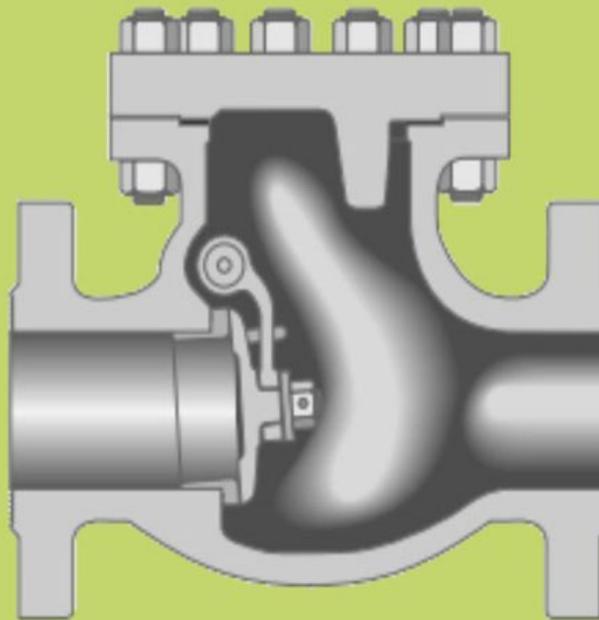


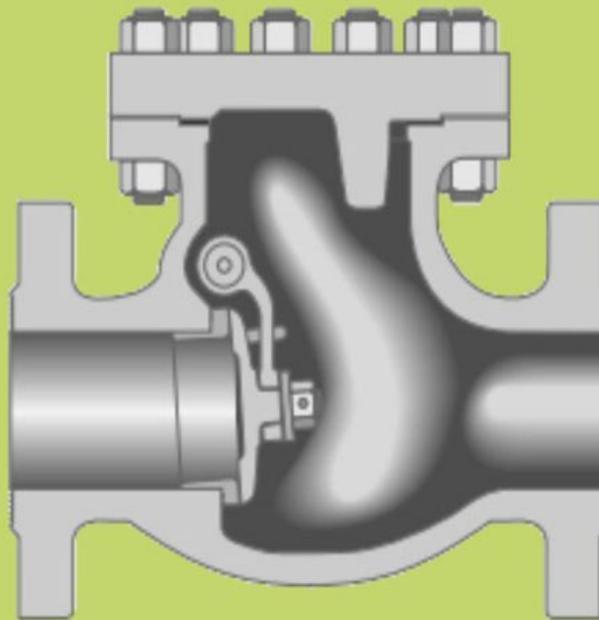
# Types of Valves in Piping



**Gustavo Cinca**

**Types of Valves - Tables to estimate man hours of assembly**

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# **Types of Valves in Piping**

Gustavo Cinca

Published by Gustavo Cinca, 2019

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TYPES OF VALVES IN PIPING

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# **Chapter 1: Introduction.**

This publication describes the types of traditional valves used in piping systems and includes Tables with records of the direct labor required for their assembly.

Valves are mechanical devices that control the flow and pressure within a system or process and are essential components of a piping system that carries liquids, gases, vapors, sludge, etc....

There are different types of valves available; for example gate, globe, spherical, butterfly, retention, diaphragm, pressure relief, control, etc. Each of these types has a model number that defines its unique characteristics and functional capabilities.

Valves are expensive items, and it is essential that the valve to be used in each piping system is specified correctly.

In this manuscript, we give a screenshot on the valves, their characteristics, and their assembly times.

Author's Website <http://calculatemanhours.com/>

## **Chapter 2: General information about valves.**

We define a valve as a device by which the flow of a fluid can be started, cut, or regulated by a moving part that opens or obstructs its passage.

The valve variations available for use in piping systems are extensive.

This is related to the wide range of functions that valves perform, the diversity of fluids transported in piping systems, and the different environmental conditions under which valves perform these tasks.

Characteristics of valves:

- Basic parts.
- Functions of valves.
- Valve models.
- Installation of valves.

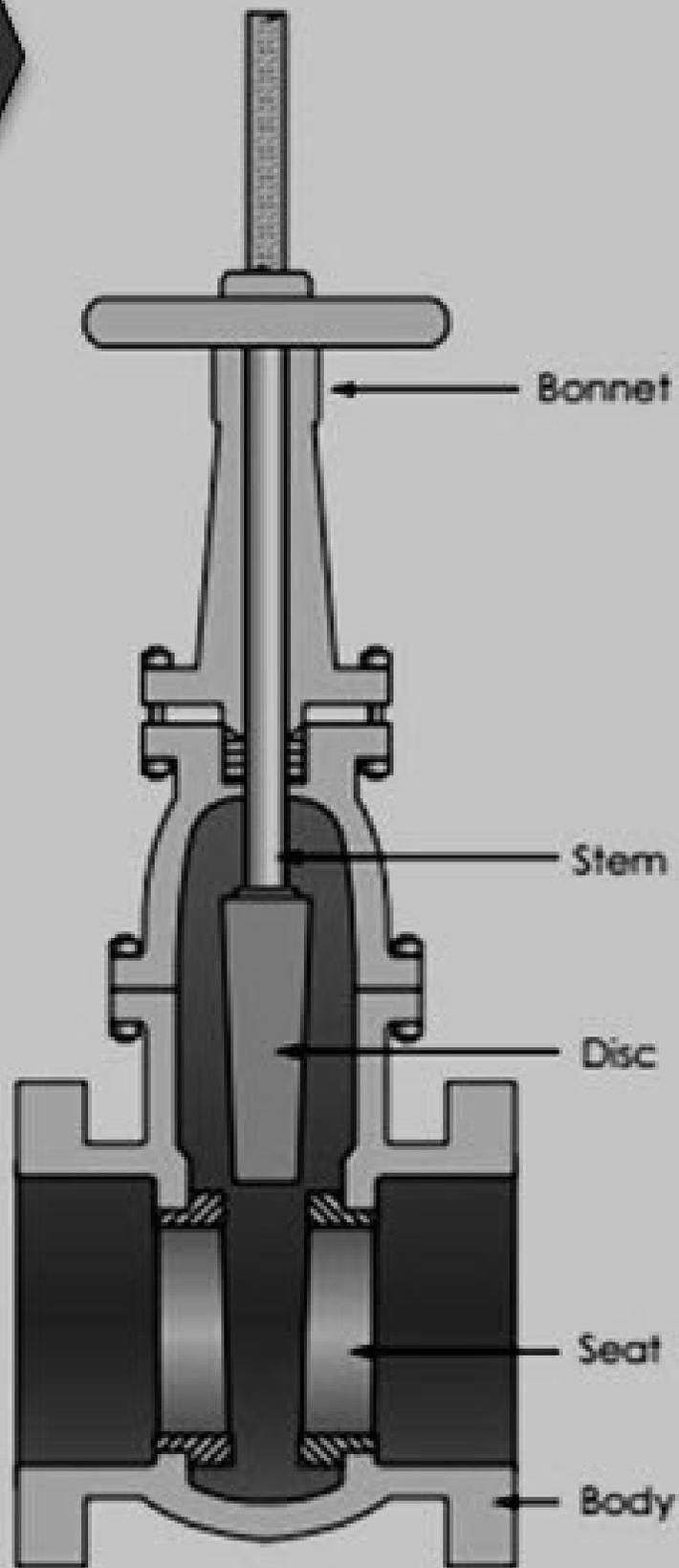
- Valve specification.

## **Basic parts of a valve**

Despite large differences in the valve design, we can identify common parts.

**See figure N°1**

1



## **The body**

The body is the primary structure of the valve that contains or to which the other parts of the valve are attached. The body must possess sufficient mechanical resistance and resistance to corrosion, erosion, fluid temperatures, and external temperatures to meet the service conditions.

The material from which the valve body is manufactured is critical in this regard and common materials in use include carbon steel, low alloy steel, bronze, brass, stainless steel, and monel metal.

## **The disc, the seat, and the orifice.**

The disc, seat, and orifice arrangement are the means of controlling the flow of fluids through the valve. Regardless of shape and arrangement, the disc is the moving part that directly controls the flow. The stationary part on which the disc rests is called the seat, and the orifice is the maximum internal opening through which fluids can pass.

## **The stem.**

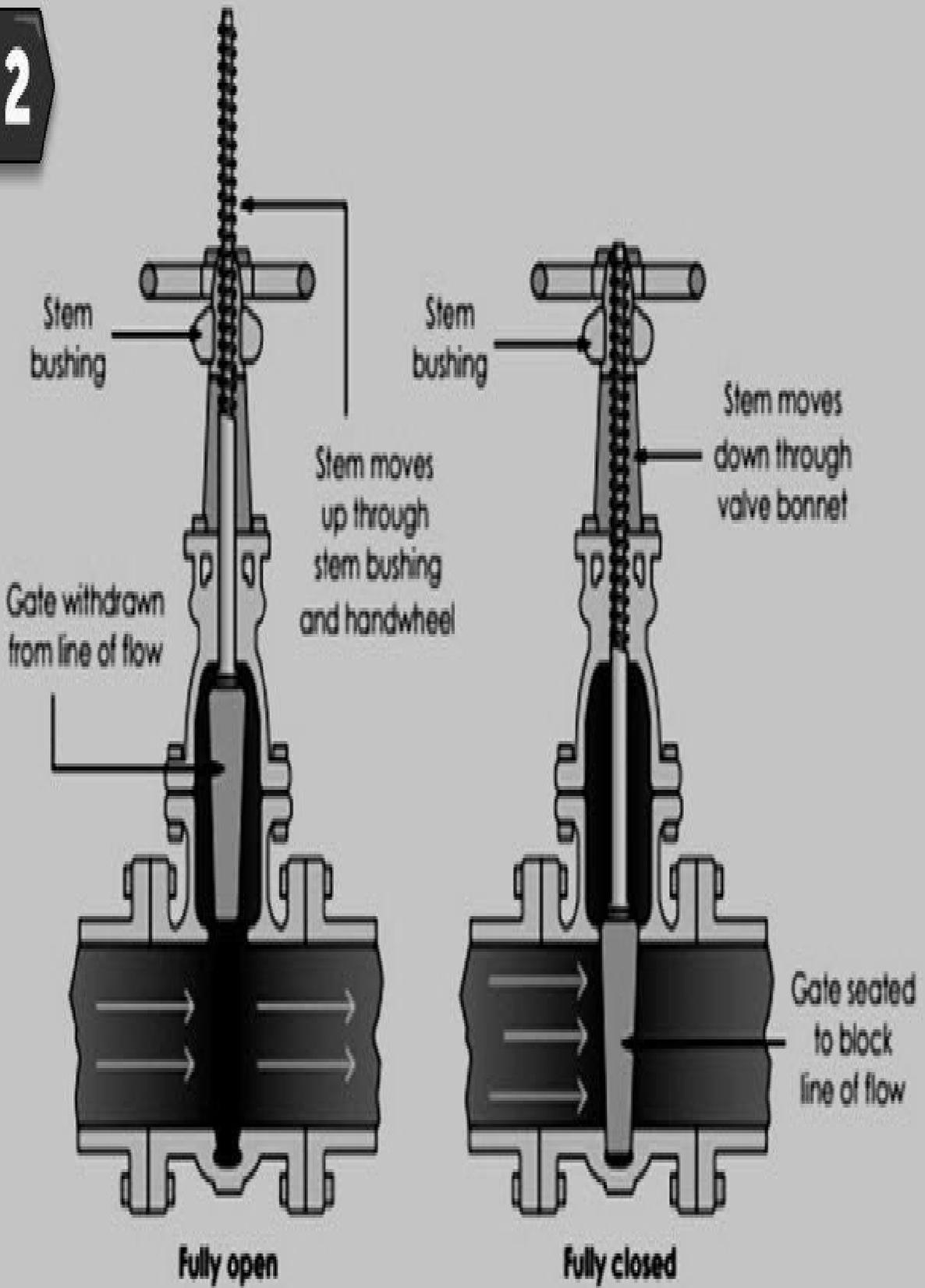
The stem is used to move the disc. It is usually a bolted rod, although sometimes the fluid under pressure moves the disc. There are two basic types of stem.

- **The rising stem.**

As the valve is actuated, the stem rises, lifting the disc with it. The flywheel can go up with the stem, or the stem can go up through the flywheel. These valves allow you to know immediately the open or closed position of a valve.

**See figure N°2**

2



- **The fixed stem.**

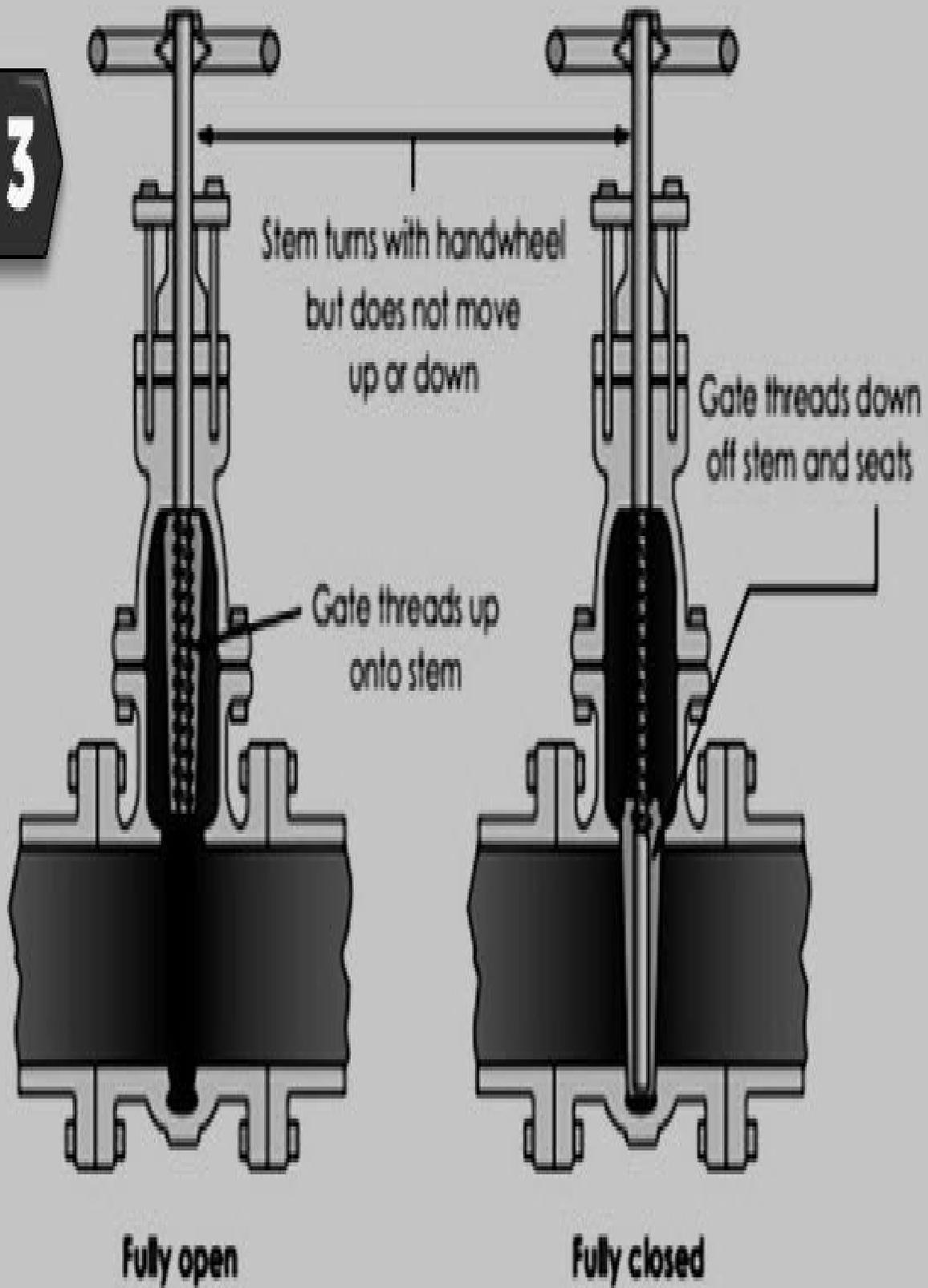
The stem remains in the same position, whether the valve is open or closed. The disc moves up the thread of the stem as the valve handwheel is actuated.

The screw is located on the inside of the bonnet and in contact with the conveyer fluid.

The stem threads are exposed to the medium of flow and are therefore subject to its impact. Therefore this model is used when space is limited to allow linear movement of the stem and when contact with the flow does not erode, corrosion, or abrasion to the stem material.

**See figure N°3**

3



## **The bonnet.**

The bonnet is the upper casing of the valve. It provides a support on which the stem can slide. It acts to seal the valve stem against leakage (usually using a stuffing box and packing). There are three basic means of attaching the bonnet to the valve body.

- The threaded bonnet is generally used on small, low-pressure valves. A problem that can sometimes occur with the screw-on bonnet is that the bonnet can unscrew as the valve is actuated. This is caused by a tight or "sticky" stem.
- The bolted bonnet is the most common type used in refinery applications. It is suitable for medium/high-pressure applications.
- The cylinder head closure is a heavier and more expensive bonnet, normally used for high-pressure work. It uses a seal weld to prevent leakage.

## **The actuator.**

Valve we select actuators based on several factors, including the torque required to operate the valve and the need for automatic actuation. Actuator types include hand-wheel, lever, electric motor, pneumatic, solenoid, hydraulic piston, and self-acting. All actuators, except the hand-wheel and lever actuators, are adaptable to automatic actuation.

## **Summary.**

The manual actuator is the most common type of valve actuator. Manual actuators include hand-wheels connected directly to the valve stem and hand-wheels connected through gears to provide a mechanical advantage.

Electric motor actuators comprise reversible electric motors connected to the valve stem through a gear train that reduces rotational speed and increases torque.

Pneumatic actuators use air pressure on one or both sides of a diaphragm to provide the force needed to position the valve.

Hydraulic actuators, as their name suggests, use a pressurized liquid on one or both sides of the piston to provide the force needed to position the valve.

Solenoid actuators have a magnetic tab attached to the valve stem. The force to position the valve comes from the magnetic attraction exerted on the stem by the solenoid coil of the valve actuator.

## **TRIM of valve**

TRIM of the valve is the set of internal components. Depending on the type of valve, the "TRIM" may include stem, disc, seat, etc. It includes all internal parts in contact with the fluid that is exposed to wear. TRIMS" are chosen to be resistant to corrosion, erosion, and wear. Besides corrosion resistance, pressure,

and temperature, the presence of thermal shock, line stresses, and fire hazards are considered for material selection. The valve body, bonnet, packing, etc., which also comes in contact with the flow medium, is not considered part of the TRIM of a valve.

Special valve parts can be constructed of various materials because of the different properties necessary to withstand different forces and conditions. Cable glands and packing sleeves do not experience the same forces and conditions as the valve disc and seat (s).

The TRIM materials may or may not be of the same material as the valve body or bonnet.

API has standardized TRIMs by assigning a unique number to each set of materials that make up each TRIM.

### **Functions performed by valves.**

Valves perform the following basic functions.

- They interrupt the supply of fluid in a pipe or allow a part of the pipe to be isolated so that repairs can be made, for example, to the piping or faulty or damaged equipment. This type of valve is called blocking or closing valve.
  
- Reducing or increasing flow through a pipe by partially closing the flow area through the valve.

- Reroute flow to a branch of the pipe by changing the trajectory along which the flow moves.

- To protect a system against excessive pressure or a sudden increase in pressure. These are the safety or relief valves. When the pressure in a line reaches a preset high pressure, the valve opens and allows the pressure to escape to the atmosphere or another part of the system.

Safety valves are generally used for steam, air, or other gases.

- They allow one part of a continuous piping system to operate at a distinct pressure from that of another part. These are pressure-reducing valves (also known as pressure regulators) and are often used in air piping to reduce the compressor or mainline pressure to a low value for the operation of low-pressure equipment.

We generally use Relief valves for liquids.

- They prevent flow in one direction along a pipeline or allow flow in one direction only. We call this valve a non-return, check, or backflow valve.

## Chapter 3: Types of valves

The type of valve to be used depends on the function it should perform and the conditions under which we expect it to operate. Here we describe the following types of valves:

- Gate valve.
- Globe valve.
- Diaphragm valve.
- Ball valve.
- Plug valve.
- Butterfly valve.
- Check valve.
- Relief valve.

## **Gate valve.**

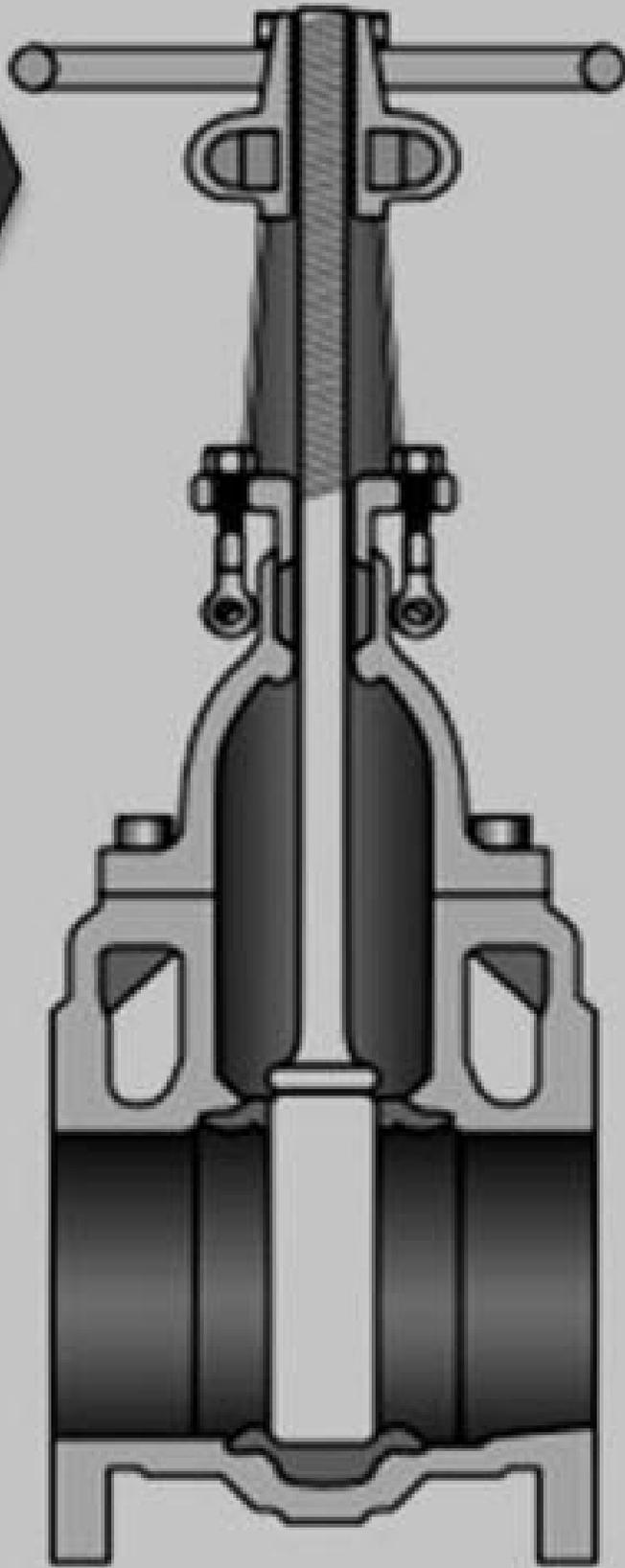
Because of the design of the disc and seat, we use the gate valve for on-off service, and not for throttling applications. If we use a gate valve for throttling applications, it will probably be damaged to the disc or seat by erosion and vibration.

The disc of a gate valve is completely removed when the valve is open; in this position, the disc is completely inserted into the valve bonnet. This leaves an opening for flow through the valve with the same inside diameter as the piping system in which we instal the valve. We can use a gate valve for a wide range of liquids and provide an airtight seal when closed.

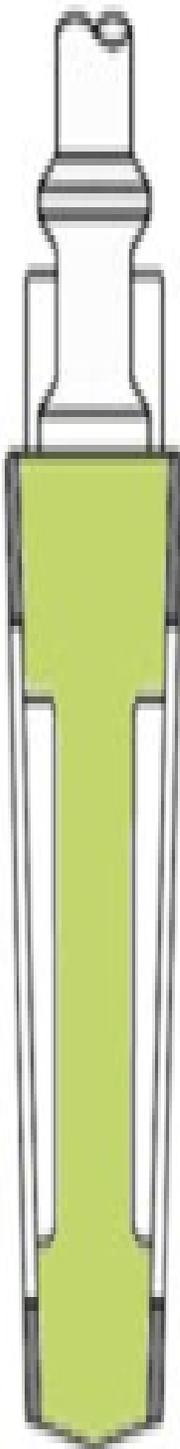
Gate valves comprise three principal parts: body, bonnet, and the TRIM of the valve. We usually connect the body to other equipment by flanges, bolted, or welded connections. The bonnet, which contains the moving parts, is attached to the body, usually with bolts, to allow maintenance. The TRIM comprises the stem, disc, or wedge and seat rings.

**See figure N°4**

4



**Disks of a Gate: Gate valves are available with different disks or wedges.  
The most common are:**



Solid wedge is the most commonly used disk by its simplicity and strength. A valve with this type of wedge can be installed in each position and it is suitable for almost all liquids. The solid wedge is a single-piece solid construction.

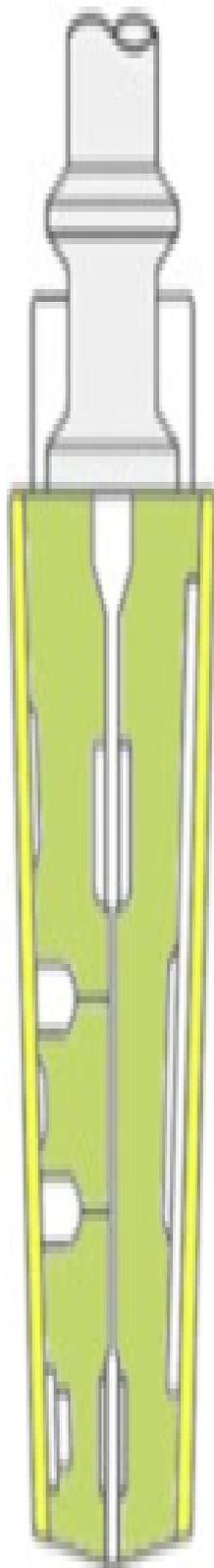




Flexible wedge is a one-piece disc with a cut around the perimeter to improve the ability to correct mistakes or changes in the angle between the seats.

The reduction will vary in size, shape and depth.





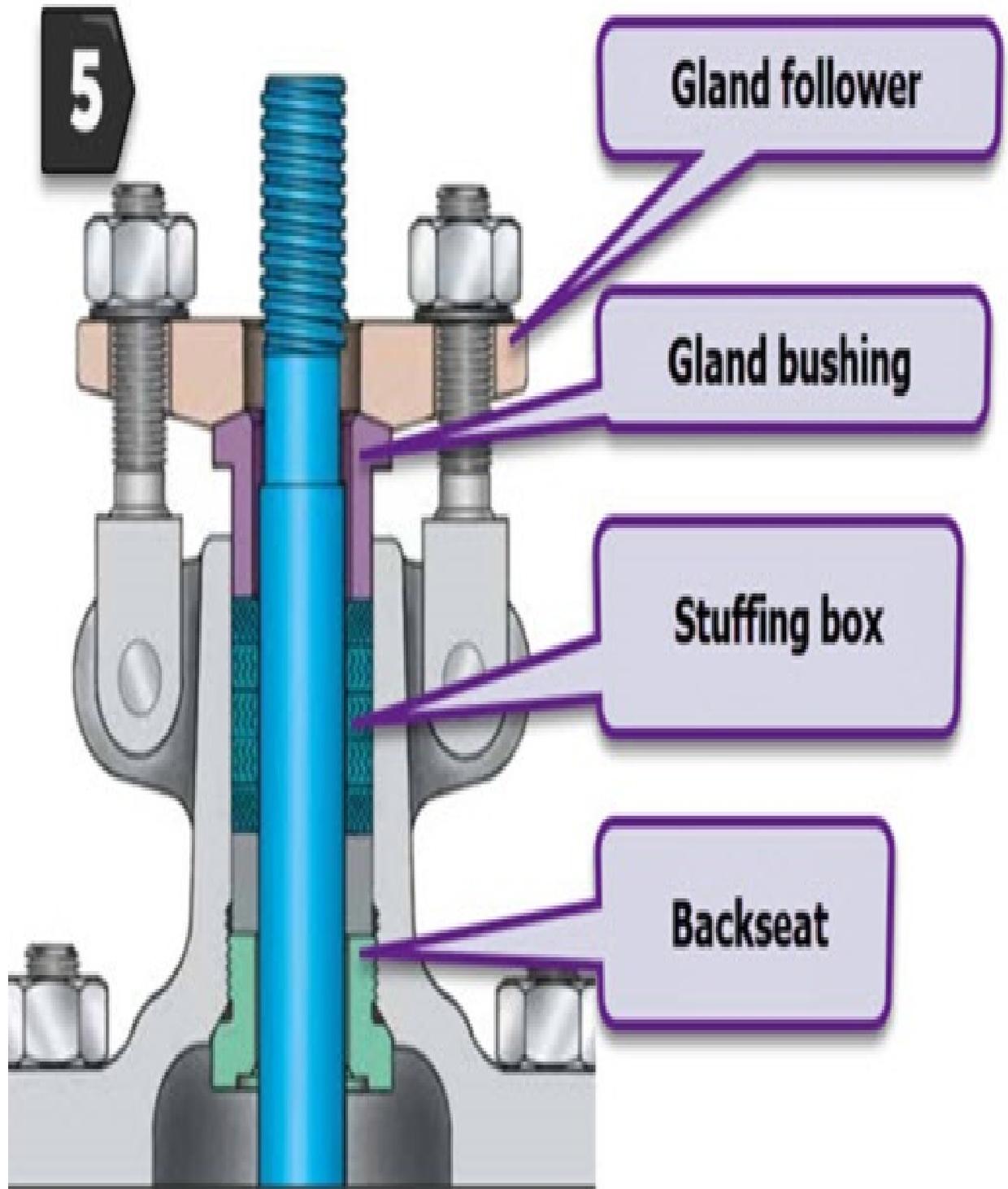
Split wedge is self-adjusting and self aligning to both seats sides. This wedge type consists of two-piece construction which seats between the tapered seats in the valve body. This type of wedge is suitable for the treatment of non-condensing gases and liquids at normal temp., particularly corrosive liquids

## **Packing**

The packing is a pressure barrier that acts radially by limiting fluid leakage to the outside between the valve stem and where the valve is mounted.

The continuous opening and closing of the valves, as well as the effect of temperature, type of fluid, and packing materials, play an important role in controlling leaks between fixed (stuffing box) and moving (stems) parts.

**See figure N°5**



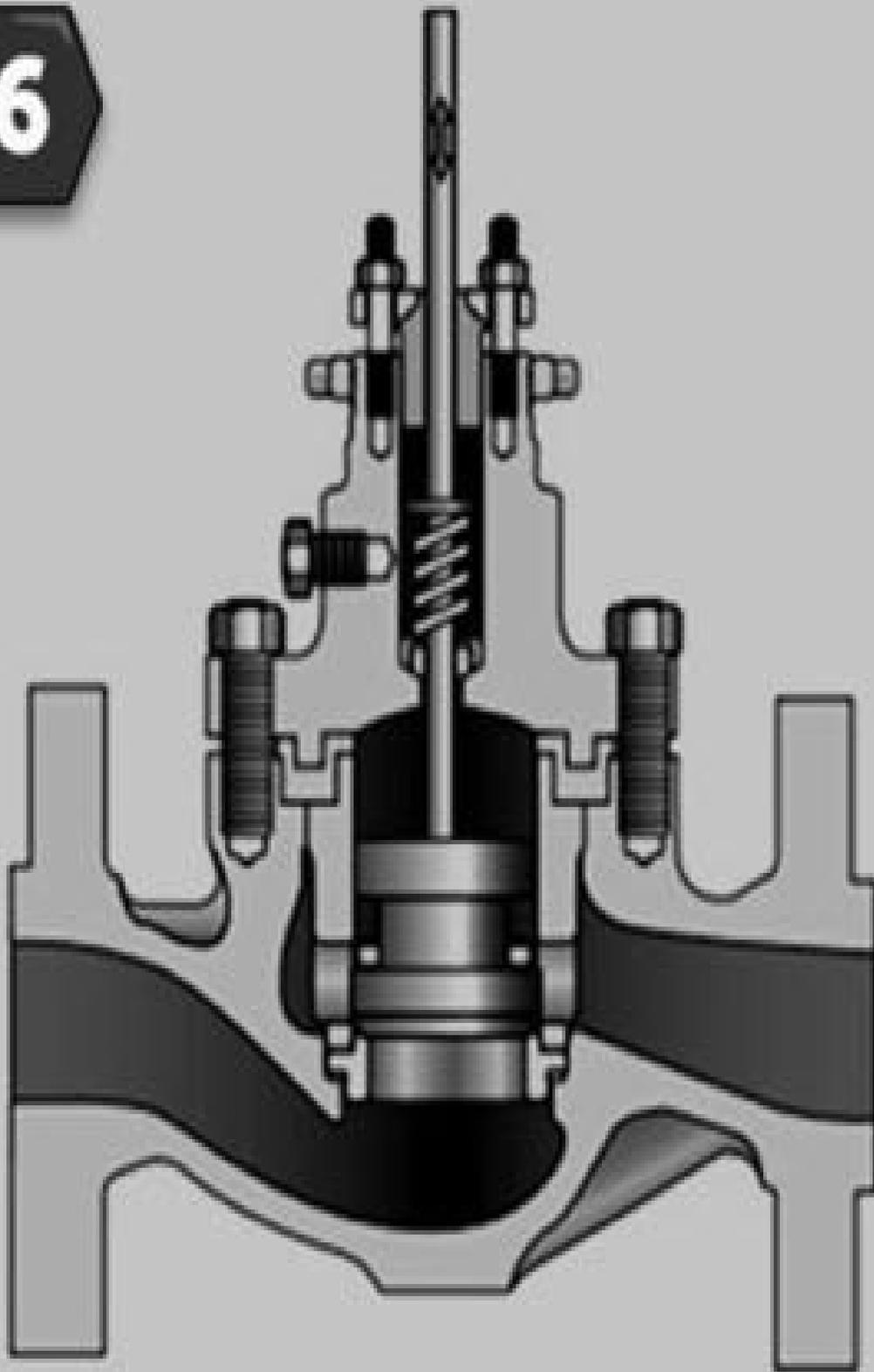
## **Globe valve.**

The term globe valve applies to a valve whose body is shaped like a globe or has characteristics like those of a globe. Globe valves are generally suitable for throttling applications, as the valve design determines how closely the flow can be regulated. The part that controls the flow in the globe valve is the disc, which is attached to the stem. The disc fits precisely into the valve seat. When the valve is open, the liquid passes through the space between the edge of the disc and the seat.

Generally, the maximum differential pressure across the valve disc should not exceed 20 percent of the maximum upstream pressure or 200 psi (1380 kPa), whichever is less. Special TRIM of valves may be designed for applications that exceed these differential pressure limits.

**See figure N°6**

6



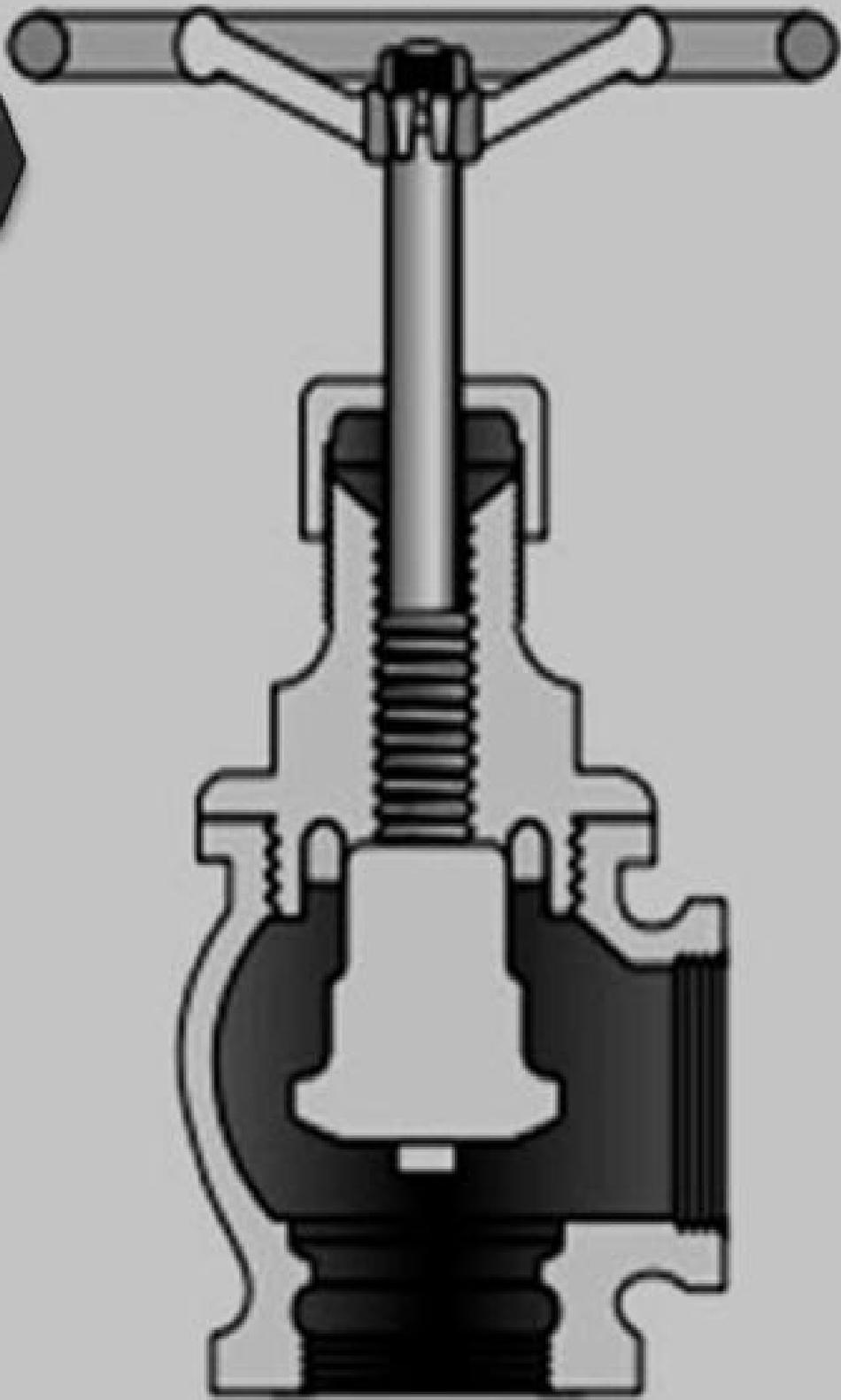
Types of globe valves include:

**Angular globe valve.**

An angular globe valve changes direction at 90°. The ends of this globe valve are at a 90-degree angle, and fluid flow occurs with a simple 90-degree turn. They have a slightly lower flow coefficient than Y- globe valves.

**See figure N°7**

7



## **Needle valve.**

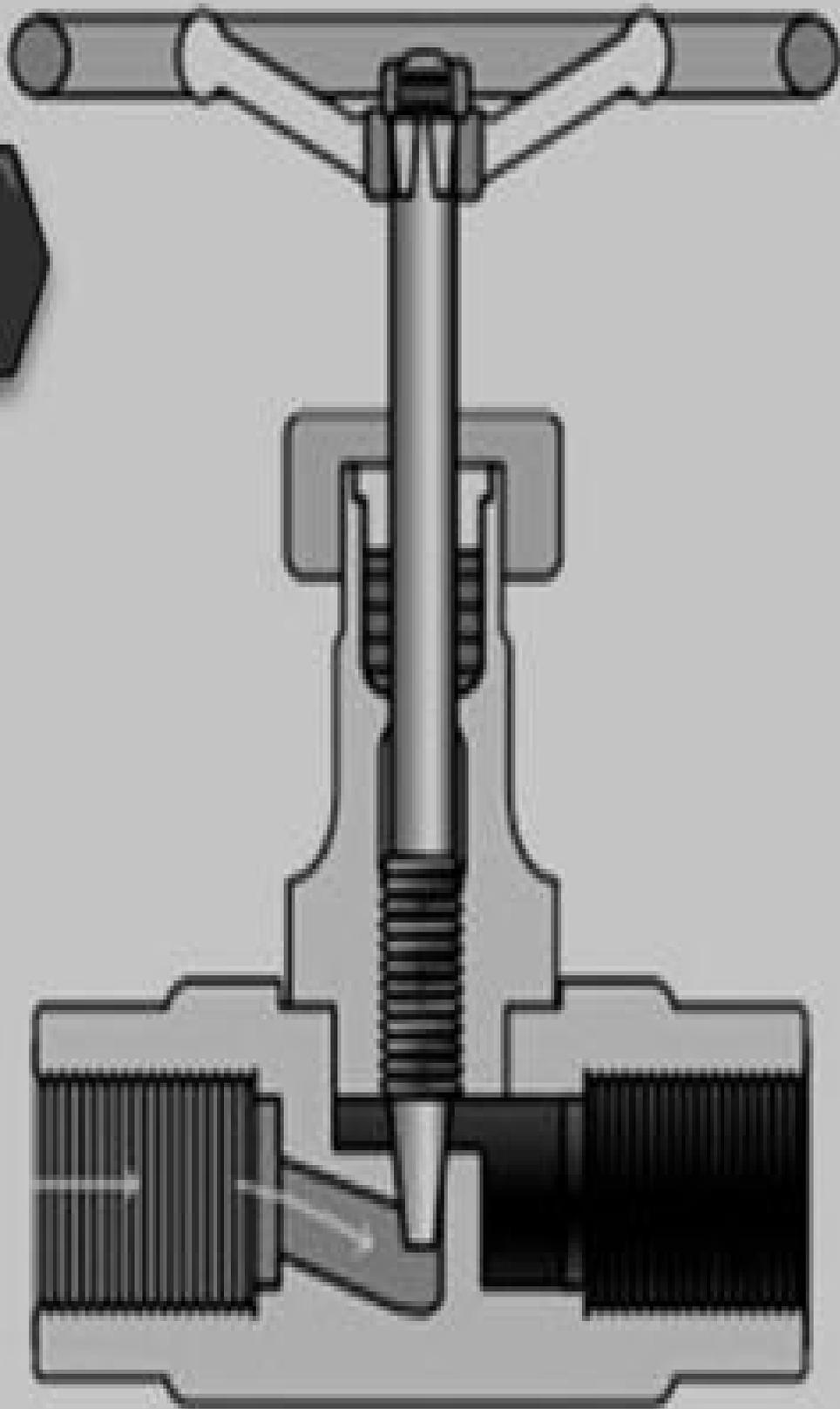
A needle valve is a valve that is used for precise flow control. The needle valve is so-called because of the conical stem that acts as a plug and penetrates an orifice of small diameter in relation to the nominal diameter of the valve.

The displacement of the stem, if it is a fine thread, is slow and by the fact that until a good number of turns is turned the flow section of the fluid is minimal, makes this valve a good flow regulator, for its stability, accuracy and the design of the plug that provides a good metal seal with little wear that avoids cavitation at large differential pressures.

In hydraulic power stations, we use the needle valves as a bypass to the butterfly valve or spherical inlet to the turbines. First, we operate the needle valve, which can work better than the main valve at large pressure differences without cavitation, and once the main valve is at balanced pressures at the ends, we make its opening, avoiding the water hammer of the installation.

**See figure N°8**

8

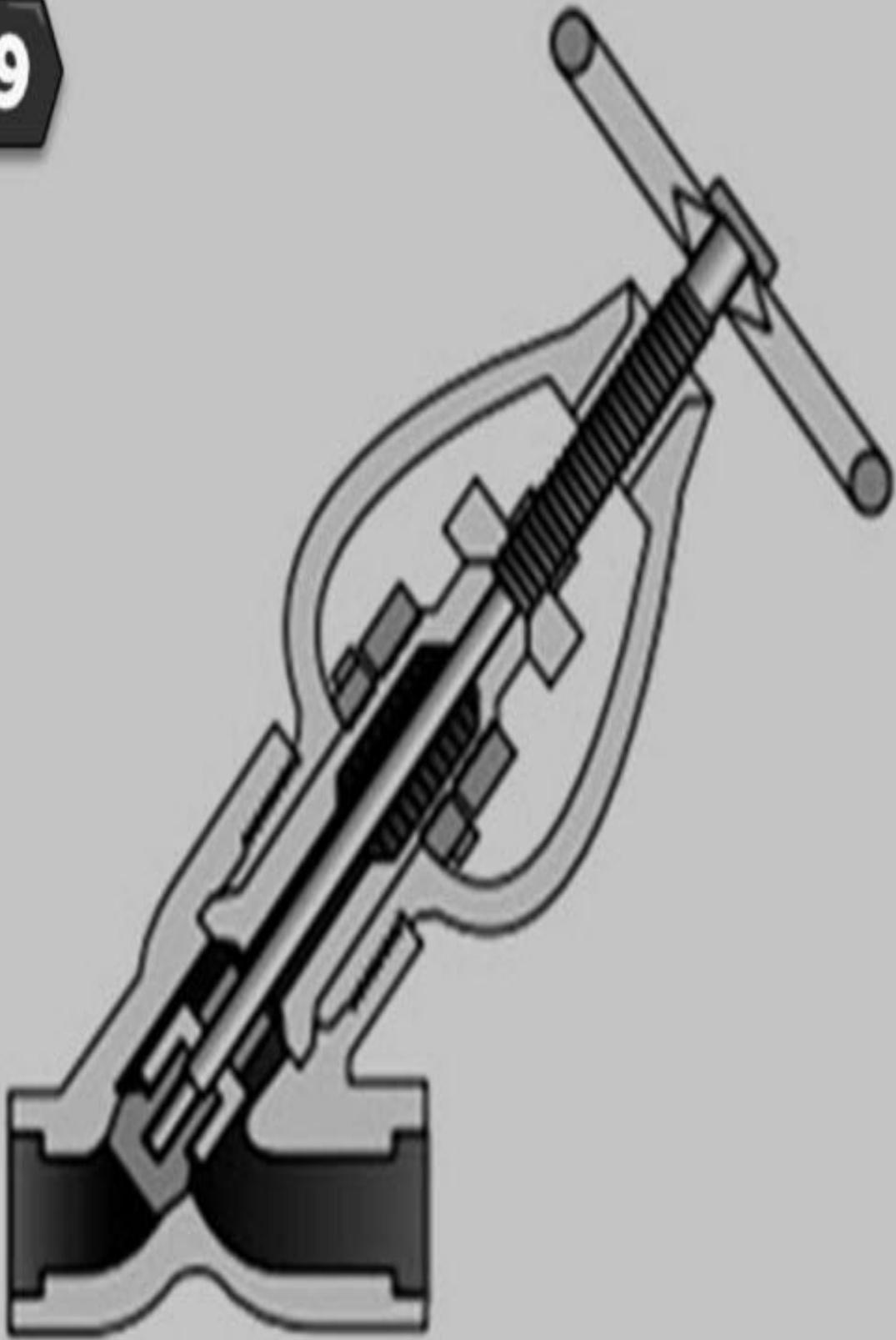


## **Wye valve.**

It is an alternative to the high-pressure drop of the traditional globe valve. The seat and stem have an angle of approximately 45 degrees, which gives a straighter flow path at full opening thus offering less resistance to flow. They are widely used for regulation during start-up operations. For its smooth flow pattern, a Wye - valve is preferable for use with erosive fluids.

**See figure N°9**

9



## **Diaphragm valve.**

We use diaphragm valves for cutting and throttling liquids that can carry a large number of suspended solids.

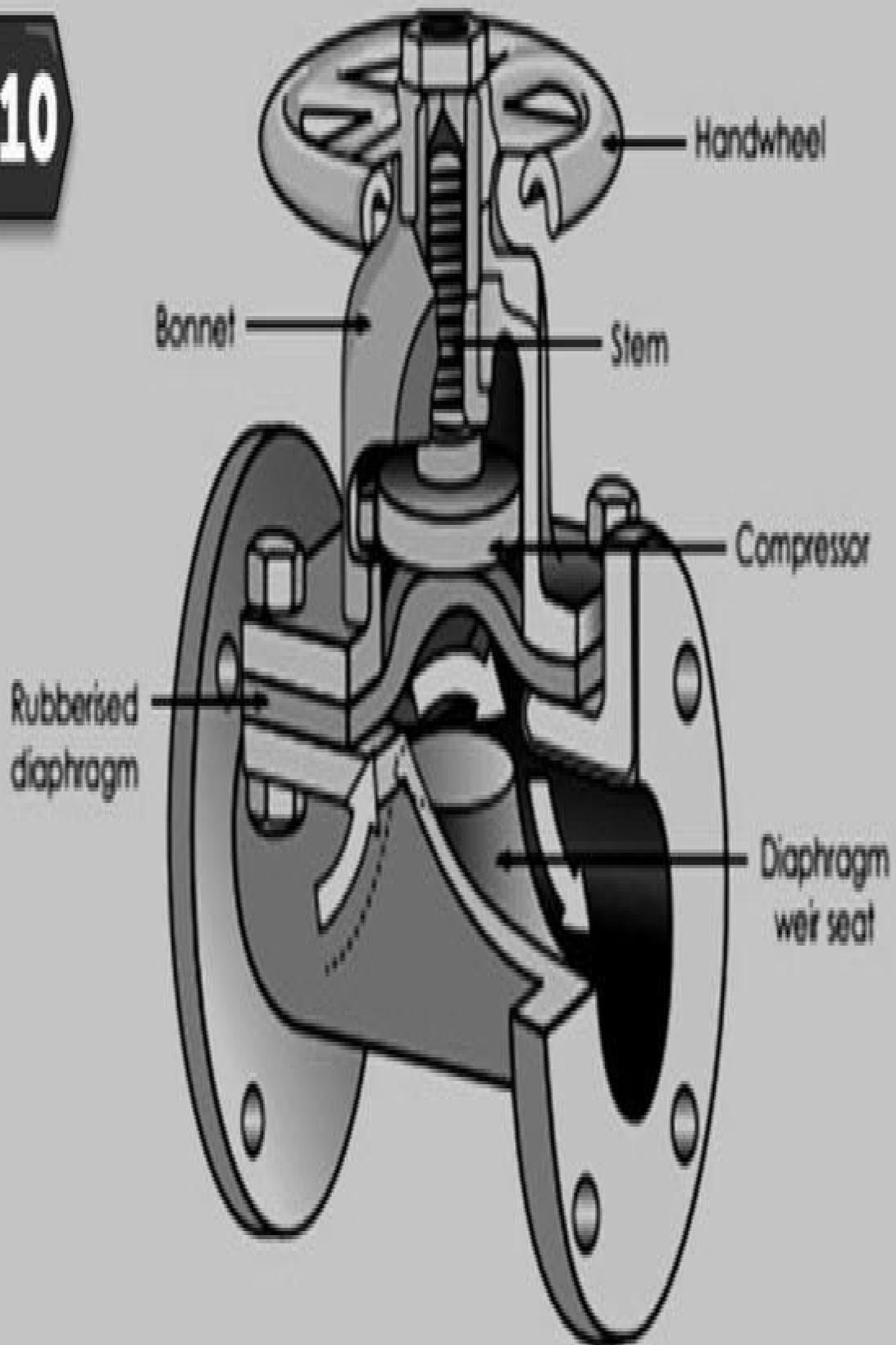
In diaphragm valves, the fluid is isolated from the parts of the operating mechanism. This makes them ideal for corrosive or viscous services, as it avoids any contamination towards or from the outside. Water tightness is achieved using a flexible membrane, generally made of elastomer, which can be reinforced with some metal, which is tightened by the effect of a linear motion punch-axis, until it contacts the body, which acts as a seat.

The applications of this type of valve are mainly for low pressures and watery pasts that would corrode and obstruct most other equipment.

They are quick to open.

**See figure N° 10**

10

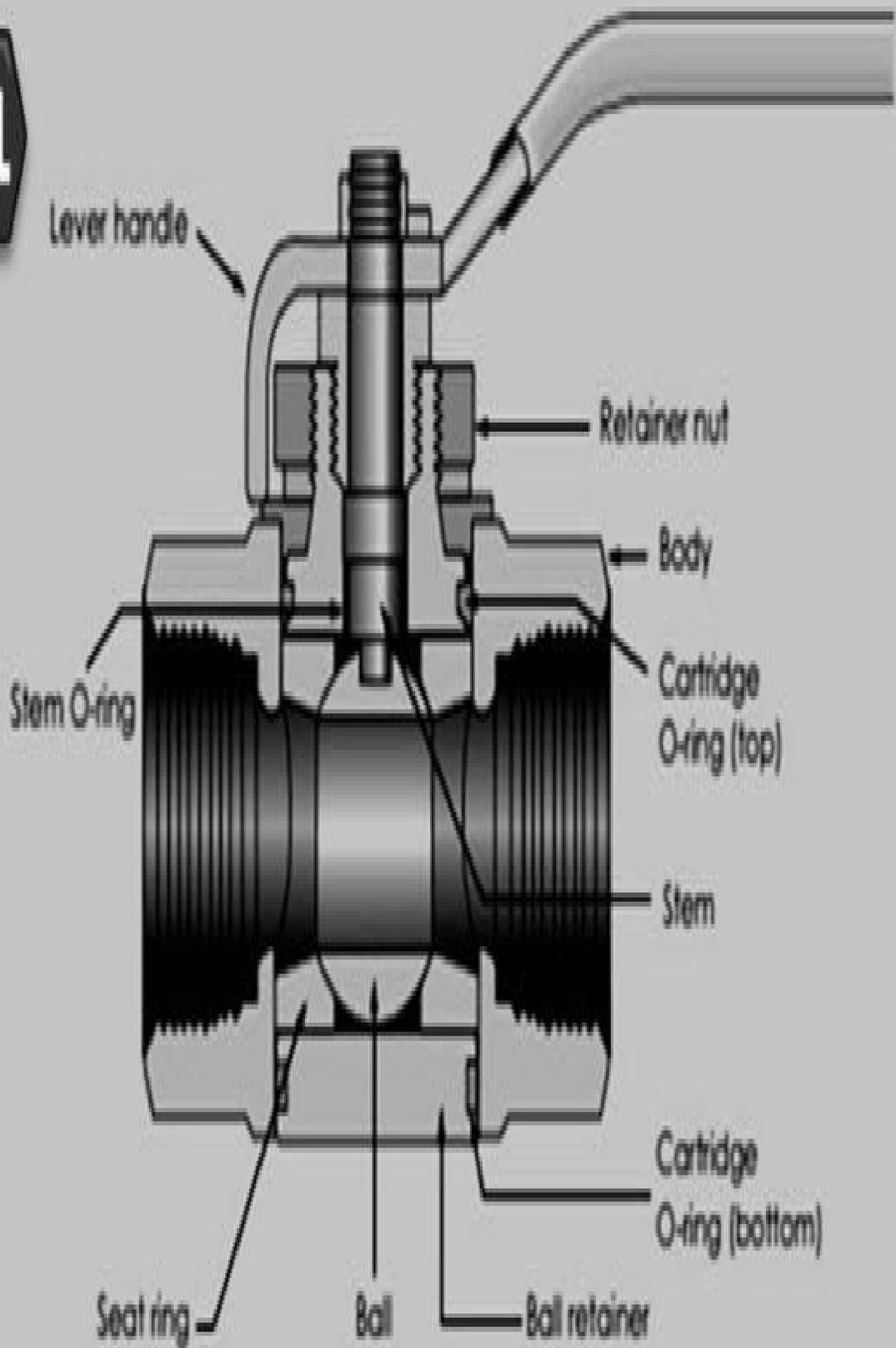


## **Ball valve.**

The spherical ball is used to block the inside diameter of this valve and cut off the flow. The ball, which has a hole through it, is rotated 90° by a lever, and flow is allowed when the hole through the ball is located along the axis of the pipe.

**See figure N° 11**

11



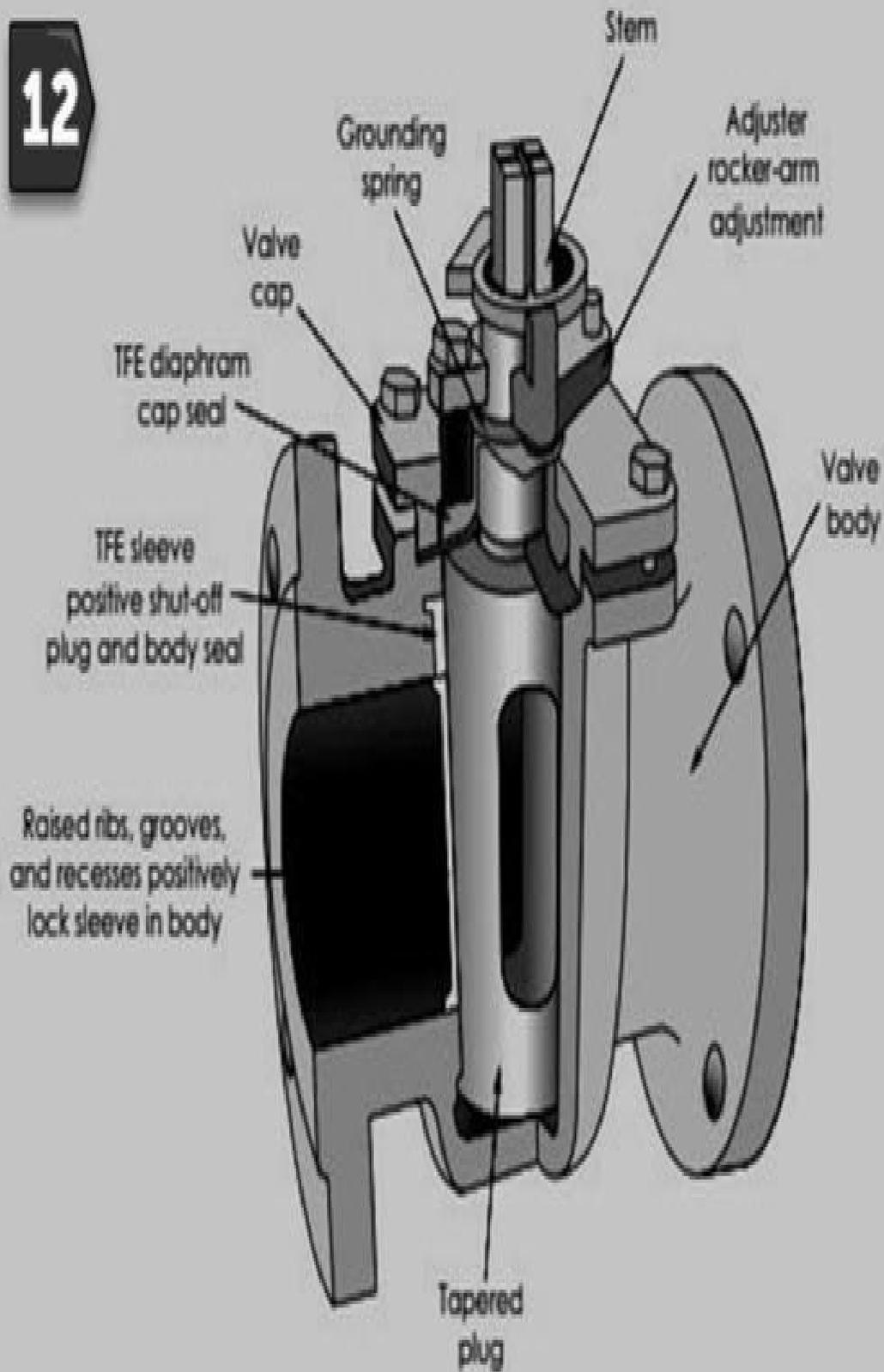
### **Conical closing plug valve.**

Like a ball valve, a conical plug is used to seal the inside diameter of the valve. An orifice is used through the plug to allow flow when this orifice is aligned with the pipe axis.

Ball valves and plugs are quick and easy to operate and require only a 90° turn of the lever to open or close the valve. When these valves are closed, they contain the liquid in the sphere or plug, which can create problems when used with corrosive fluids.

**See figure 12**

12



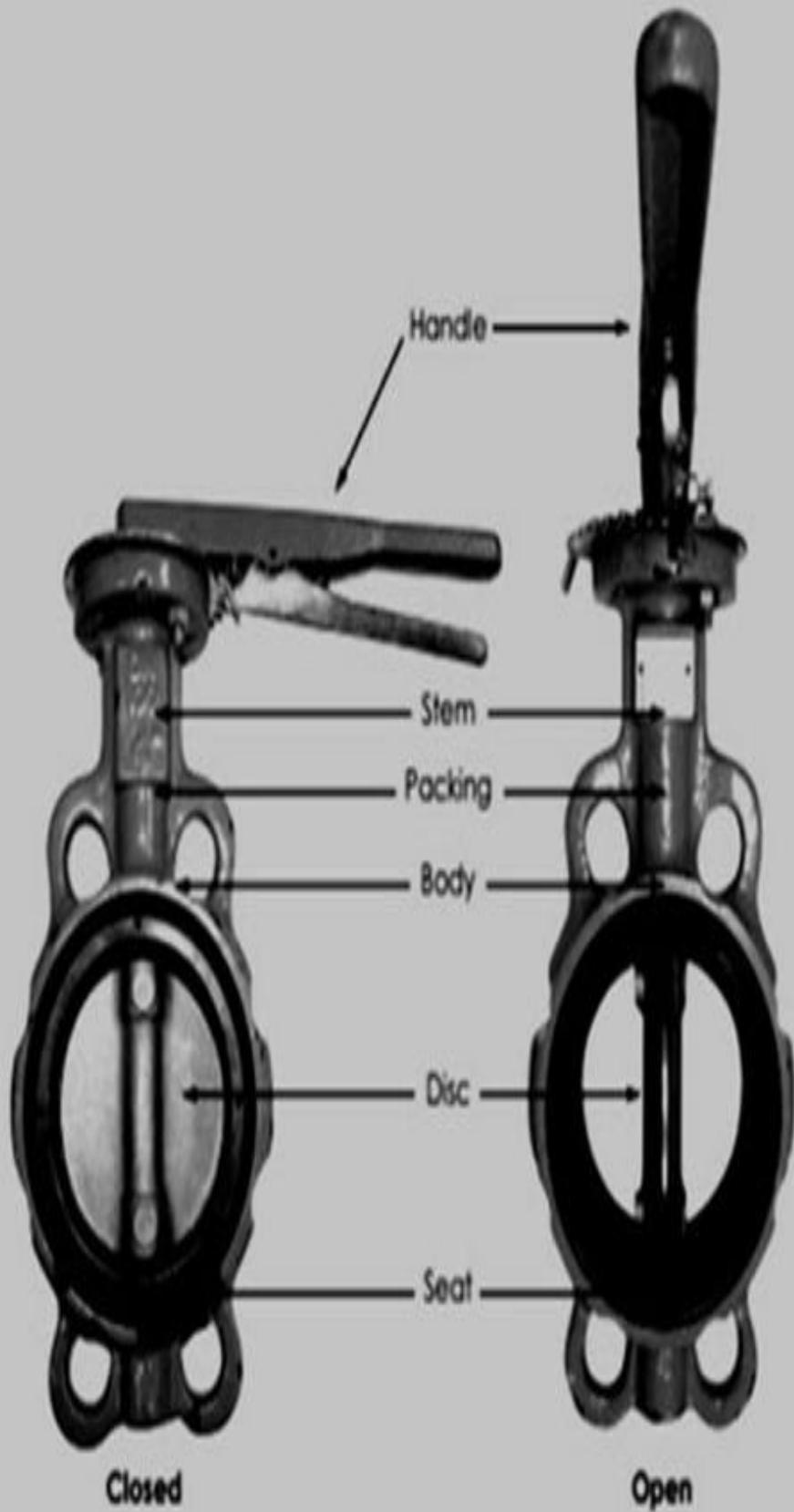
## **Butterfly valve.**

A butterfly valve has a circular disc about the size of the pipe orifice diameter. This disc rotates around its center so that when it is closed, the disc covers and completely seals the inside diameter of the pipe. When completely open, the thickness of the disc is along the center of the pipe. The contents of the tubing pass through both sides of the disc.

The butterfly valve has the advantage of a 90° closing operation and does not accumulate fluids such as the ball valve and plug valve.

**See figure N°13**

13



## **Check valve (non-return).**

Check valves allow flow in one direction only. The valve closes if the flow is reversed.

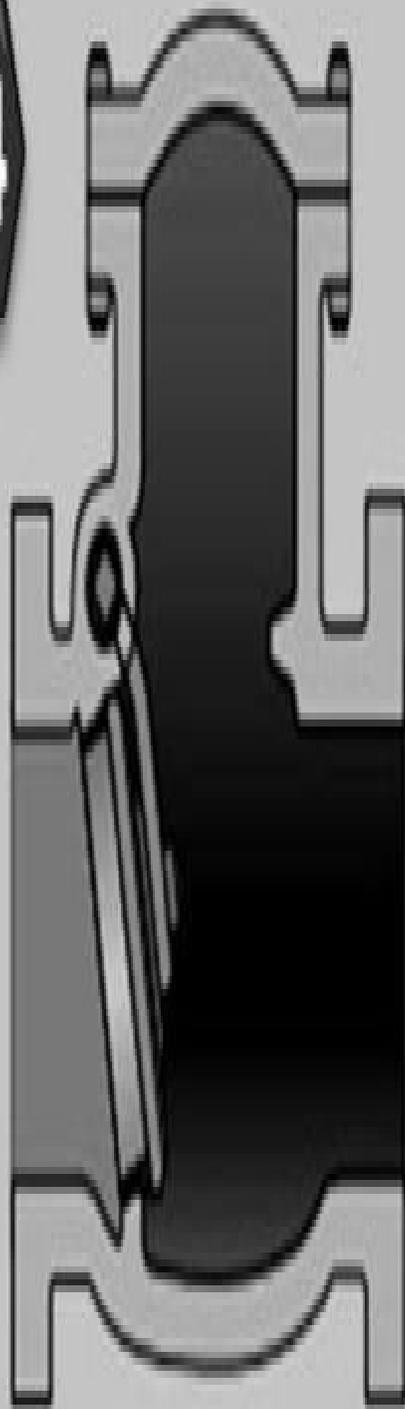
The figure shows an oscillating flap valve and a piston flap valve:

In the flap valve, a swing flap acts as a shutter and closes the flow by gravity, when the fluid flows in an undesirable direction. Since they operate by gravity, we must place them in the proper position.

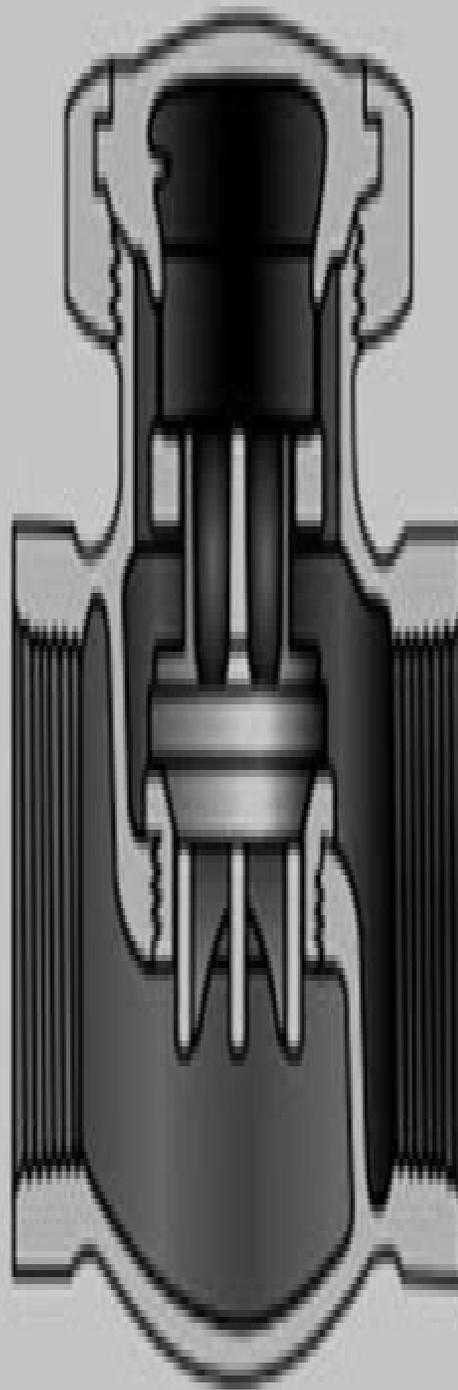
In the piston valve: a plunger, ending in an obturator rests on the seal ring; it is housed in a cylindrical piston so that when the fluid flows in the correct direction it lifts the plunger, but when changing direction, the plunger rests on the ring; the shape of the plunger support helps the backward water pressure tighten the obturator on the seal ring. Like the oscillating flap, it needs to be mounted in the proper position, as it also operates by gravity.

**See figure N°14**

14



Swing check



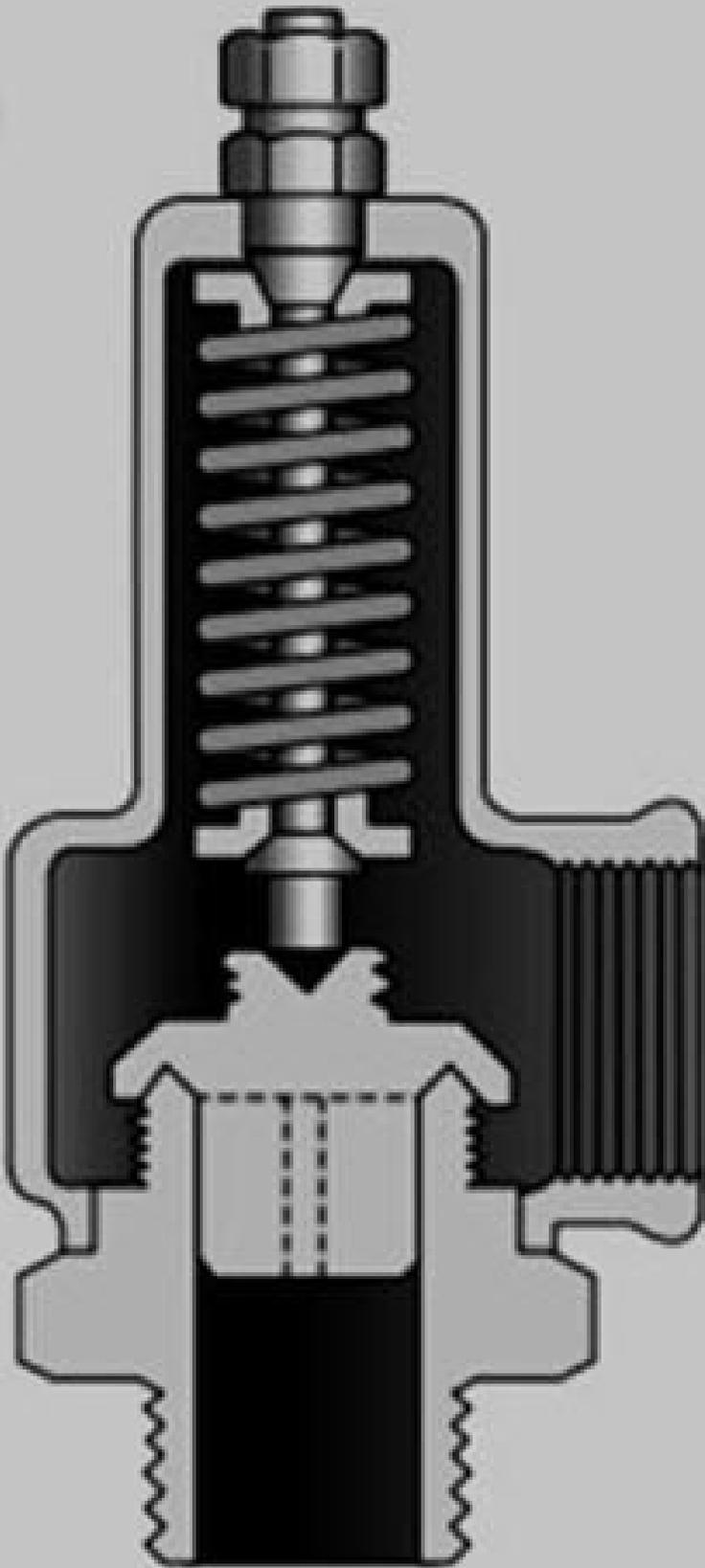
Lift check

## **Relief valve.**

A pressure relief valve is a safety device designed to protect a vessel or pressurized system during an overpressure event.

An overpressure event refers to any condition that causes the pressure in a vessel or system to increase beyond the specified design pressure or maximum allowable working pressure. Relief valves are used to prevent the build-up of excessive gas or liquid pressure in lines or vessels. They usually operate against a preset spring load. Gas relief valves are designed to allow high flow. With liquids, the relief of a small flow rapidly decreases the pressure of the system. See figure N°15

15



## **Chapter 4: Valve installation**

Valves can be attached to lines, equipment, or vessels by:

### **Threading.**

Generally used in low pressure and small diameter lines. We use threaded end valves, e.g., for instrument connections or as sample taking.

### **Socket Weld.**

Weld socket welding is prepared by lowering the valve ends with an inner hole, slightly larger in diameter than the pipe. The pipe enters the recess and once positioned, is welded.

Standard B16.11. Forged Fittings, Socket-Welding and Threaded.

This standard covers the requirements in ratios, dimensions, tolerances, marking, and material for socket-welded and threaded joints. These joints are designed as Class 2000, 3000, and 6000 for threaded ends and Class 3000, 6000, and 9000 for socket-welded ends.

### **Flanged Joints.**

The valve body is flanged to make it compatible with flanges of the same pressure rating. It offers the advantages of easy installation and disassembly and is suitable for medium/high-pressure applications.

### **Valves for butt welding.**

Valve ends are supplied with standard weld preparation. Although difficult to assemble and disassemble, this is the preferred method for extreme service applications. We should design welding procedures to minimize distortion of the valve body.

### **Wafer valves.**

These do not have their flanges and fit between the flanges on the ends of the tubes. They are located and held in position by the bolts that pass between the pipe flanges. Because the pipe flanges are kept at a distance equal to the thickness of the wafer valve, longer than normal bolts will be required. The valve has flat faces that contact the flanges. O-rings are used to seal against leaks. The outside diameter of the body is adapted to the diameter of the pitch circle of the flange bolts. Bolts surround the valve body instead of passing through it. See figure N°16

16



## **Guidelines to follow when installing valves.**

- The direction of flow through the valve must be correct. When this is important, the direction of flow will be showed on the valve body (usually by an arrow).
- On/off valves should, where possible, be placed in horizontal rather than vertical sections to facilitate line drainage when valves are closed.
- Heavy valves must be properly supported. We should leave a minimum of 300 mm between the flange and bracket to facilitate installation and disassembly.
- For aesthetic reasons, it is important to keep the valve centerlines at the same height and in line with the plan view.
- There should be no safety risks to the operator when accessing the valves.
- Lines carrying hazardous fluids must have the valves mounted in such a manner that the operator has easy access to open or close them.
- Valve stems should not point downward at any angle below the horizontal. This prevents sediment from accumulating in the stuffing box packing, which can damage the stem.

- Valve stems must not point to gangways, etc.

## Chapter 5: Valve specifications

Manufacturers use identification codes or model numbers to identify their valves; these are usually cast or stamped into the valve body. There is no standard system and each manufacturer uses its own, so it is necessary to consult the manufacturers' catalogs to facilitate the identification or ordering of valves.

The important factors that determine the suitability of a valve for a service are:

- Nominal pressure.
- Type of valve (gate, globe, etc.).
- Method of attachment to the equipment or piping.
- Type of operator.
- Disc and seat material.
- Body material.

These same factors are also used to classify different valve models.

## Chapter 6: Valve assembly times

Bases to be taken into account when estimating man-hours in the valve assemblies.

The working hours indicated in the Table are records got under Standard conditions and where the assembly site is isolated from any plant or equipment in operation.

This implies that the Labor shall be adjusted when the conditions at the assembly site deviate from these Standard conditions for the estimate to the particular Project.

Standard Conditions.

The criteria that define the Standard conditions with which we obtained the records of the Tables are the following:

- We carry the tasks out in a moderate climate (i.e. With average temperatures between 5° C and 40° C) and with winds of less than 30km/hour.
- We work in a non-seismic zone.

- The area where the work is carried out is free of contamination.
  
- We carry the work out during daylight hours.
  
- The maximum height of the working plane does not exceed 1.50 m above ground level. If we carry the assembly out at a higher level, a significant change in the number of man-hours required in the installation of each valve.
  
- Minimum free height of the covered places = 2,60 m.
  
- Maximum transport distance from the storage or unloading area to the construction site of 300 m.
  
- Operators' entrance door is 200 m or less of the work area.
  
- The engineering deliverables and materials supply comply with the project schedule.
  
- Adequate infrastructure services are available.
  
- Trained field personnel are available.
  
- Appropriate construction equipment and tools are available.

They are not included:

- Scaffolding.

- Review work for design errors.

- The hours of the personnel of Security, Inspection, Storeroom, Topographers, etc., only the direct labor hand-applied to the task is contemplated.

- Working hour's units do not include torque times or torque review of bolts in flange unions.

- We assume tasks to be performed on a new Construction site with no interference with an existing plant or service.

- The hours to be consumed by tightness tests on large valves before proceeding to their assembly. This is usually indicated in the customer's Technical Specification.

**Figure N°17 shows the times in man-hours for the assembly of gate valves on the floor level. We tabulate the registers according to the diameter and class of the valves.**

From NPS ½" to 2" the valve is made of forged steel with ends are threaded.  
From NPS 2½" onwards the valve is made of cast steel with ends with flanges.  
The weights of the valves in figure 17 are only indicative. Once the model of the valve to be assembled has been selected, the manufacturer's catalog must be consulted to have the precise weight.

# Figure 17

NPS	150#		300#		600#		900#		1500#	
	Kg.	Mhr	Kg.	Mhr	Kg.	Mhr	Kg.	Mhr	Kg.	Mhr
½"	1,25	1,3	1,8	1,4	2,9	1,5	4,5	1,6	6,5	1,7
¾"	2,5	1,5	2,9	1,6	4	1,7	6	1,8	10,8	2
1"	3,6	1,8	4,5	1,9	6,3	2	10,6	2,2	18	2,5
1 ½"	8,4	2,6	9,8	2,7	15	2,7	25,4	3	38,5	3,5
2"	13,6	3	17	3,2	19,5	3,4	36	3,7	68	4
2 ½"	30	1,5	47	1,7	77	2,2	90	2,5	164	3
3"	41	1,7	44	2	63	2,5	130,7	3	289	4
4"	54	2	71	2,5	120	3	261	4	385	5,3
6"	92	3	127	4	270	6	515	8,5	784	11
8"	147	4	196	5,6	430	8,5	891	12	1485	16
10"	186	5,2	300	7,5	740	12	1042	16	2595	21
12"	289	6,5	407	9,5	874	15	2080	20	3580	25
14"	485	8	782	12,5	1300	19	2760	25		
16"	636	10	1043	15	1800	24	3158	30		
18"	840	12	1383	18	2008	33	3762	40		
20"	1015	14	1864	22	2700	45				
24"	1521	18	2270	32	4500	55				

**Figure N°18 shows the times in man-hours for the assembly of wafer type valves on the ground level. We tabulate the registers according to the diameter and series of the valve and do not include the times for torque or revision of bolts.**

**Figure 18**

<b>NPS</b>	<b>150 #</b>	<b>300 #</b>	<b>600 #</b>
<b>1/2"</b>	<b>0,14</b>	<b>0,21</b>	<b>0,28</b>
<b>3/4"</b>	<b>0,14</b>	<b>0,28</b>	<b>0,35</b>
<b>1"</b>	<b>0,14</b>	<b>0,28</b>	<b>0,42</b>
<b>1 1/2"</b>	<b>0,28</b>	<b>0,42</b>	<b>0,56</b>
<b>2"</b>	<b>0,42</b>	<b>0,98</b>	<b>1,12</b>
<b>3"</b>	<b>0,77</b>	<b>1,54</b>	<b>2,38</b>
<b>4"</b>	<b>1,4</b>	<b>2,45</b>	<b>3,43</b>
<b>6"</b>	<b>2,31</b>	<b>4,2</b>	<b>5,81</b>
<b>8"</b>	<b>3,43</b>	<b>4,76</b>	<b>6,44</b>
<b>10"</b>	<b>4,2</b>	<b>6,09</b>	<b>8,26</b>
<b>12"</b>	<b>5,67</b>	<b>6,93</b>	<b>10,15</b>
<b>14"</b>	<b>6,02</b>	<b>7,14</b>	<b>13,58</b>
<b>16"</b>	<b>7,28</b>	<b>10,71</b>	<b>16,8</b>
<b>18"</b>	<b>8,19</b>	<b>11,69</b>	<b>23,8</b>
<b>20"</b>	<b>9,03</b>	<b>14,7</b>	<b>27,3</b>
<b>24"</b>	<b>11,69</b>	<b>21,7</b>	<b>37,1</b>

**Figure N°19, shows the times in man-hours for the assembly of butt weld end valves on floor level. We tabulate the registers according to the diameter and series of the valve and do not include the welds.**

**Figure 19**

<b>NPS</b>	<b>150 #</b>	<b>300 #</b>	<b>600 #</b>	<b>900 #</b>	<b>1500 #</b>	<b>2500 #</b>
1/2"	0,21	0,21	0,28		0,49	0,63
3/4"	0,21	0,35	0,42		0,7	0,77
1"	0,21	0,35	0,42		0,77	0,91
1 1/2"	0,35	0,49	0,63		1,19	1,4
2"	0,49	1,12	1,33		1,4	1,61
3"	0,91	1,75	2,73	3,08	3,43	3,92
4"	1,75	2,8	3,99	4,83	5,67	6,65
6"	2,59	4,83	6,65	7,14	7,56	8,75
8"	3,92	5,53	7,42	8,4	9,38	10,85
10"	4,83	7	9,52	10,78	12,04	14
12"	6,51	7,98	11,69	14	16,8	18,2
14"	6,93	8,19	15,4			
16"	8,4	12,32	19,6			
18"	9,38	13,44	27,3			
20"	10,36	17,5	31,5			
24"	13,44	25,2	42,7			

**Figure N°20 shows the times in man-hours for the assembly of safety valves and control valves on the ground level. We tabulate the registers according to the diameter and series of each valve and do not include the times for torque or revision of bolts.**

## Figure 20

NPS	150 #	300 #
1/2"	0,84	0,91
3/4"	0,84	1,26
1"	0,84	1,26
1 1/2"	1,05	1,75
2"	1,47	3,15
3"	2,03	4,41
4"	2,73	5,81
6"	5,53	9,38
8"	7,21	10,78
10"	9,87	14,7
12"	12,11	16,8
14"	13,16	18,2
16"	16,1	24,5
18"	18,2	28
20"	21	32,9
24"	25,9	45,5

## **Further Reading: Estimator's Piping Man-hours Tool**

Did you love Types of Valves in Piping?

Then you should read Estimator's Piping Man-hours Tool, by Gustavo Cinca!

# Estimator's Piping Man-hours Tool



**Gustavo Cinea**

Estimating Man-hours for Process Piping Projects  
Manual of Man-hours, Examples

## **Estimator's Piping Man-hours Tool.**

Estimator's Piping Man-hours Tool for Process Piping Project - Basic Manual for any Engineer, Designer, Seller, Installer, or Owner with Examples.

*To the reader.*

This book is destined for you too easily and rapidly learn or increase your knowledge about how to accurately estimate the number of man-hours consumed during steel carbon process piping assembly.

The writer of this Manual has an expertise of 45 years in his professional practice as Head of Work, Project Manager and finally as president of a Company of Construction and Industrial Installation in different plants of Chemical Processes, Refineries, Pipelines, Gas Compressors, and Thermal Power plants of their country and abroad, developing the direction of the activities and the management of the resources used for their execution, especially with installation of piping.

This Manual that gives the reader is the product of that Technical Competence.

*Tables for determining manpower in Piping.*

The author has verified the direct man-hours stated in the 14 (fourteen) tables of this Manual during the Piping assemblies of the different installations.

## *Estimating Man-hours for piping installation.*

It is necessary to understand that there are no identical projects or works in this business and that it is not possible to automate or copy.

The approach to respect is that any estimated work should be serious and professional, this Manual gives the reader a precise and convenient method to estimate the direct work in Piping installations for each specific project.

In the content of this book, the reader will access simple and reliable methods to carry out the estimates.

## **Examples of calculating Piping installations.**

In the Manual, the author presents complete calculation examples of Piping installations, based on the man-hours showed by the tables to later apply the corrections or adjustments required for each Project.

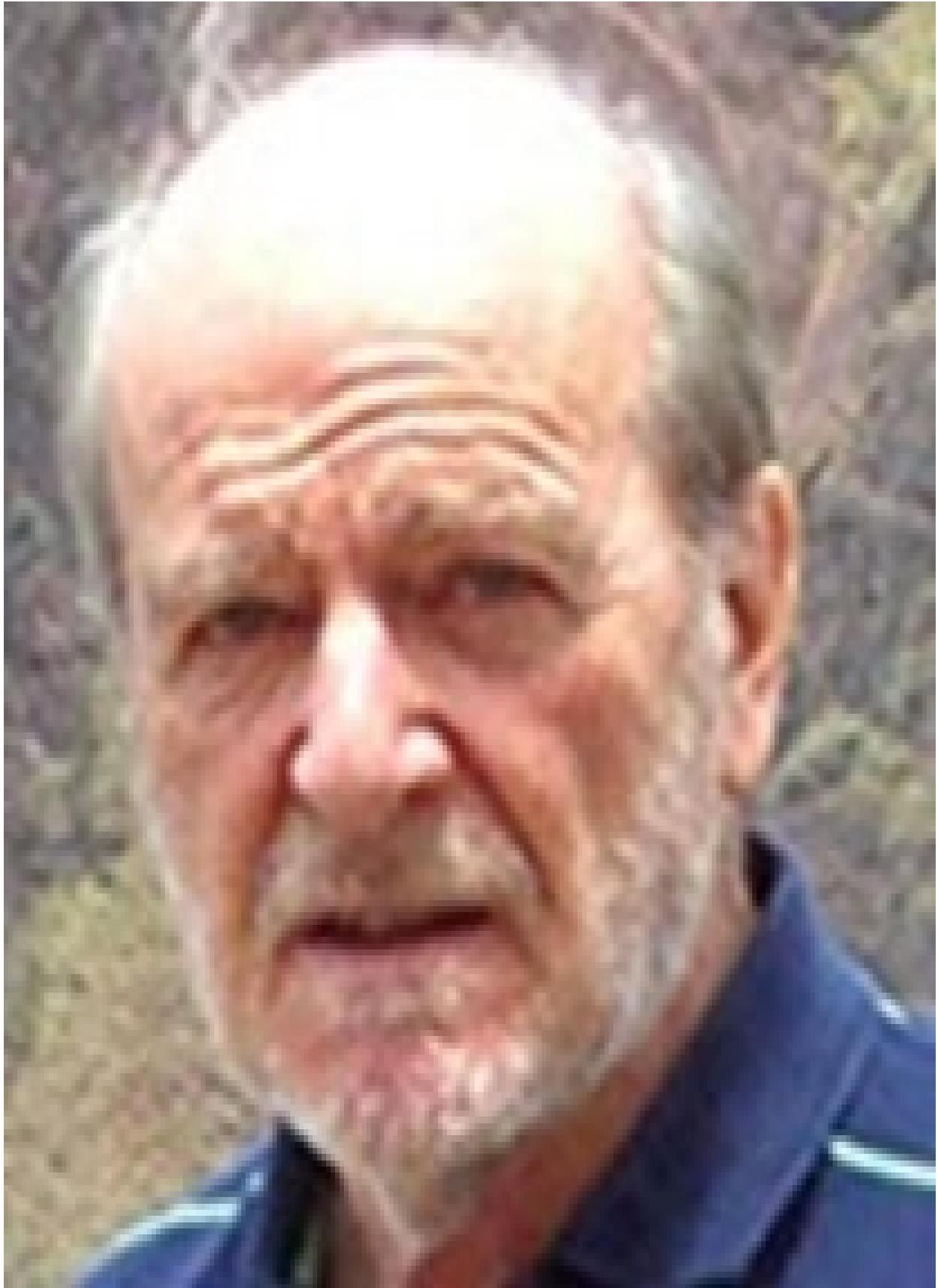
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This publication provides the estimator and the business owner a reliable instrument for the unique task of estimating man hours with precision.

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Read more at [Gustavo Cinca's site](#).

## **About the Author**



Gustavo Miguel Cinca was born in San Rafael, Argentina, graduating as a Chemical Engineer.

During his professional career, he worked as a construction manager and finally as president of a Construction and Installation Company.

In his work trajectory, he built plants of Chemical Processes, Refineries, Gas Pipelines, Compressor Plants, and Thermal Power Station of the country and the foreigner.

As a result of this experience, the author gives the reader this e-book. The time-consuming tables of this e-book have been used by the author in his professional career.

Read more at Gustavo Cinca's site.