

VALVES (GATE AND GLOBE VALVES)



PRESENTED BY
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EMP # 1140

CONTENTS OF PRESENTATION

- What is valve?
- Classification of valves
- Major valve parts
- Gate valve
- Globe valve
- Ends of valves
- Valves operating devices
- Selection of valve
- Valves component materials
- Valves manufacturing methods and their materials
- Valves inspection and testing
- Codes and Standards



What is Valve?

A device that regulates the flow of (either gases, fluidized solids, slurries or liquids) by opening, closing or partially obstructing various passageways.

CLASSIFICATION OF VALVES

- CLASSIFICATION BASED ON MECHANICAL MOTION
 - Linear motion valve
 - Rotary motion valve
 - Quarter turn valve
- CLASSIFICATION BASED ON VALVE SIZE
 - Small valves (NPS 2 and smaller)
 - Large valves (NPS 2 1/2 and larger)
- CLASSIFICATION BASED ON PRESSURE-TEMP RATING
 - Class rating
 - Cold working pressure (CWP) rating OR Water-oil-gas rating
 - General service rating
 - Steam working pressure rating (SWP) rating
 - Dual or multiple rating

CLASSIFICATION OF VALVES

■ CLASSIFICATION BASED ON FUNCTION

■ Isolation

Gate valve, Ball valve, Butterfly valve, Diaphragm valve

■ Control (flow/pressure)

Globe valve, Ball valve, Butterfly valve, Diaphragm valve

■ Prevention of flow reversal

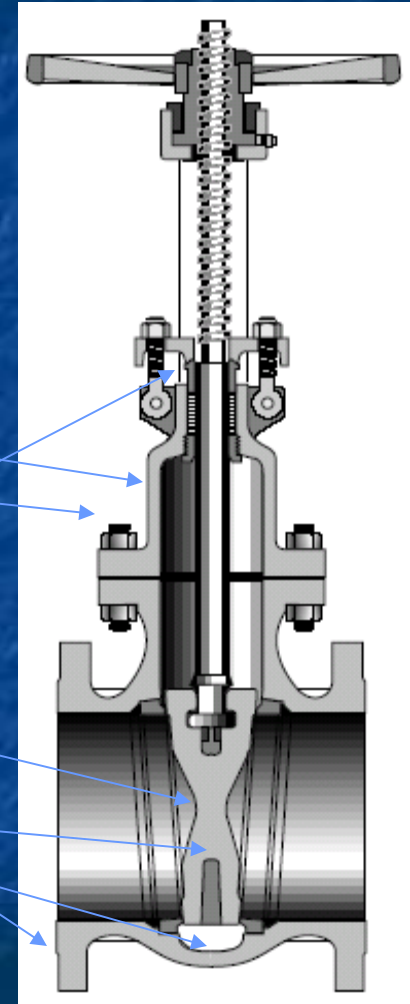
Check valve (swing, lift, piston, etc.)

■ Flow diversion

Ball valve, Plug valve, Angle valve (Three way, Four way, etc.)

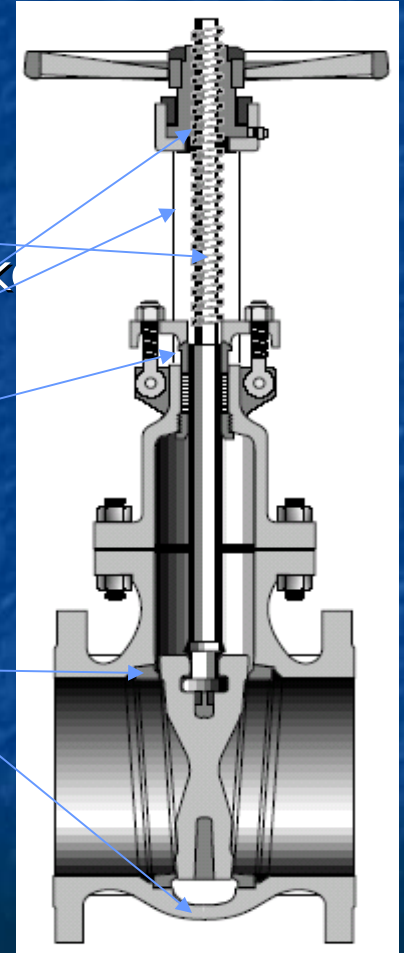
MAJOR VALVE PARTS

- PRESSURE RETAINING PARTS
 - Body
 - Bonnet or cover
 - Bonnet or cover bolting
 - Disc
 - Valve trim
 - Valve seat(s)
 - Disc
 - Glands etc.



MAJOR VALVE PARTS

- Non-pressure retaining parts
 - Valve seat(s)
 - Valve stem
 - Rising stem with outside screw and yoke
 - Rising stem with inside screw
 - Non-rising stem with inside screw
 - Sliding stem
 - Rotary stem
 - Stem packing
 - Back seat
 - Yoke
 - Yoke bushing



GATE VALVE



GATE VALVE

■ INTRODUCTION

A gate valve is a valve that opens by lifting a round or rectangular gate out of the path of the fluid. Gate valves are sometimes used for regulating flow, but many are not suited for that purpose, having been designed to be fully opened or closed. When fully open, the typical gate valve has no obstruction in the flow path, resulting in very low friction loss

YOKE SLEEVE NUT

YOKE

YOKE SLEEVE

BONNET BUSHING

GATE (DISK)

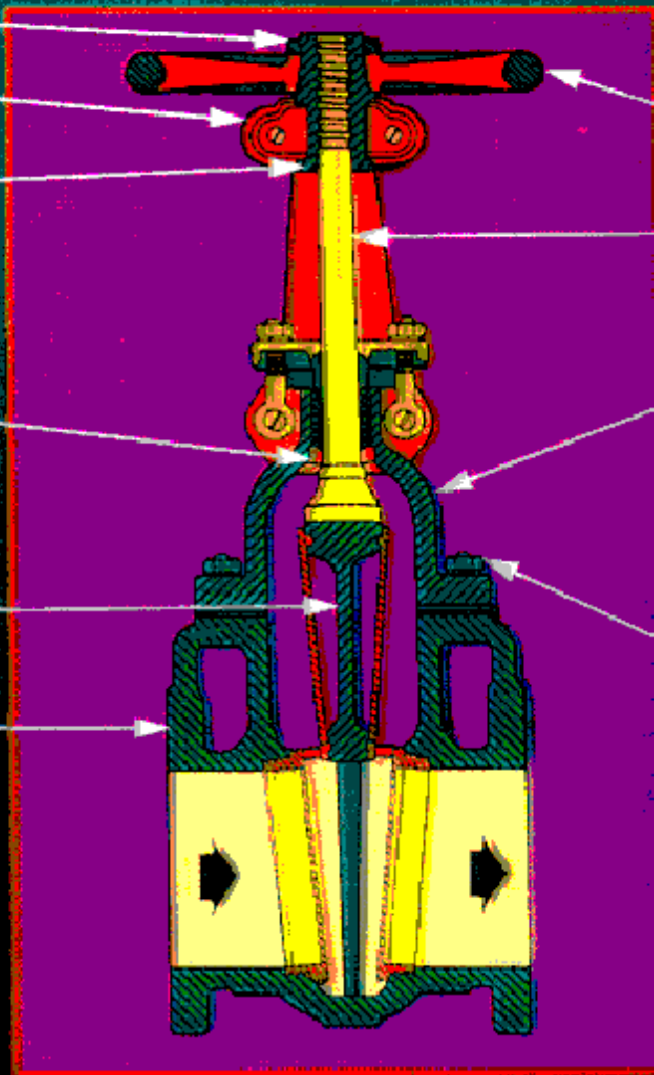
BODY

WHEEL

STEM

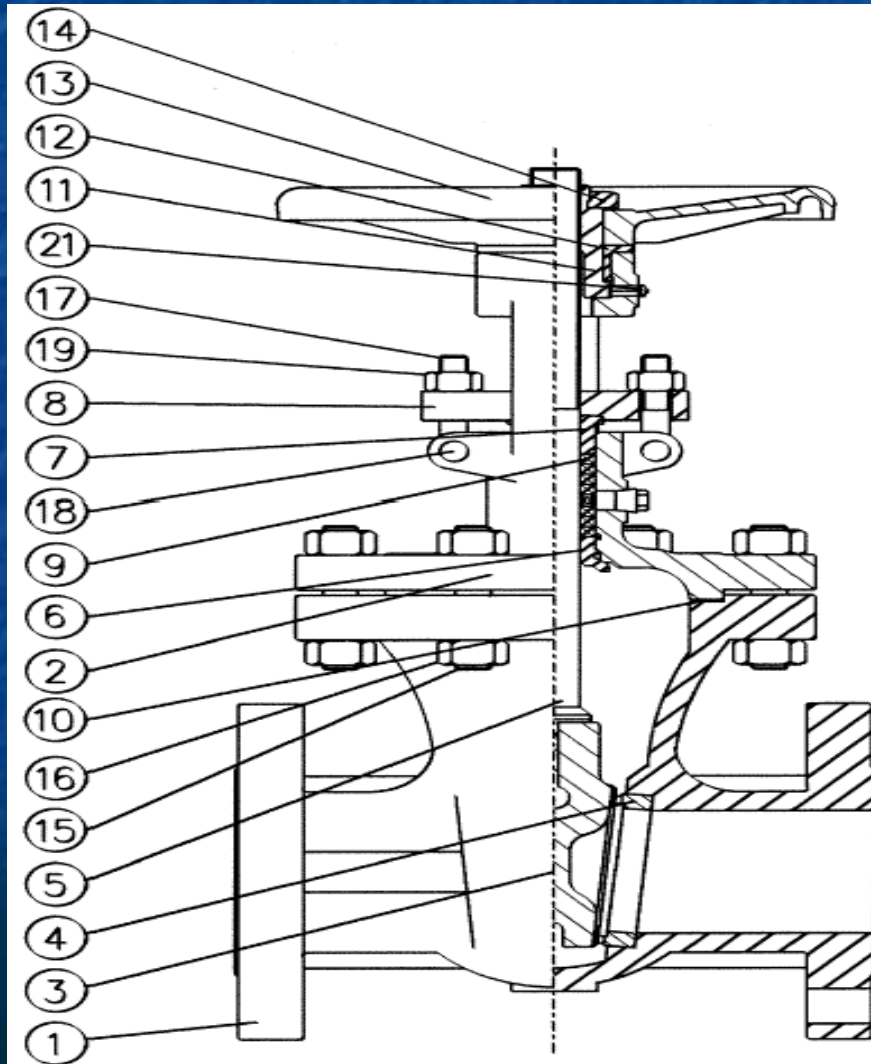
BONNET

**BODY BONNET
BOLTS**



CUTAWAY VIEW OF A GATE STOP VALVE (rising stem)

OUTSIDE SCREW AND YOKE GATE VALVE(API 600)

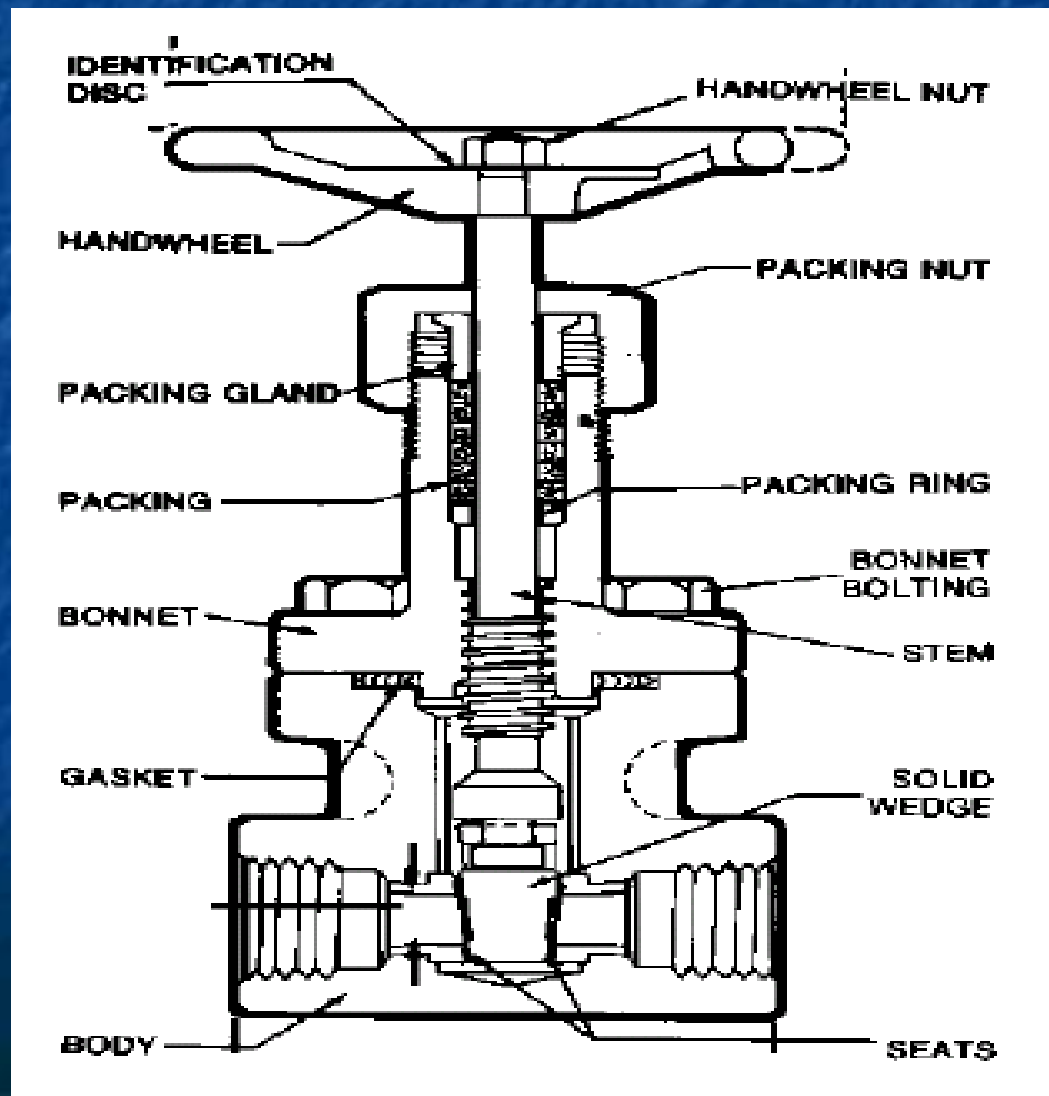


No.	Part Name
1	Body
2	Bonnet
3	Wedge Disc
4	Seat Ring
5	Stem
6	Backseat Bushing
7	Gland Bushing
8	Gland Flange
9	Packing
10	Gasket
11	Yoke Sleeve
12	Retainer Nut
13	Handwheel
14	Handwheel Nut
15 / 16	Stud Bolt / Hex Nut
17	Eyebolt
18	Pin
19	Hex Nut
21	Grease Fitting

STANDARD MATERIALS OF CONSTRUCTION (API 600)

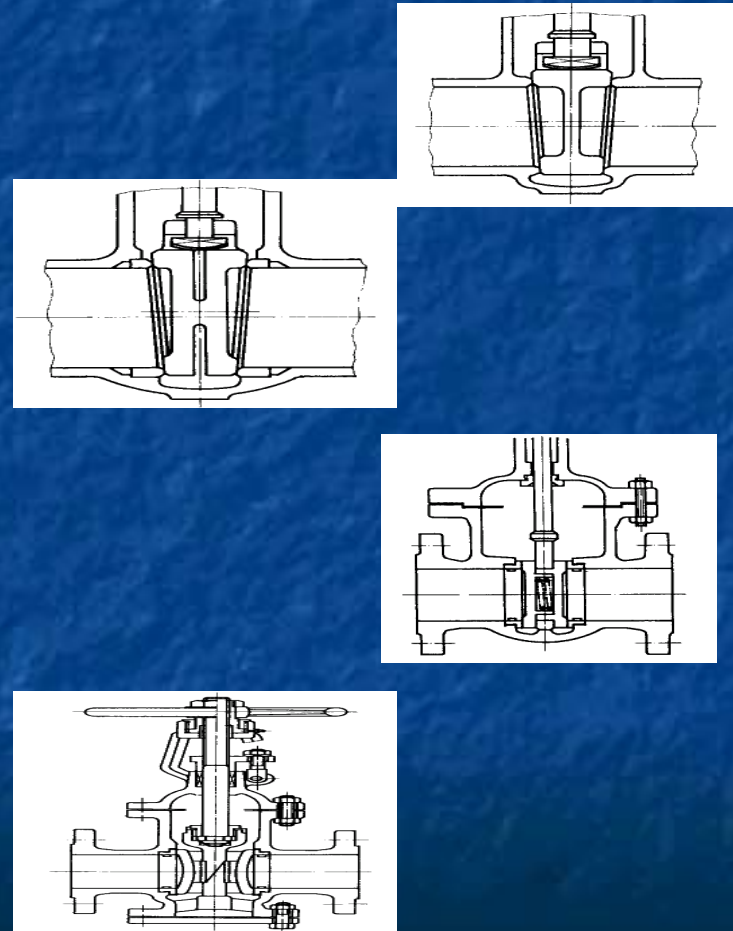
Part	ANSI B16.34 Material Group										
	Carbon Steel	C-Mn Steel	Alloy Steel								
	1.1	1.2	1.9	1.10	1.13						
Body / Bonnet	A216 Gr. WCB	A352 Gr. LCC	A217 Gr. WC6	A217 Gr. WC9	A217 Gr. C5						
Gland Bushing	← 13% Chromium ASTM A182 Gr. F6a →										
Stud Bolts & Hex Nuts	B7 / 2H	L7 / 7	← ASTM A193 Gr. B16 / ASTM A194 Gr. 2H →								
Yoke / Gland Flange	← Carbon Steel →										
Yoke Sleeve	← Austenitic Ductile Iron ASTM A439 Type D2 →										
Retainer Nut	← Carbon Steel →										
Handwheel	← Ductile / Malleable Iron →										
Handwheel Nut	← Carbon Steel →										
Gland Eyebolts & Nuts	← Carbon Steel ASTM A307 Gr. B →										
Part	Corrosion Resistant Steel										
	2.1		2.2		3.17						
Body / Bonnet	A351 Gr. CF8	A351 Gr. CF3	A351 Gr. CF8M	A351 Gr. CF3M	A351 Gr. CN7M						
Gland Bushing	304SS	304L SS	316SS	316L SS	Alloy 20						
Stud Bolts & Hex Nuts	← Corrosion Resistant Steel ASTM A193 Gr. B8 / A194 Gr. 8 →										
Yoke / Gland Flange	← Corrosion Resistant Steel →										
Yoke Sleeve	← Austenitic Ductile Iron ASTM A439 Type D2 →										
Retainer Nut	← Carbon Steel →										
Handwheel	← Ductile / Malleable Iron →										
Handwheel Nut	← Carbon Steel →										
Gland Eyebolts & Nuts	← Corrosion Resistant Steel ASTM A193 Gr. B8 / ASTM A194 Gr. 8 →										
Note: Other materials available upon request.											
Trim Materials											
Part	API Trim No.										
	1	2	5	8	9	10	11	12	13	14	15
Wedge Disc	F6	304SS	HF	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	HF
Seat Ring	F6	304SS	HF	HF	Ni-Cu	316SS	HF	HF	Alloy 20	HF	HF
Stem	F6	304SS	F6	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	304SS
Backseat	F6	304SS	F6	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	304SS
Part	API Trim No.			DPV Trim No.							
	16	17	18	A	B	C	D	E	F	G	H
Wedge Disc	HF	HF	HF	HF	Bronze	F6	304SS	316SS	Ni-Cu	Alloy 20	Bronze
Seat Ring	HF	HF	HF	HF	Bronze	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE
Stem	316SS	347SS	Alloy 20	Ni-Cu	Brass	F6	304SS	316SS	Ni-Cu	Alloy 20	Brass
Backseat	316SS	347SS	Alloy 20	Ni-Cu	Brass	F6	304SS	316SS	Ni-Cu	Alloy 20	Brass

INSIDE SCREW STEM GATE VALVE(API 602)



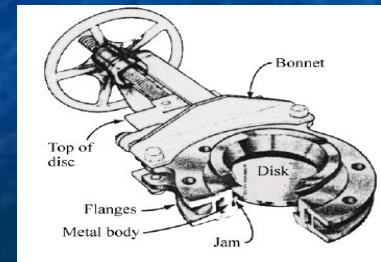
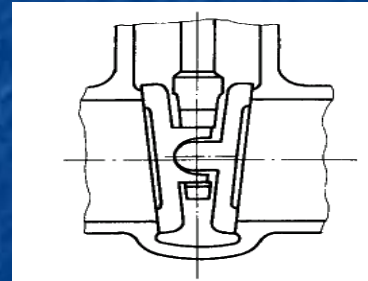
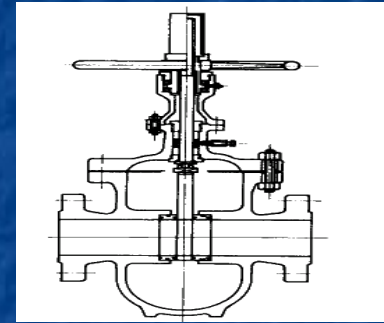
TYPES OF GATE VALVE

- Solid wedge type
 - Solid plain type
 - Solid flexible type
- Parallel type
 - Slide type
 - Double disc



TYPES OF GATE VALVE

- Conduit type
 - Parallel faced disc
- Split wedge
- Knife gate



ADVANTAGES & DISADVANTAGES OF GATE VALVE

■ ADVANTAGES

- Pressure drop through the valve is minimal.
- Good shutoff characteristics.
- Operation torque is smaller than those of globe valves.

■ DISADVANTAGES

- Cannot be throttled.
- Not suitable for frequent switch-on/off operation.
- Requires large space envelope for installation, operation and maintenance.
- Repair or machining of valve seats in place is difficult.

Typical Usage of Gate Valve

- Block valve for control valve
- Pump suction valve
- Pump discharge valve
- Block valve for level controller & level gauge
- Drain valve of equipment
- Drain valve of process & utility line
- First block valve of sampling nozzle
- Block valve for safety valve
- Block valve for equipment
- Block valve for steam trap
- By-pass valve for emergency shut-down valve
- Flow control valve for large size gas & city water line

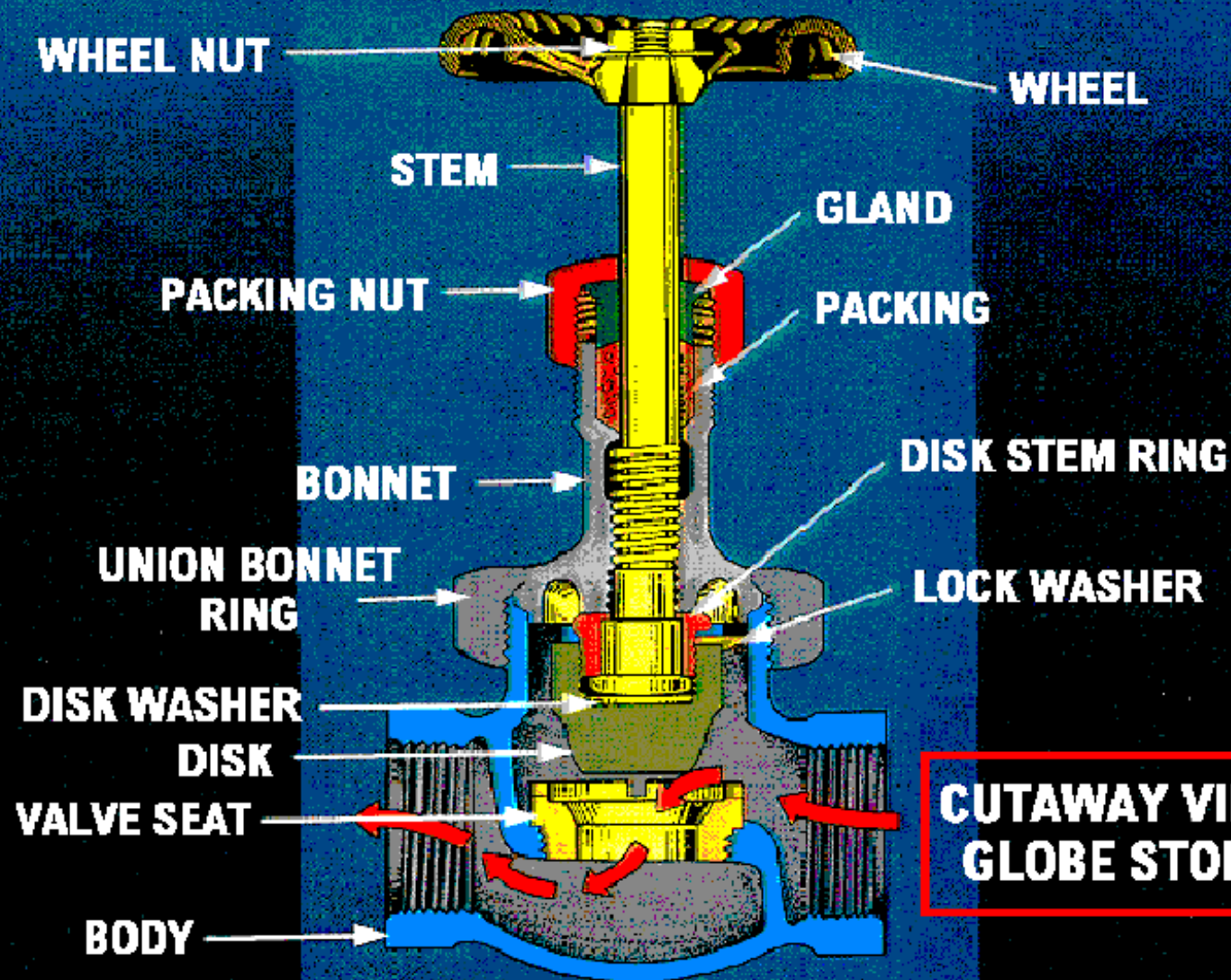
GLOBE VALVE



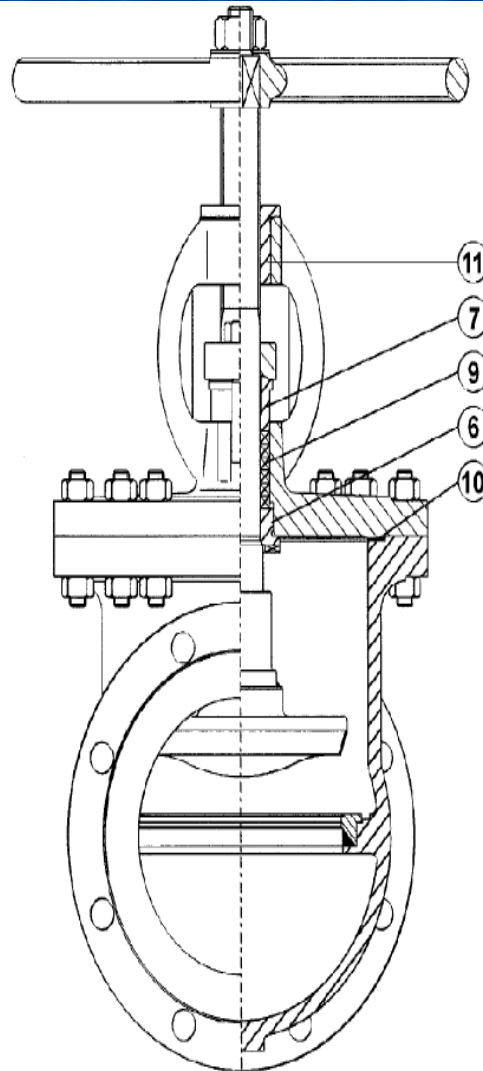
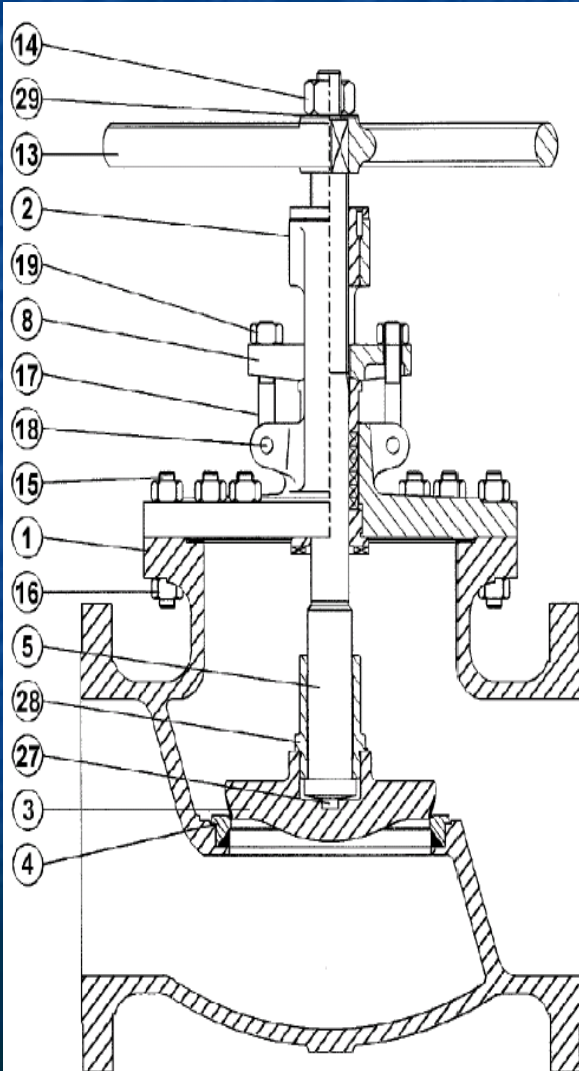
GLOBE VALVE

- INTRODUCTION

Globe valves are named for their spherical body shape. The two halves of the valve body are separated by a baffle with a disc in the center. Globe valves operate by screw action of the handwheel. They are used for applications requiring throttling and frequent operation. Since the baffle restricts flow, they're not recommended where full, unobstructed flow is required.



OUTSIDE SCREW AND YOKE GLOBE VALVE (API 600)



No.	Part Name
1	Body
2	Bonnet
3	Disc
4	Seat Ring
5	Stem
6	Backseat Bushing
7	Gland Bushing
8	Gland Flange
9	Packing
10	Gasket
11	Yoke Bushing
13	Handwheel
14	Handwheel Nut
15 / 16	Stud Bolt / Hex Nut
17	Eyebolt
18	Pin
19	Hex Nut
27 / 28	Disc Washer / Nut
29	Washer

STANDARD MATERIALS OF CONSTRUCTION

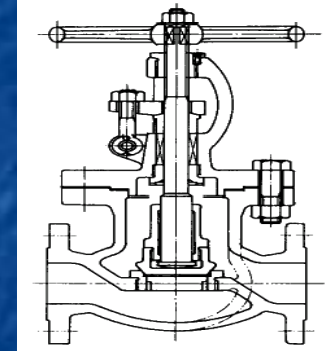
Part	ANSI B16.34 Material Group				
	Carbon Steel	C-Mn Steel	Alloy Steel		
	1.1	1.2	1.9	1.10	1.13
Body / Bonnet	A216 Gr. WCB	A352 Gr. LCC	A217 Gr. WC6	A217 Gr. WC9	A217 Gr. C5
Gland Bushing	← 13% Chromium ASTM A182 Gr. F6a →				
Stud Bolts & Hex Nuts	B7 / 2H	L7 / 7	← ASTM A193 Gr. B16 / ASTM A194 Gr. 2H →		
Yoke / Gland Flange	← Carbon Steel →				
Yoke Bushing	← Austenitic Ductile Iron ASTM A439 Type D2 →				
Handwheel	← Ductile / Malleable Iron →				
Handwheel Nut	← Carbon Steel →				
Gland Eyebolts & Nuts	← Carbon Steel ASTM A307 Gr. B →				
Part	Corrosion Resistant Steel				
	2.1		2.2		3.17
	A351 Gr. CF8	A351 Gr. CF3	A351 Gr. CF8M	A351 Gr. CF3M	A351 Gr. CN7M
Body / Bonnet	304SS	304L SS	316SS	316L SS	Alloy 20
Gland Bushing	← Corrosion Resistant Steel ASTM A193 Gr. B8 / ASTM A194 Gr. 8 →				
Stud Bolts & Hex Nuts	← Corrosion Resistant Steel →				
Yoke / Gland Flange	← Corrosion Resistant Steel →				
Yoke Bushing	← Austenitic Ductile Iron ASTM A439 Type D2 →				
Handwheel	← Ductile / Malleable Iron →				
Handwheel Nut	← Carbon Steel →				
Gland Eyebolts & Nuts	← Corrosion Resistant Steel ASTM A193 Gr. B8 / ASTM A194 Gr. 8 →				

Note: Other materials available upon request.

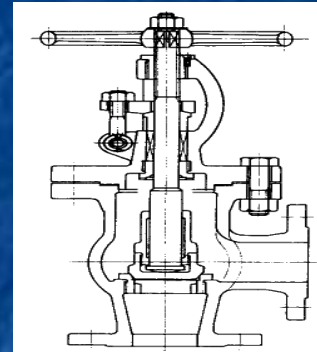
Trim Materials											
Part	API Trim No.										
	1	2	5	8	9	10	11	12	13	14	15
Disc	F6	304SS	HF	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	HF
Seat Ring	F6	304SS	HF	HF	Ni-Cu	316SS	HF	HF	Alloy 20	HF	HF
Stem	F6	304SS	F6	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	304SS
Backseat	F6	304SS	F6	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	304SS
Washer / Nut	F6	304SS	F6	F6	Ni-Cu	316SS	Ni-Cu	316SS	Alloy 20	Alloy 20	304SS
Part	API Trim No.			DPV Trim No.							
	16	17	18	A	B	C	D	E	F	G	H
Disc	HF	HF	HF	HF	Bronze	F6	304SS	316SS	Ni-Cu	Alloy 20	Bronze
Seat Ring	HF	HF	HF	HF	Bronze	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE
Stem	316SS	347SS	Alloy 20	Ni-Cu	Brass	F6	304SS	316SS	Ni-Cu	Alloy 20	Brass
Backseat	316SS	347SS	Alloy 20	Ni-Cu	Brass	F6	304SS	316SS	Ni-Cu	Alloy 20	Brass
Washer / Nut	316SS	347SS	Alloy 20	Ni-Cu	Brass	F6	304SS	316SS	Ni-Cu	Alloy 20	Brass

TYPES OF GLOBE VALVE

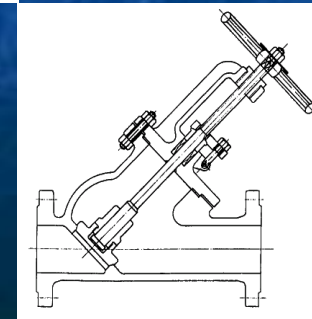
- Straight type



- Angle type

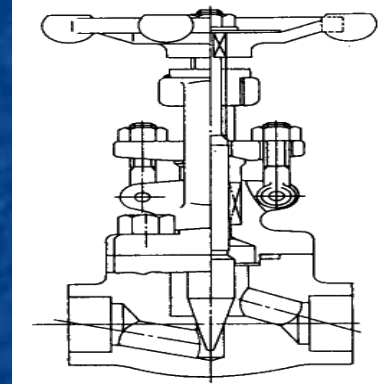


- Y-type

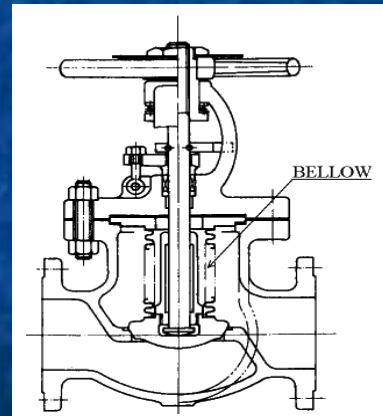


TYPES OF GLOBE VALVE

- Needle



- Below sea



ADVANTAGES & DISADVANTAGES OF GLOBE VALVE

■ ADVANTAGES

- Good shutoff capability
- Moderate to good throttling capability
- Easy to machine or resurface the seats
- Flow rate and pressure can be regulated.
- Frequent switch on/off operation can be carried out

■ DISADVANTAGES

- Pressure loss is large
- Turbulent flow likely to occur
- Operating torque is larger than that of gate valve

USAGE OF GLOBE VALVE TYPICAL

- Manual flow control valve
- By-pass valve for control valve
- Hose connection
- Vent valve of equipment and piping
- Minimum flow line for pump
- Pressure gauge outlet
- By-pass line of reciprocating compressor

TYPES OF ENDS OF VALVE

- Butt welding ends



- Flanged ends



- Socket welding ends



- Threaded ends



VALVE OPERATING DEVICES

- Manual
 - Handwheel or lever is directly connected to the stem and is operated by hand
- Hydraulic
 - Hydraulic pressure is applied to one side of a piston which is connected to the stem of the valve
- Motor
 - A hydraulic, electric, or air driven motor is used to turn the stem of the valve
- Solenoid
 - Uses an electromagnet to open or close a valve against spring pressure

SELECTION OF VALVE

- Identify application characteristics
- Select type of valve required
- Select valve size
- Select valve end connection
- Select valve body, bonnet and trim materials
- Identify seat-leakage criteria
- Identify requirements for valve-stem packing arrangement
- Be-aware of piping layout and valve orientation
- Taken into consideration maintenance requirements
- Initial cost

VALVE SELECTION BASED ON FLUID PHASE AND TYPE AND THE FUNCTION THE VALVE PERFORMS

Nature of Fluid	Valve Function	Type of Disc
Liquid Phase		
Neutral (water, oil, etc.)	On/off	Gate Rotary ball Plug Diaphragm Butterfly Plug gate
	Regulating	Globe Butterfly Plug gate Diaphragm Needle
Corrosive (acid, alkaline)	On/off	Gate Plug gate Rotary ball Plug Diaphragm Butterfly
	Regulating	Globe Diaphragm Butterfly Plug gate
Hygienic (food, beverages, drugs)	On/Off	Butterfly Diaphragm
	Regulating	Butterfly Diaphragm Squeeze Pinch
Slurry	On/off	Rotary ball Butterfly Diaphragm Plug Pinch Squeeze
	Regulating	Butterfly Diaphragm Squeeze Pinch Gate
Fibrous suspensions	On/off, regulating	Gate Diaphragm Squeeze Pinch

VALVE SELECTION BASED ON FLUID PHASE AND TYPE AND THE FUNCTION THE VALVE PERFORMS

Gas Phase		
Neutral (air, steam)	On/off	Gate Globe Rotary ball Plug Diaphragm
	Regulating	Globe Needle Butterfly Diaphragm Gate
Corrosive (acid vapors, chlorine)	On/off	Butterfly Rotary ball Diaphragm Plug
	Regulating	Butterfly Globe Needle Diaphragm
Vacuum	On/off	Gate Globe Rotary ball Butterfly
Solid (powder) Phase		
Abrasive powder (silica)	On/off, regulating	Pinch Squeeze Spiral sock
Lubricating powder (graphite, talcum)	On/off, regulating	Pinch Gate Spiral sock Squeeze

MATERIALS FOR COMPONENTS OF VALVE

- Components of valve are generally made of metallic and non-metallic materials

- METALLIC COMPONENTS
 - Pressure containing components and with areas in contact with the process material, such as body and bonnet.
 - Non-pressure containing but inside a pressure containing envelope and with areas in contact with the process material, such as the stem or seat.
 - Outside a pressure containing envelope, such as hand wheel, bolts, nameplate, support, cover plate.

MATERIALS FOR COMPONENT OF VALVE

■ NON-METALLIC COMPONENTS

- Primary seals-pressure containing and wetted.
- Secondary seals-pressure retaining and partially wetted.
- Soft seats-pressure containing and wetted
- Gaskets-pressure containing and partially wetted

METHODS OF MANUFACTURING OF VALVE

- Casting method
- Forging method

MATERIALS FOR CASTING

	Carbon Steel	CA-15	High Temp.	High Temp.	304-S.S	316-S.S	Hastelly-8	304L-S.S	316L-S.S	Low Temp.	Hight	Temp.
ASTM Std	A-216	A-217	A-217	A-217	A-351	A-351	A-494	A-351	A-351	A-352	A-217	A-217
Grade	WCB	CA-15	WC6	WC9	CF8	CF8M	N-12MV	CF3	CF3M	LCB	C5	C12
C% Max.	0.30	0.15	0.20	0.18	0.08	0.08	0.12	0.03	0.03	0.30	0.20	0.20
Mn %	1.00Max	1.00	0.50-0.80	0.40-0.70	1.50	1.50	1.00	1.50	1.50	1.00	0.40-0.70	0.35-0.65
P% Max	0.04	0.040	0.04	0.04	0.04	0.04	0.040	0.04	0.04	0.05	0.040	0.040
S% Max	0.045	0.040	0.045	0.045	0.04	0.04	0.030	0.04	0.04	0.06	0.045	0.045
Ni%	0.50	1.00	-	-	8.00	9.00	Bal	8.00-12.0	9.00-13.0	-	-	-
Cr%	0.40	11.5-14.0	1.00-1.50	2.00-2.75	18.0-21.0	18.0-21.0	1.00	17.0-21.0	17.0-21.1	-	4.0-6.50	8.00-10.00
Mo%	0.25	-	0.45-0.65	0.90-1.20	-	2.00-3.00	26.0-30.0	2.00-3.00	2.00-3.00	-	0.45-0.65	0.90-1.20
Cu	0.0	-	-	-	-	-	-	-	-	-	-	-
Si	0.30	1.50	0.60	0.60	2.00	2.00	1.00	1.50	1.50	0.60	0.75	1.00
Fe	-	-	-	-	-	-	4.0-6.0	-	-	-	-	-
V	-	-	-	-	-	-	0.20-0.60	-	-	-	-	-

MATERIALS FOR FORGING

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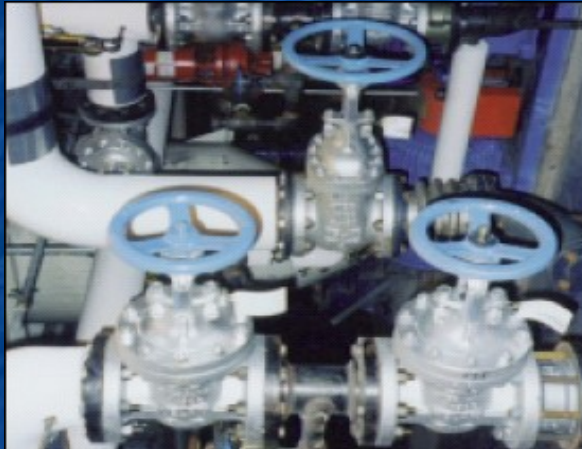
VALVE INSPECTION & TESTING (API 598)

- Shell test
- Backseat test
- Low-pressure closure test
- High-pressure closure test
- Visual examination of casting
- High-pressure pneumatic shell test



After assembly, pressure testing of shell, seats, packing and backseat to API 598.

INDUSTRIAL EXAMPLES



CODES & STANDARDS

- **API 600**

- **Steel Valves - Flanged & Buttwelding Ends**

- API 600 is the primary steel gate valve purchase specification. Valve design and construction criteria are detailed, as well as materials and trim designations.

- **API 602**

- **Compact Steel Gate Valves- Flanged, Threaded, Welding and Extended-Body Ends**

- API 602 is the 4" & smaller forged steel gate valve purchase specification. Valve design and construction criteria are detailed, as well as materials and trim designations.

- **ASME/ANSI B16.34**

- **Steel Valves - Flanged & Buttwelding Ends**

- ASME B16.34 is the base document from which steel valve pressure/temperature ratings are derived. It also offers additional valve specification data including nondestructive examination procedures for upgrading valves to Special Class

- **API 598**

- **Valve Inspection & Testing**

- API 598 covers the testing and inspection requirements for gate, globe, check, ball, plug & butterfly valves. Steel valve pressure ratings found in ASME/ANSI B16.34 are required to determine API 598 test pressures for steel valves.