105	A350 LF2	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Stem	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316L
Disc Nut	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316L
Gasket	Stainless steel and graphite spiral wound										
Bonnet	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Bonnet Bolt	A193 B7	A320 L7	A193 B7	A193 B16	A193 B16	A193 B16	A193 B16	A193 B7	A193 B7	A193 B7	A193 B7
Bonnet Nut	A194 2H	A194 4	A194 2H	A194 4	A194 4	A194 4	A194 4	A194 2H	A194 2H	A194 2H	A194 2H
Backseat Bushing	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316L
Stem Packing	Graphite										
Lantern	A182 F6	A182 F6	A182.F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316L
Pin	Carbon steel										
Gland Flange	WCB	A350 LF2	A105	A105	A105	A105	A105	A351 CF8	A351 F8M	A351 CF3	A351 CF3M
Gland	A182 F6	A182 F6	A182 F6	A182 F6	A182 F304	A182 F6	A182 F6	A182 F304	A182 F316	A182 F304L	A182 F316L
Gland Eyebolt	A307 B	A320 L7	A307 B	A193 B7	A193 B7	A193 B7	A193 B7	A193 B8	A193 B8	A193 B8	A193 B8
Gland Nut	A194 2H	A194 4	A194 2H	A194 2H	A194 2H	A194 2H	A194 2H	A194 8	A194 8	A194 8	A194 8
Stem Nut	C63000 or A439 D2										
Hand wheel	Ductile lion or Steel										
H.W .Lock Nut	Carbon Steel										

CHECK VALVE:

-- Check valves prevent flow reversal.

-- Typical check valve applications are in pump and compressor discharge piping.

-- Valves with discs provide lower resistance to flow of working fluid than those that contain balls or pistons.

-- The later are often used where there is an angular change in flow stream.

-- Ball and lift check valves are used for sizes 2” and smaller.

-- Swing check and Plate check valves are used for higher pipe sizes.

-- Major types are as below.

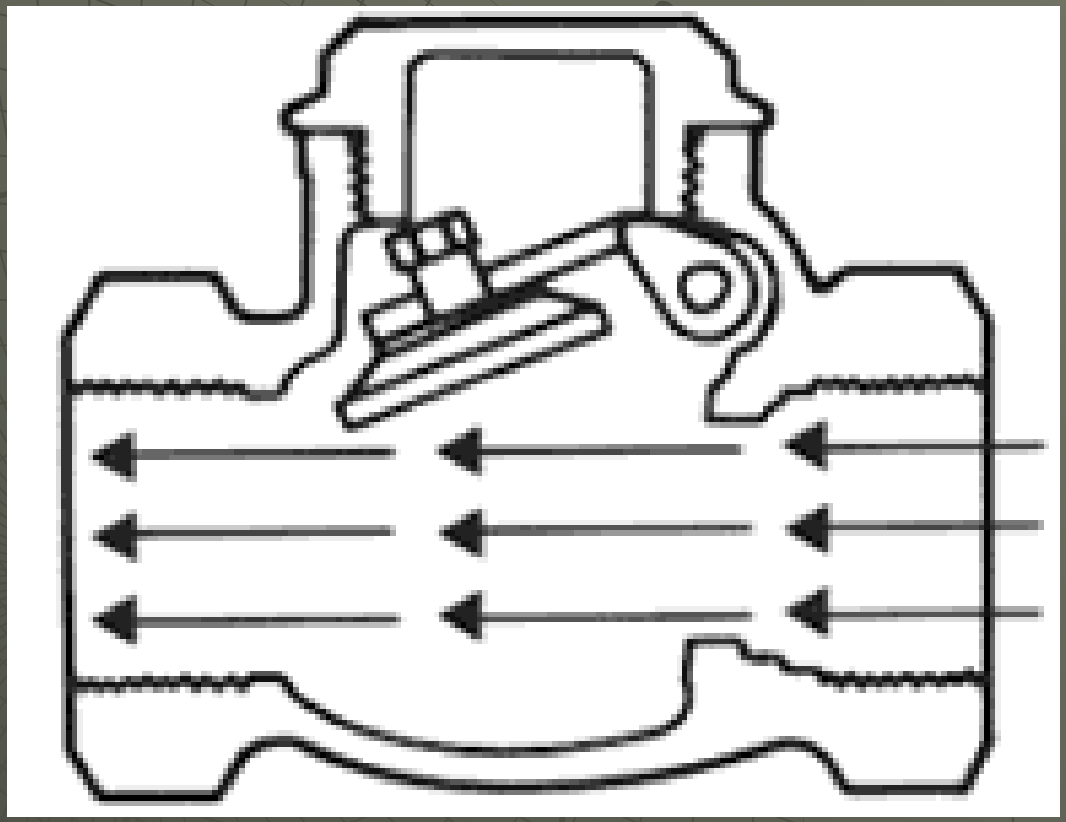
SWING CHECK VALVES:

--The disc swings freely in the form of an arc.

--Valve is kept open by the flow and disc seating is accomplished by gravity and/or flow reversal.

-- When used in vertical lines the flow should be upwards only.

SWING CHECK VALVE-WORKING:



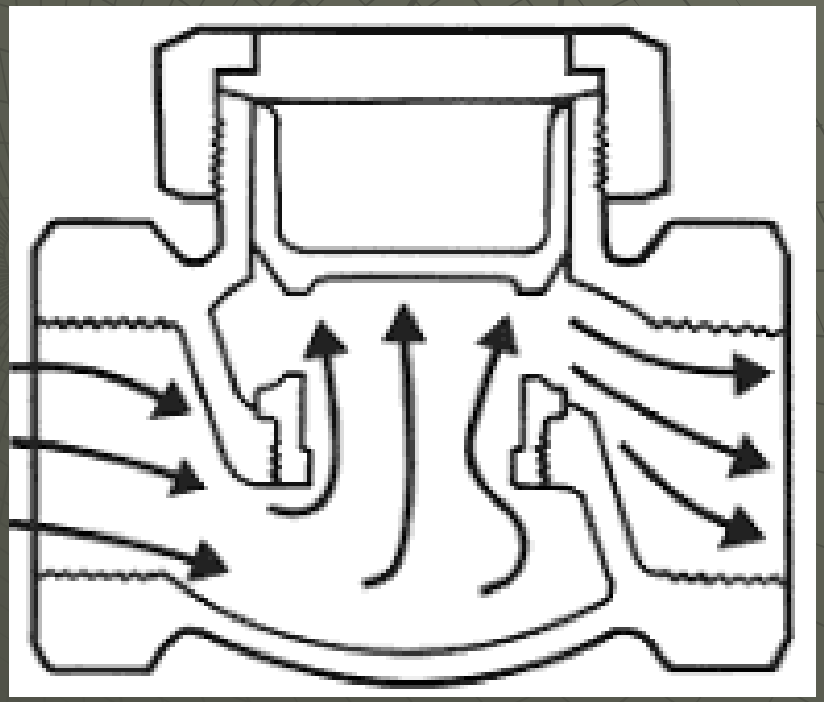
LIFT CHECK VALVES:

-- Basic types are piston lift check valve,Ball lift check valve etc.,

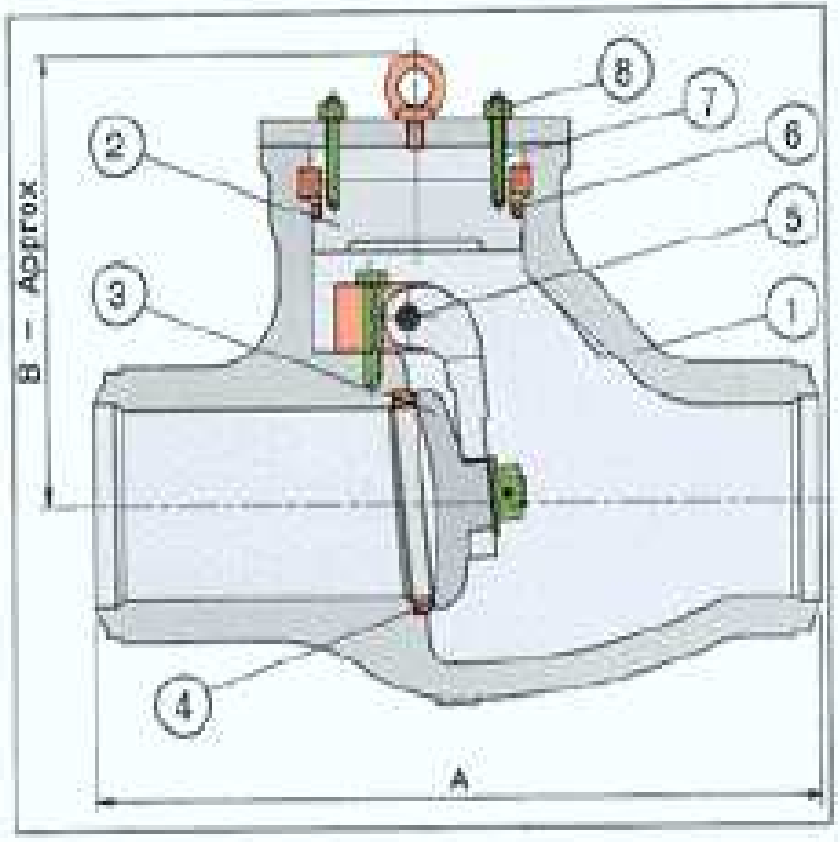
-- Used for sizes ½” to 2”.

-- Reverse flow forces piston or ball against seat.

-- Used to control vertical flow.



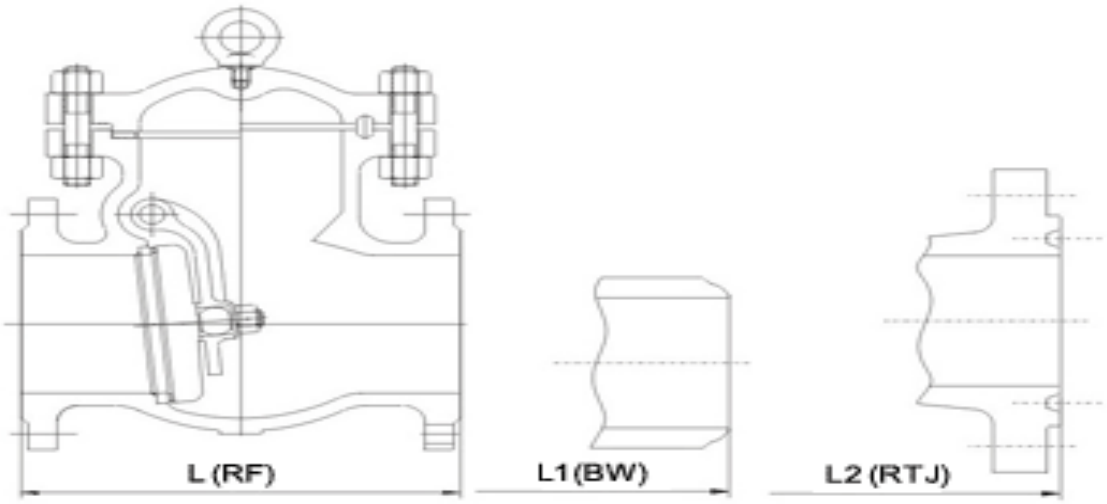
CHECK VALVE



MATERIAL SPECIFICATION

Name of Part	Specification		
1. Body 2. Cap	ASTM A 216 Gr. WCB	ASTM A 217 Gr.WC6	ASTM A 217 Gr.WC9
3. Disc 4. Seat ring	ASTM A 216 Gr.WCB - Stellited	ASTM A 217 Gr.WC6 -Stellited	ASTM A 217 Gr.WC9 -Stellited
5. Hinge pin	AISI 410		
6. Gasket	Graphite		
7. Stud	ASTM A 193 Gr. B7		
8. Nut	ASTM A 194 Gr. 2H		

Swing Check Valve ANSI Class 150-1500



Bolted Cover, Swing Type Disc,
Threaded Or Welded Seat Ring
- Valve designed to API 6D
- Valve tested to API and API 6D and API 598
- Face-to-Face to API 6D ANSI B16.10

- RF flanged ends to ANSI B16.5
- Butt-welding ends to ANSI B16.25

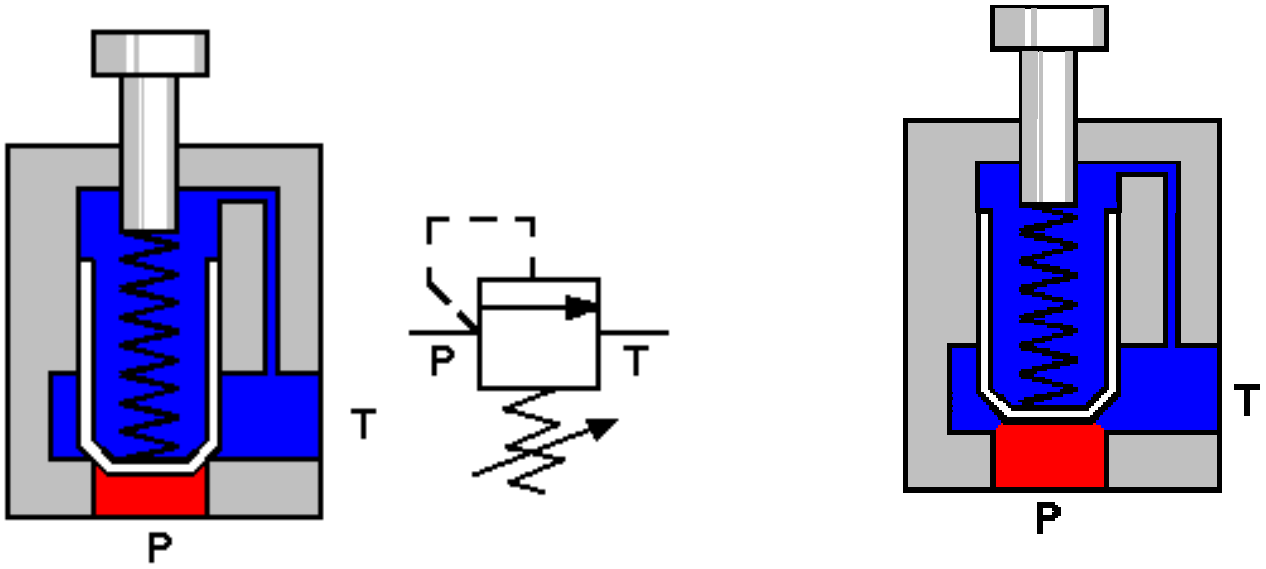
» Standard Material Specifications

Part Name	MATERIAL										
Body	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A315 CF8	A351 CF8M	A351 CF3	A351 CF3M
Seat Ring	A105	A350 LF2	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316	A182 F304L	A182 F316L
Disc	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Disc Nut	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316L	A182 F304	A182 F316L
Hinge	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Hinge Pin	A182 F6	A182 F6	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F304	A182 F316	A182 F304L	A182 F316L
Gasket	Stainless steel and graphite spiral wound										
Cover	A216 WCB	A352 LCB	A217 WC1	A217 WC6	A217 WC9	A217 C5	A217 C12	A351 CF8	A351 CF8M	A351 CF3	A351 CF3M
Cover Bolt	A193 B7	A320 L7	A193 B7	A193 B16	A193 B16	A193 B16	A193 B16	A193 B7	A193 B7	A193 B7	A193 B7
Cover Nut	A194 2H	A194 4	A194 2H	A194 4	A194 4	A194 4	A194 4	A194 2H	A194 2H	A194 2H	A194 2H
Eyebolt	A193 B7										

THE PRESSURE RELIEF VALVE

Closed position

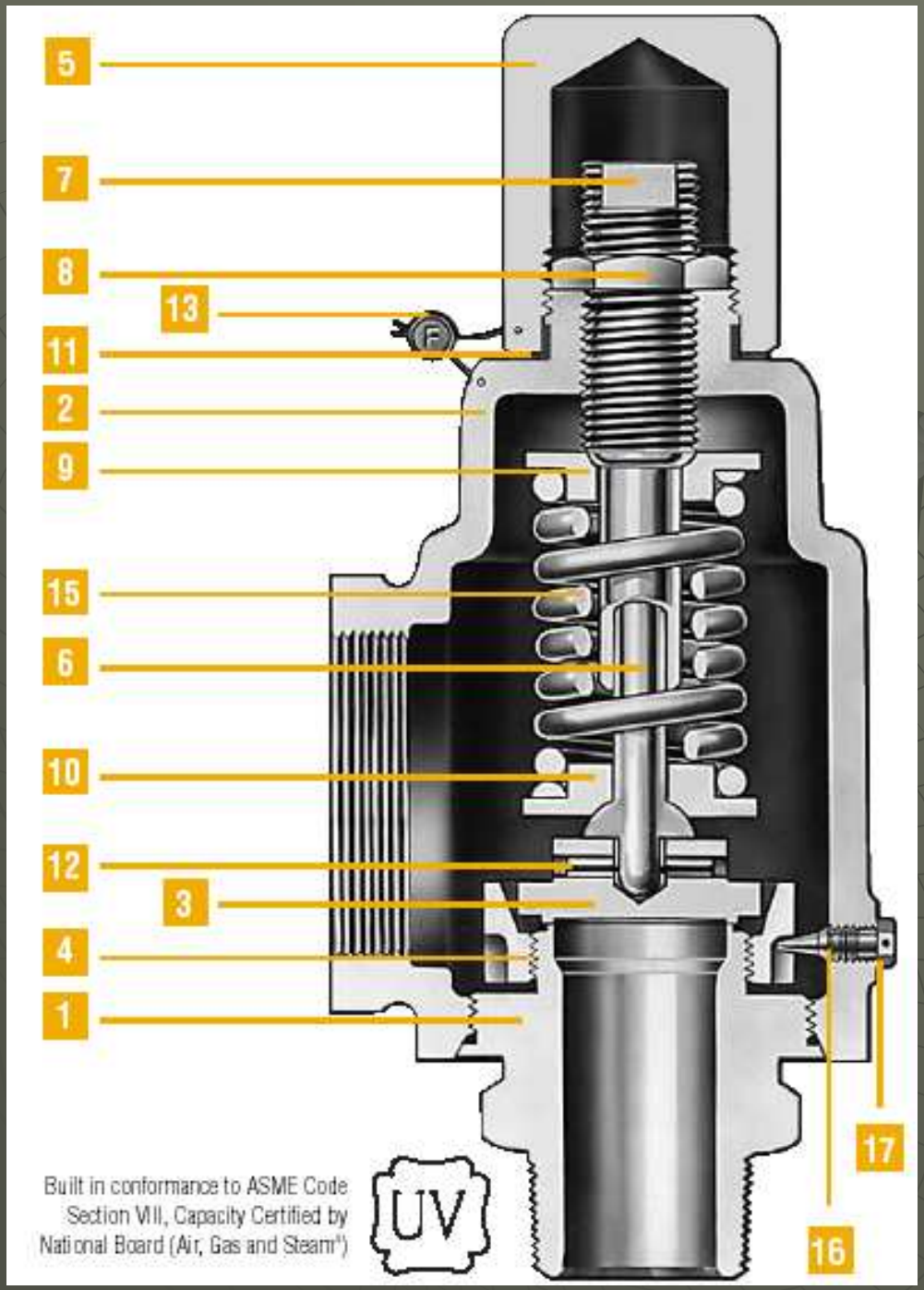
Open position



Drawing and simulation of a direct operating pressure relief valve: left: valve closed; middle: symbol of a direct operating pressure relief valve according to ISO 1219; right: simulation of an operating pressure relief valve

Description:

The pressure relief valve is mounted at the pressure side of the hydraulic pump. It's task is to limit the pressure in the system on an acceptable value. In fact a pressure relief valve has the same construction as a spring operated check valve. When the system gets overloaded the pressure relief valve will open and the pump flow will be leaded directly into the hydraulic reservoir. The pressure in the system remains on the value determined by the spring on the pressure relief valve! In the pressure relief valve the pressure (=energy) will be converted into heat.For that reason longtime operation of the pressure relief valve should be avoided.



Bill of Materials

Item No.	Part Name	Material
1	Body	ASTM B16 H.H. Brass
2	Bonnet	SB-62 Bronze
3	Disc	ASTM B16 H.H. Brass
4	Blow Down Ring	316 St. St.
5	Cap, Plain Screwed	Brass
6	Stem	316 St. St.
7	Spring Adj. Screw	Brass
8	Jam Nut	Brass
9	Spring Button (Upper)	316 St. St.
10	Spring Button (Lower)	316 St. St.
11	Cap Gasket	316 St. St.
not shown	Body Gasket (2″ inlet size only)	316 St. St.
12	Grooved Pin	Hardened Stainless Steel
13	Wire Seal	Stainless Steel Wire/Lead Seal
14	Nameplate (not shown)	Stainless Steel
15	Spring	316 St. St.
16	Blow Down Ring Lock Screw	316 St. St.
17	B.D.R. Lock Screw Gasket	316 St. St.

DIAPHRAGM VALVE:

-- These valves are used for low pressure corrosive services as shut off valve.

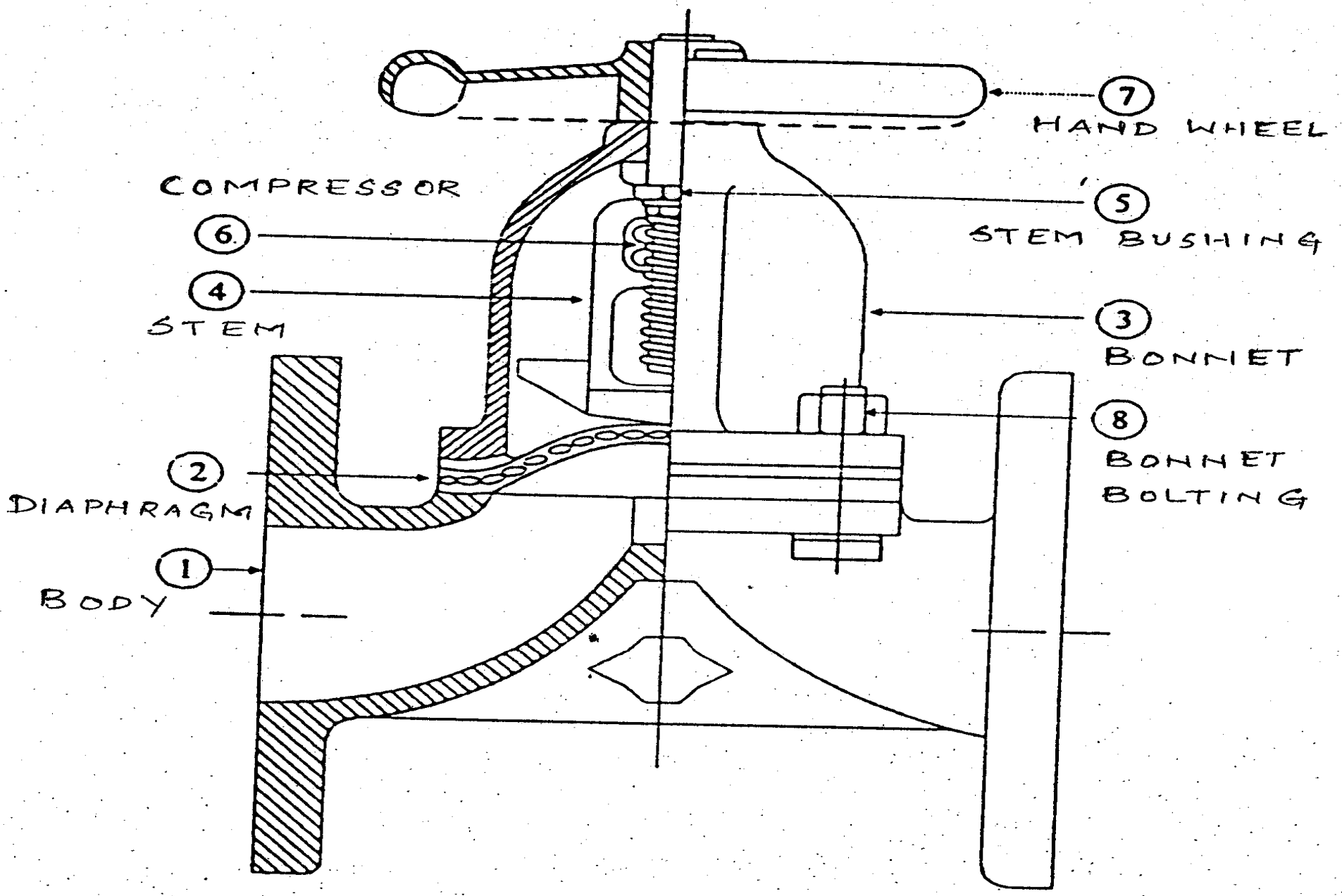
-- These can also be used as control valves.

-- Here the diaphragm moves up and down to operate the valve.

-- The major parts of diaphragm valves are,

1. Body
2. Diaphragm
3. Bonnet
4. Stem
5. Stem bushing
6. Compressor
7. Hand wheel
8. Bonnet bolting.

1.5 DIAPHRAGM VALVES



Diaphragm Materials in Diaphragm Valves

Typical diaphragm materials and their main properties for use in diaphragm valves.

Material	Size		Temperature		Main uses
	in	mm	F	C	
Butyl rubber	0.6-14	15-350	-22 to 134	- 30 to 90	Acids and alkalies
Nitril rubber	0.6-14	15-350	14 to 134	-10 to 90	Oils, fats and fuels
Neprene	0.6-14	15-350	- 4 to 134	- 20 to 90	Oils, greases, air and radioactive fluids
Natural/syntetic rubber	0.6-14	15-350	- 40 to 134	-40 to 90	Abrasives, brewing and dilute mineral acids
White natural rubber	0.6-5	15-125	- 31 to 134	- 35 to 90	Fods and pharmaceuticals
White butyl	0.6-6	15-150	- 22 to 212	- 30 to 100	Natural color, food, plasticizers and pharmaceuticals
Viton	0.6-14	15-350	41 to 284	5 to 140	Hydrocarbon acids, sulphuric and chlorine applications
Hypalon	0.6-14	15-350	32 to 134	0 to 90	Acid and ozone resistant
Butyl rubber	0.6-14	15-350	- 4 to 248	-20 to 120	Hot water and intermittent steam services, sugar refining

CONTROL VALVES & PRESSURE REGULATORS:

-- Control valves automatically regulates temperature, pressure,level and flow rate for any process variables.

-- The control valve is usually chosen to be smaller than line size to avoid throttling and consequent rapid wear of the seat.

-- Globe pattern valves are normally used for control and their ends are usually flanged for ease of maintenance.The disc is moved by hydraulic,pneumatic or electrical operators.

-- Control valves of globe type which adjusts downstream pressure of liquid or gas to a set pressure is called as ***Pressure regulators.***

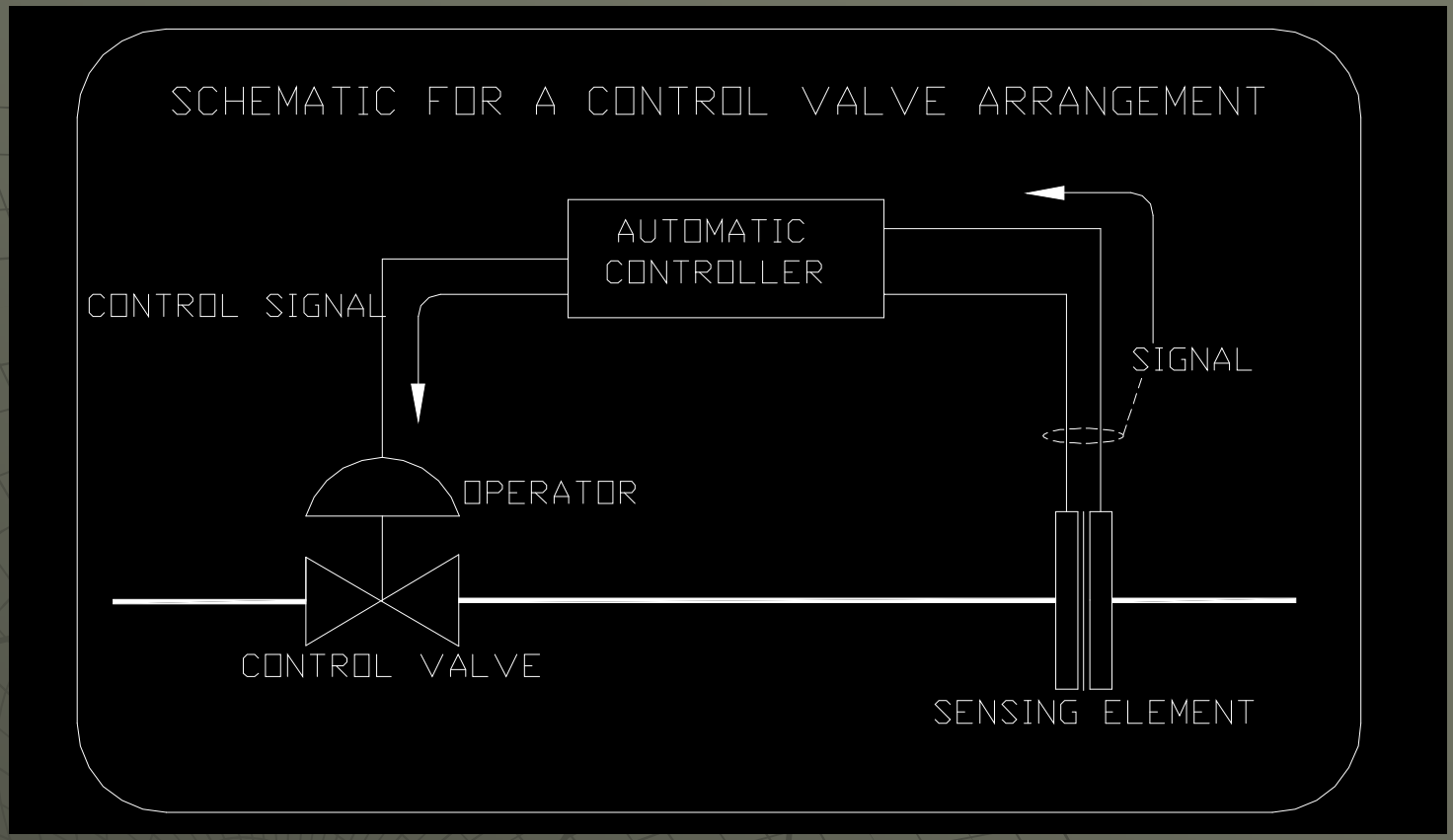


Fig shows how a control valve can be used to control the rate of flow in a line.

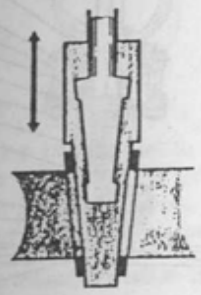
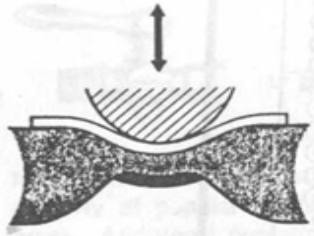
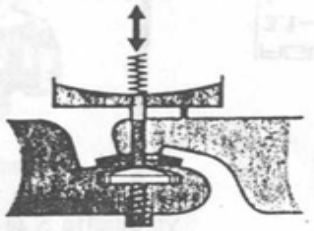
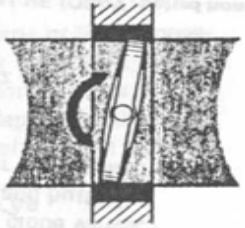
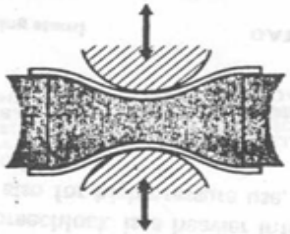
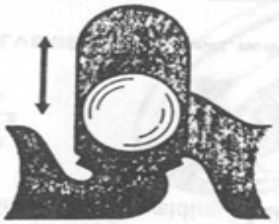
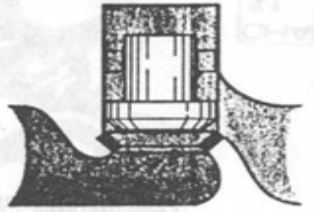
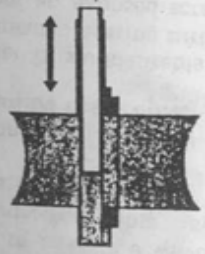
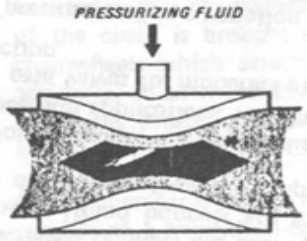
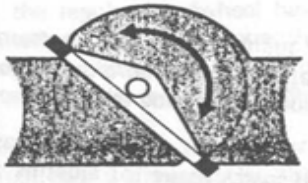
--Here flow rate is related to the pressure drop across the sensing element.

--The controller receives the pressure signals,compares them with the pressure drop for the desired flow and thus if the actual flow is different ,it adjusts the control valve to increase or decrease the flow.

BASIC VALVE MECHANISMS
FLUID CONTROL ELEMENTS (DISCS)

CHART 3.1

IN THESE SCHEMATIC DIAGRAMS, THE DISC IS SHOWN WHITE, THE SEAT IN SOLID COLOR, & THE CONVEYED FLUID SHADED.

OPERATED VALVES				SELF-OPERATED VALVES	
GATE	GLOBE	ROTARY	DIAPHRAGM	CHECK	REGULATING
 SOLID-WEDGE GATE	 GLOBE	 ROTARY-BALL	 DIAPHRAGM (SAUNDERS TYPE)	 SWING CHECK	 PRESSURE REGULATOR
 SPLIT-WEDGE GATE	 ANGLE GLOBE	 BUTTERFLY	 PINCH	 BALL CHECK	 PISTON CHECK
 SINGLE-DISC SINGLE-SEAT GATE	 NEEDLE	 PLUG or COCK	 *PRESSURIZING FLUID* *Central seat is optional SQUEEZE	 TILTING DISC CHECK	 STOP CHECK

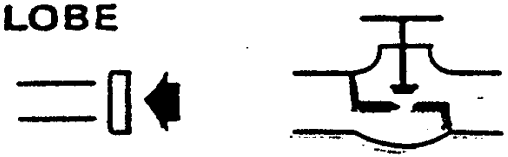
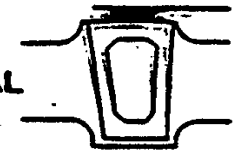
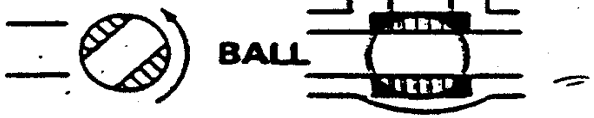
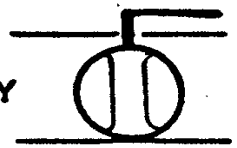
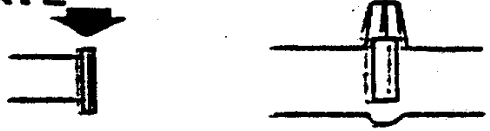
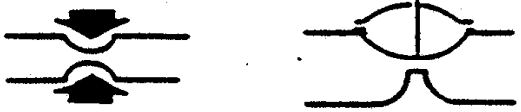
		ADVANTAGES	DISADVANTAGES
GLOBE 1		Best shut-off and regulating characteristics	High head loss
PLUG CONICAL		Quick acting. Straight through flow	Temperature limitations on PTFE sleeved valves and need for attention to 'lubricant' in lubricated valves
2 BALL		Quick acting. Straight through flow. Easy operation	Temperature limited by seating material
BUTTERFLY		Quick acting. Good regulating characteristics Compact	Metal to metal seated type does not give tight shut-off. Temperature limited by seating material on resilient seated type
GATE 3		Straight through flow	Slow acting. Bulky
DIAPHRAGM 4		Glandless. Positive shut-off on dirty fluids	Pressure and temperature limited by diaphragm material

Chart No. 2

VALVE SELECTION PROCESS:

-- The steps that follow provide a general procedure for selecting valve components,

1. Determine operation-on/off, regulating, special purpose.

2. Determine type of conveyed fluid-liquid,gas,slurry or powder.

3. Determine nature of fluid:

- ***Neutral services:*** Oil,Drinking water, Nitrogen, Gas, Air.
- ***Corrosive service:*** Acid,Alkaline.
- ***Hygienic services:*** Food,Drugs.
- ***Slurry:*** Suspension of solid particles in the fluid media.

4.Pressure and temperature of conveyed fluid.

5.Method of operating stem: consider closing time.

6.Cost.

7.Availability.

8.Installation problems:Such as welding valves into lines.

VALVE SELECTION BASED ON SERVICE

Valve Type	Duty	Service
Globe	1. Controlling flow, Starting and Stopping flow 2. Frequent Valve operation	1. Gases and liquids free of solids 2. Vacuum, Cryogenics 3. Critical service
Piston	Same as globe	1. Fluids with solids in suspension 2. Gases, liquids, Vacuum
Gate (Min Pressure drop)	1. Starting, Stopping 2. Infrequent Operation	1. Gases, liquids, Fluids with solids. 2. Vacuum, Cryogenics 3. Knife Gate – Slurry, fibre, powder granules etc. 4. Corrosive service
Ball (Quick Opening)	1. Moderate throttling 2. Flow diversion 3. Starting and Stopping	1. Gas, Liquid, Vacuum, Fire safe 2. Cryogenic 3. Non – abrasive slurry 4. Corrosion plus Pr / Temp
Plug (Positive Shut Off)	Same as ball	1. Gas, Liquid, Vacuum 2. Sticky fluid service, corrosive service 3. Abrasive & Non-abrasive slurry 4. Sanitary handling of pharma and food stuff
Butterfly (Not Bubble tight)	1. Start / Stop 2. Controlling Flow	1. Gas, Liquid, Vacuum, Where low pr. Drop is needed 2. Slurries, Powder, granules 3. Sanitary handling of pharma and food-stuff
Pinch	Same as butterfly	1. Liquid, Abrasive slurry, Corrosive resistance 2. Powder, granules 3. Sanitary handling of pharma and food stuff
Diaphragm	Same as butterfly	1. Gas, Liquids which may carry solids 2. Viscous fluids, Vacuum, Dry media 3. Abrasive slurry, Sludge, Volatile service. 4. Leak proof handling of hazardous fluids 5. Sanitary handling of pharma and food stuff
Needle	Close Manual Regulation of flow	1. High pr. Application 2. Small sizes.

TESTS CONDUCTED ON VALVES:

- Hydro tests
- Pneumatic Tests
- Fugitive Emission & Helium Leak Tests
- Cryogenic Tests
- Fire Tests
- Hot & Cold Cyclic Tests
- Seismic Tests
- Natural Frequency Tests
- Static Load Simulation
- Pipe End Reaction Tests

Fire Test

Valve after Cryogenic Test

TESTING FACILITIES:

Cryogenic Test Facility

42” Trunnion-mounted Ball Valve undergoing Hydro test

TERMS USED FOR VALVES SPECIFICATION:

1.Pressure-Temperature ratings:

It is the maximum allowable sustained non-shock pressure at the corresponding tabulated temperature

Reference standards: ANSI B 16.34 & ANSI B 16.5.

2.Class:

As per American standard,

Class 150#
Class 300#
Class 600#
Class 900#
Class 1500#
Class 2500#
Class 4500#

- Material Standards- **ASTM** (America Society for Testing and Materials)
- Dimensional Standards-**ANSI** (American National Standards Institute)
- Adapted by **ASME** (American Society for Mechanical Engineers)
- **The American Petroleum Institute (API)** Standards for Some Commonly used Valves are as follows:
- API 6D – Pipe Line Valves, End Closures, Connectors and Swivels
- API 6F – Recommended Practice for Fire Test valves
- API 593 – Ductile Iron Plug Valves – Flanged Ends
- API 598 – Valves Inspection and Test
- API 600 – Steel Gate Valves
- API 602 – Compact Design Carbon Steel Gate Valves
- API 604 – Ductile Iron Gate Valves – Flanged Ends
- API 607 – Fire Test for Soft Seated Ball Valves

The American Iron and Steel Institute (AISI), Standardsfor Some Commonly used Valves are as follows:

American Welding Society (AWS)

American Water Works Association (AWWA)

These Standards refer to the piping elements required for low pressure water services.

These are less stringent than other standards. Valves, Flanges etc., required for larger diameter water pipe lines are covered under this standard and are referred rarely by the piping Engineers.

C – 500 : Gate Valves for Water and sewage system

C – 510 : Cast Iron Sluice Gate Valves

C – 504 : Rubber Seated Butterfly Valves

C – 507 : Ball Valves 6″ to 48″

C – 508 : Swing Check Valves 2″ to 24″

C – 509 : Resilient Seated Gate Valves for Water and sewage

The Manufacturers Standardization Society of Valves and Fitting Industry – Standard Practices (MSS – SP):

In addition to the above standards and material codes, there are standard practices followed by the manufacturers and are widely used.

The most Common MSS-SP standards referred for Valves are as follows:

MSS – SP – 42 : Class 150 corrosion resistant gate, globe and check valves

MSS – SP – 61 : Pressure testing of valves

MSS – SP – 67 : Butterfly Valves

MSS – SP – 68 : High Pressure off seat butterfly valves

MSS – SP – 70 : Cast iron gate valves

MSS – SP – 71 : Cast iron check valves

MSS – SP – 72 : Ball Valves

MSS – SP – 78 : Cast iron plug valves

MSS – SP – 80 : Bronze gate, globe and check valves

MSS – SP – 85 : Cast iron globe valves

MSS – SP – 88 : Diaphragm valves

MSS – SP – 108 : Resilient seated eccentric CI plug valves

BRITISH STANDARDS (BS):

The following are some of British Standards referred by Indian Manufacturers for Valves:

BS 970 : Steel for Forging, Bars, Rods, valves steel, etc
BS 1212 : Specification for Float Operated Valves
BS 1414 : Gate Valves for Petroleum Industry
BS 1868 : Steel Check Valves for Petroleum Industry
BS 1873 : Steel Globe and Check Valves for Petroleum Industry
BS 2080 : Face to Face / End to End dimensions of Valves
BS 5150 : Cast Iron Wedge and Double Disc Gate Valves for general purposes
BS 5151 : Cast Iron Gate (Parallel slide) Valves for general purposes
BS 5152 : Cast Iron Globe and Check Valves for general purposes
BS 5153 : Cast Iron Check Valves for general purposes
BS 5154 : Copper alloy Globe, Gate and Check Valves
BS 5155 : Cast Iron and Cast Steel Butterfly Valves for general purposes

BS 5156 : Diaphragm Valves for general purposes
BS 5157 : Steel Gate (parallel slide) Valves for general purposes
BS 5158 : Cast Iron and Cast Steel Plug Valves for general purposes
BS 5159 : Cast Iron and Cast Steel Ball Valves for general purposes
BS 5160 : Flanged Steel Globe and Check Valves for general purposes
BS 5163 : Flanged Cast Iron Wedge Gate Valves, smaller than 2”NB
BS 5353 : Specification for Plug Valves
BS 5433 : Specifications for underground stop valves for water
BS 6364 : Specifications for Valves for Cryogenic services
BS 6755 : Testing of Valves
BS 6759 : Safety Valves

INDIAN STANDARDS : Bureau of Indian Standards (BIS)

Unlike American Standards, Indian Standards cover Dimensional and material Specifications under the same Standard Number:

The following are some of the commonly referred Indian standards by Piping Engineers:

IS 778 : Specification for Copper Alloy Gate, Globe and Check Valves

IS 780 : Specification for Sluice Valves – 50 NB to 300 NB

IS 2906 : Specification for Sluice Valves – 350 NB to 1200 NB

IS 4038 : Specifications for Foot Valves

IS 5312 : Specification for Check Valves

IS 6157 : Inspection and Testing of Valve

IS 10605 : Steel Globe Valves for Petroleum Industries

IS 10611 : Steel Gate Valves for Petroleum Industries

IS 10805 : Foot Valves

IS 11790 : Code of practice for preparation of Butt welding ends for valves, flanges and fittings

IS 11792 : Steel Ball Valves for Petroleum Industry

IS 13095 : Butterfly Valves

DIN standards of Germany and JIS standards of Japan.

ERECTION TIPS:

- Gate/ Globe Stem to be erected in vertical direction to avoid the chances of leakage.
- Check Valve to be erected in Horizontal and according to the flow of direction marked in the valve.
- While lifting Higher size Gate valves, Integral By-pass lines should not be used for lifting purpose.
- If Valves are tested with water, Valve internals to be dried by Nitrogen/ Air.

Quality needs:

- ISO 9001-2000.
- API Spec Q1.
- API 6A.
- API 6D (Product Specification).
- IBR.

IF THERE IS NO P&ID .....

- Provide valves at headers, pumps, equipment, etc., to ensure that the system will be pressure-tight for hydrostatic testing, and to allow equipment to be removed for maintenance without shutting down the system
- Provide isolating valves in all small lines branching from headers—for example, see figure 6.12
- Provide isolating valves at all instrument pressure points for removal of instruments under operating conditions
- Provide valved drains on all tanks, vessels, etc., and other equipment which may contain or collect liquids
- Protect sensitive equipment by using a fast-closing check valve to stop backflow before it can gather momentum
- Consider butt-welding or ring-joint flanged valves for lines containing hazardous or 'searching' fluids. Hydrogen is especially liable to leak
- Consider seal welding screwed valves if used in hydrocarbon service —see chart 2.3 (inset sketch)
- Provide sufficient valves to control flows

- Consider providing a concrete pit (usually about 4 ft x 4 ft) for a valve which is to be located below grade
- Consider use of temporary closures for positive shutoff—see 2.7
- Provide a bypass if necessary for equipment which may be taken out of service
- Provide a bypass valve around control stations if continuous flow is required. See 6.1.4 and figure 6.6. The bypass should be at least as large as the control valve, and is usually globe type, unless 6-inch or larger, when a gate valve is normally used (see 3.1.4, under 'Gate valve')
- Provide an upstream isolating valve with a small valved bypass to equipment which may be subject to fracture if heat is too rapidly applied on opening the isolating valve. Typical use is in steam systems to lessen the risk of fracture of such things as castings, vitreous-lined vessels, etc.
- Consider providing large gate valves with a valved bypass to equalize pressure on either side of the disc to reduce effort needed to open the valve


Thank You