

Technical guide

General installation instructions for valves and fittings

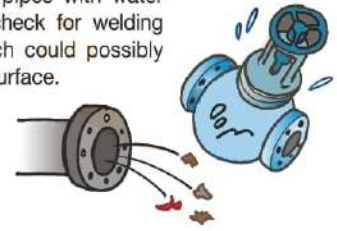
1. Storage

Before installation, please store the valves and fittings in a dry place to protect them from harsh weather conditions, wind and sand. Please leave the goods in their original packing and do not remove the flange or end protections. Please handle the products with care. Do not drop or drag them on the floor.



2. Cleaning of pipes

Before installing the valves and fittings on the pipes, please clean the pipes with water or compressed air. Please check for welding spatters or metal chips which could possibly damage the valves' sealing surface.



3. Deviations of pipes

Before installing the valves and fittings, please check the pipe dimensions with the equipment already in place. Please also verify the correct alignment of the upstream and downstream pipes.

Do not count on the valves and fittings to make up for pipe deviations.

This might result in sealing leakages, blockages or mechanical ruptures.



4. Expansion joints

For pipes carrying heat transfer fluids, please anticipate the compensation of dilatations with the help of adapted equipment (loops and/or expansion joints).

Their absence may lead to mechanical ruptures and a blocking of the valves.



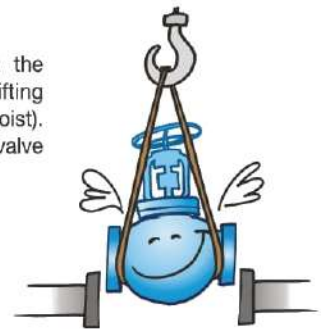
5. Mounting direction

A certain number of devices do not necessarily have a symmetrical functioning. It is essential to comply with the mounting direction indicated by the engraved or stamped arrow on the body and adapt it to the direction of the fluid flow.



6. Slings

When installing the valves on the pipes, please use adapted lifting devices (bridge crane, forklift, hoist). It is necessary to align the valve correctly while installing it.



7. Support

For valves representing a significant weight in comparison with the pipes' solidity, it is essential to provide an additional support independently from the pipes.

Likewise, the valves cannot serve as support for pipes since they have to be supported themselves. The failure to respect these rules can lead to leakages, blockages and breakages.



8. Tightening

For threaded and flanged valves and fittings, please use a suitable tightening torque. Insufficient tightening can result in leakages.

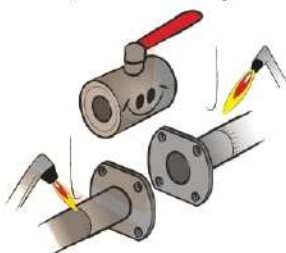
Overtightening can lead to blocking the valve or mechanical ruptures. The coupling torques are indicated on every product manual.



9. Welding of valves

When welding steel or stainless steel valves, make sure they are in the open position.

Extreme care must be taken with small valves to cause no damage to the critical valve components, which may be close to the weld area. Great caution must be taken when welding soft-seated ball valves.



10. Water hammers

A water hammer, by generating a sudden rise in pressure, can cause considerable damage:

slotted valve closure member, deformed stem etc. The causes of water hammers are varied.

The non-progressive start of a pump and the sudden closing of a valve are the most frequently found causes.



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Selecting your valve - Aspects to take into consideration when determining a valve.

Service conditions

- Fluid used:
 - Phase: gas, liquid or powdered
 - Nature: water, air, petrol, solvent...
 - Classification acc. to Regulation n°1272 (hazardous, non-hazardous)
- Operating pressure: allowable maximum and minimum
- Operating temperature: allowable maximum and minimum

Type of valve and its functionality

- Type:
 - Ball valve
 - Gate valve
 - Safety valve
 - Butterfly valve
 - Knife gate valve
 - Pressure regulating valve
 - Globe valve
 - Check valve
 - Strainers
 - Needle valve
 - Control valve
 - etc.
- Function: sectioning, regulation, balancing, safety, passing, releasing...

Features

- Material of the body, the closing member, the seats and gaskets
- Nominal diameter and bore
- Type of connection:
 - Threaded: BSP/NPT/SMS
 - Welding: SW/BW
 - Flanged: various standards
 - Quick couplings (camlock, symmetrical, clamp...)
- Face-to-face dimension acc. to EN 558 or others
- Type of operation:
 - Manual valves: handle, handwheel, lever, gear box
 - Actuated valves: pneumatic, hydraulic, electric

Other factors

- Environmental conditions & installation location of the valves
- Standards: ISO, EN, ANSI, other specific national standards, fire safe, fugitive emissions...
- Required certification: CE-PED, ATEX, inspection documents acc. to EN 10204, hydraulic test
- Service lifetime, cycles and expected wear
- Maintenance procedures and spare parts availability

Usual standards for valves

General standards		
EN 736-3	Valves - Terminology - Part 3: Definition of terms	May 2008
EN 12266-1	Industrial valves - Testing of metallic valves Pressure tests, test procedures and acceptance criteria. Mandatory requirements	May 2012
EN 12516	Industrial valves - Shell design strength - Parts 1 to 4	(acc. to parts)
EN 1267	Industrial valves - Test of flow resistance using water as test fluid	March 2012
EN 12627	Industrial valves - Butt welding ends for steel valves	November 2017
EN 12760	Industrial valves - Socket welding ends for steel valves	July 2016
EN 12982	Industrial valves - End-to-end and centre-to-end dimensions for butt welding end valves (including DIN 3202-4)	October 2009
EN 19	Industrial valves - Marking of metallic valves	May 2016
EN 558	Industrial valves - Face-to-face and centre-to-face dimensions of metal valves for use in flanged pipe systems (PN & Class)	February 2022
EN 16722	Industrial valves - End-to-end and centre-to-end dimensions for valves with threaded ends	December 2015
EN 1074	Valves for water supply - Fitness for purpose requirements and appropriate verification tests - Parts 1 to 6	(acc. to parts)
EN 1092	Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated - Parts 1 to 4	(acc. to parts)
EN 1759	Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, Class designated - Parts 1 to 4	(acc. to parts)
EN 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems	January 2011
ISO 10497	Testing of valves - Fire type-testing requirements	February 2022
ISO 7-1	Pipe threads where pressure-tight joints are made on the threads - Part 1: Dimensions, tolerances and designation	January 1994
ISO 228-1	Pipe threads where pressure-tight joints are not made on the threads - Part 1: Dimensions, tolerances and designation	September 2000
ISO 15848	Industrial valves - Measurement, test and qualification procedures for fugitive emissions	June 2015
ISO 5208	Industrial valves - Pressure testing of metallic valves	June 2015
ISO 6708	Pipework components - Definition and selection of DN (nominal size)	July 1995
ISO 7268	Pipe components - Definition of nominal pressure.	May 1983

Product standards		
EN 593	Industrial valves - Metallic butterfly valves for general purposes	December 2017
EN 1983	Industrial valves - Steel ball valves	October 2013
EN 1349	Industrial process control valves	December 2009
EN 1074	Valves for water supply - Fitness for purpose requirements and appropriate verification tests - Parts 1 to 6	(acc. to parts)
ISO 4126-1	Safety devices for protection against excessive pressure - Part 1: Safety valves	September 2013

ANSI standards		
ANSI B1.20	Pipe Threads, General Purpose, Inch	November 2013
ANSI B16.1	Gray Iron Pipe Flanges And Flanged Fittings: Classes 25, 125, And 250	November 2020
ANSI B16.5	Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24, Metric/Inch Standard	February 2021
ANSI B16.9	Factory-Made Wrought Buttwelding Fittings	October 2018
ANSI B16.10	Face-to-Face and End-to-End Dimensions of Valves	June 2017
ANSI B16.11	Forged Fittings, Socket-Welding and Threaded	June 2017
ANSI B16.20	Metallic Gaskets for Pipe Flanges	December 2017
ANSI B16.25	Buttwelding Ends	December 2017
ANSI B16.34	Valves-Flanged, Threaded, and Welding End	January 2021

(more standards on pages 15 & 17).

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PED - Pressure Equipment Directive (2014/68/EU)

On May 15th, 2014, the new Pressure Equipment Directive (PED) has been adopted by the European Parliament and the Council of the European Union. Some essentials of the former PED remain unchanged such as the scope, the "Essential Safety Requirements" (Annex I), the "Conformity Assessment Tables" (Annex II), and the CE marking requirements.

However, concerning changes, the new PED defines the obligations and responsibilities of importers (Art.8) and distributors (Art. 9). It is also quite noticeable that the Art. 3, §3 of the 97/23/EC Directive, defining the exclusions of the PED's Technical Requirements, becomes the Art. 4, §3 under the 2014/68/EU Directive.

1 - Scope

The PED applies to the design, manufacture and conformity assessment of pressure equipment and assemblies with a maximum allowable pressure (PS) greater than 0,5 bar such as: vessels, pressurised storage containers, heat exchangers, steam generators, boilers, industrial pipes, safety devices, pressure accessories, valves and fittings.

Equipment excluded from the PED (CE marking prohibited) :

- Equipment with PS < 0,5 bar (Art. 1 §1)
- Valves and fittings < DN32 (Art. 4 §3)

DN: Nominal size
PS: Maximum allowable pressure
TS: Maximum/minimum allowable temperature

2 - Classification & fluid groups acc. to Regulation n°1272/2008 (2014/68/EU Directive, Art. 13, §1)

Fluids means gases, liquids and vapours in pure phase as well as mixtures thereof. Fluids may contain a suspension of solids.

Group 1 - Hazardous fluids		Group 2 - Non hazardous fluids	
explosive, extremely flammable, highly flammable, flammable (max. allowable temp. above flashpoint), pyrophoric, very toxic, toxic, oxidizing.		other fluids not referred to in Group 1	
Liquids example: fuel	Gases example: natural gas	Liquids example: water	Gases example: saturated steam

3 - Risk categories (Annex II)

Risk category IV only applies for safety devices.

3/1 - Dangerous gases (Group 1), example: natural gas (Annex II, table 6)

Class	PN	DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	
2,5																			
6																			
10																			
16																			
150																			
25																			
40																			
300																			
63																			
100																			
600																			
1500																			
2500																			

3/2 - Other gases (Group 2), example: air (Annex II, table 7)

Class	PN	DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
2,5																				
6																				
10																				
16																				
150																				
25																				
40																				
300																				
63																				
100																				
600																				
1500																				
2500																				

3/3 - Dangerous liquids (Group 1), example: fuel (Annex II, table 8)

Class	PN	DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
2,5																				
6																				
10																				
16																				
150																				
25																				
40																				
300																				
63																				
100																				
600																				
1500																				
2500																				
> 500 bar																				

3/4 - Other liquids (Group 2), example: water (Annex II, table 9)

Class	PN	DN	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500
2,5																				
6																				
10																				
16																				
150																				
25																				
40																				
300																				
63																				
100																				
600																				
1500																				
2500																				
> 500 bar																				

4 - Conformity assessment procedures (Art. 4 + Annex III)

	Without Quality Assurance		With Quality Assurance	
	type	unit	type	unit
Category I	Module A Internal production control (self-certification)		-	
Category II	Module A2 Internal manufacturing control & Random checks + monitoring of final assessment by NB		Module D1 Production process QA by NB	Module E1 Final product inspection QA by NB
Category III	Module B (design type) + C2 EU design-examination + conformity to type by NB & Random checks	Module B (design type) + F EU design-examination + product verification by NB	Module B (production type) + E EU type-examination + product QA by NB	Module H Full QA = Quality system assessment & surveillance by NB
Category IV	Module B (production type) + F EU type-examination + product verification by NB	Module G EU unit verification by NB	Module B (production type) + D EU type-examination + production process QA by NB	Module H1 Full QA + design-examination + special surveillance of final assessment by NB

QA: Quality assurance / NB: Notified bodies

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5 - Notified bodies

List of notified bodies operating with our manufacturers under 2014/68/EU Directive:

0035	0036	0045	0056	0062	0408	0409	0496	0497	0948	1115
										
TÜV Rheinland Industrie Service Germany	TÜV Süd Industrie Service Germany	TÜV Nord Systems Germany	ECA Grupo Bureau Veritas Spain	Bureau Veritas France	TÜV Austria Services Austria	Inspecta Sweden Sweden	DNV GL Business Assurance Italia Italy	CSI Italy	TÜV Italia Italy	Consorzio Pascal Italy

ATEX Directive (2014/34/EU)

Directive on equipment and protective systems intended for use in potentially explosive atmospheres (ATEX - ATmosphères EXplosibles).

There are 2 ATEX Directives: Directive 2014/34/EU concerns equipment (products) and Directive 1999/92/EC relates to the minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres.

Potential explosive atmospheres exist when air is mixed, under atmospheric conditions, with flammable substances in the form of gases, vapours, mists or clouds of dust which can entirely spread combustion when exposed to a source of ignition.

The new 2014/34/EU Directive defines the obligations and responsibilities of importers (Art.8) and distributors (Art. 9). Moreover, the Directive establishes that every operator shall keep records of any supply of ATEX equipment for 10 years (Art. 11).

1 - About valves

The Directive (Art. 2, §1) and the "ATEX 2014/34/EU Guidelines" (§38) **determine that equipment and simple piping elements such as fittings, manual valves, non-return valves, strainers, pressure reducers, safety valves, steam traps... are out of the scope of the directive** because they do not have their "own potential source of ignition". Therefore, they do not need certification to be installed in hazardous areas.

Only actuated valves (whether electric or pneumatic) and sight glasses (because of the mechanical resistance of their glass part) are subject to the ATEX Directive.


However, regarding manual valves and other simple piping elements, a risk analysis should be carried out to ensure the compatibility of the valve with the explosive environment. This involves, for example, ensuring that the electrostatic risk due to the plastic elements of a valve is eliminated.

2 - Zone classification

The Directive concerns gassy mines and surface industries for the two risk atmospheres: presence of gas or presence of dust. It is up to the operator to define the zones in which an explosive atmosphere can occur using the following classification according to 1999/92/EC Directive:

Gases	Dusts	Definition of zone
0	20	areas where an explosive atmosphere is expected to exist continuously or for long periods of time or more than 1000h/year.
1	21	areas where an explosive atmosphere is expected to exist for short periods of time and less than 1000h/year.
2	22	areas where an explosive atmosphere is not expected and if released, it will only exist for a very short period of time and less than 10h/year.

3 - ATEX marking - Example & explanation

CE 0409  II 2 G Eex ia IIC T6 IP6X

"IP6X" Ingress Protection rating: apply for dust group (see p. 10)

"T6" Max. surface temperature class	Gas group	T1 450°C T2 300°C T3 200°C T4 135°C T5 100°C T6 85°C	Dust group	"T300°C" The max. surface temperature indicated on the material must be below the ignition temperature (dust layer <5mm). In case of dust cloud, it must not exceed 2/3 of ignition temperature.
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I Methane (Mining)
"IIC" Explosion group (gas group):
 IIA less easily ignited such as Propane
 IIB easily ignited such as Ethylene
 IIC most easily ignited such as Hydrogen & Acetylene

"ia" Type of protection:
 d Flameproof pressure-resistant encapsulation
 e Increased safety
 i Intrinsic safety: "ia" for zone 0 / "ib" sufficient for zone 1 / "ic" sufficient for zone 2
 m Encapsulated: "ma" for zone 0 / "mb" sufficient for zone 1 / "mc" sufficient for zone 2
 o Oil immersion
 q Powder filling
 p Pressurised enclosure
 n Protection mode: "nA" Non-sparking / "nC" Enclosure break / "nR" Restricted / "nL" Limited energy

"Eex" Explosion protection
"G" Environment:
 G Gas group
 D Dust group

"2" Equipment Category:
 1 Category 1 - Equipment that is intended for use in zone 0 or 20
 2 Category 2 - Equipment that is intended for use in zone 1 or 21
 3 Category 3 - Equipment that is intended for use in zone 2 or 22
 M1 Mining
 M2 Mining

"II" Equipment Group:
 I Mining - Category M1 and M2.
 II All other places - Category 1, Category 2 & Category 3.

 Specific marking for explosion protection
 0409 Notified body involved in the production control procedure
 CE marking certifying the compliance with the Directive

Summary of inspection documents acc. to EN 10204:2004

EN 10204 Reference	Designation of the document type	Document content	Document validated by
Type 2.1	Declaration of compliance with the order	Statement of compliance with the order.	The manufacturer
Type 2.2	Test report	Statement of compliance with the order, with indication of results of non-specific inspection.	The manufacturer
Type 3.1	Inspection Certificate 3.1	Statement of compliance with the order, with indication of results of specific inspection.	The manufacturer's authorized inspection representative independent of the manufacturing department
Type 3.2	Inspection Certificate 3.2	Statement of compliance with the order, with indication of results of specific inspection.	The manufacturer's authorized inspection representative independent of the manufacturing department and either the purchaser's authorized inspection representative or the inspector designated by the official regulations.

Testing of metallic valves

Different standards may be referred to regarding metallic valve testing and leakage rating. Two main standards are most commonly used : **EN 12266-1** and **API 598**. Where any of those 2 standard is specified as a normative reference in a product, its performance shall be considered according to the requirements of that standard.

■ EN 12266-1

Industrial valves - Testing of metallic valves - Part 1: Pressure tests, test procedures and acceptance criteria - Mandatory requirements

The EN 12266-1 specifies the mandatory test requirements, test procedures and acceptance criteria for production testing of industrial valves made of metallic materials. Safety devices are not in the scope of the EN 12266-1. The prescribed tests may also be used as type tests, or acceptance tests.

The following requirements are considered : **Shell resistance, shell tightness, seat tightness** and **closure resistance**. The Annex A of the standard defines the test procedures and acceptance criteria.

1 - Test pressure & medium

- **Shell resistance (P10), shell tightness (P11) and closure resistance (P20)**: test pressure = 1.5 x PS (max. allowable pressure at ambient temp.). Shell resistance & tightness must be tested with liquid unless otherwise agreed by the parties.
- **Seat tightness (P12)**: the test pressure shall be at least 1.1 x PS (max. allowable pressure at ambient temp.). If the test medium is a gas, the test pressure shall be the lower between 1.1 x PS and 6 bar (± 1 bar).

2 - Duration of test (Tables A.2 & A.4 - Minimum duration of test)

Test ref.	P10 & P11 (+P20)		P12	
	Shell resistance & tightness (+Closure resistance ^(A))		Seat tightness	
Closure	Partially open		Open to closed	
Testing pressure	1.5 x PS		1.1 x PS ^(B)	
	Production & reception testing	Type testing	Production & reception testing	Type testing
			Metallic seated & metallic soft-seated valves	All valves
Medium	Liquid or gas ^(C)	Liquid or gas ^(C)	Liquid or gas	Liquid or gas
Up to DN50	15 s	10 min	15 s	10 min
DN65 to DN150	60 s	10 min	60 s	10 min
DN200 to DN300	120 s	10 min	120 s	10 min
DN350 and above	300 s	10 min	120 s	10 min

(A) Check the pressure resistance of the closure if the valve is used as the sole means of isolation between the contents of a pressure equipment and the downstream part not designed to withstand the upstream pressure.

(B) If the test medium is a gas, the test pressure shall be the lower between 1.1 x PS and 6 bar (± 1 bar).

(C) Shell resistance must be tested with liquid unless otherwise agreed by the parties.

3 - Acceptance criteria

- For the shell resistance, shell tightness and closure resistance tests:
 - Whether the test is performed with a liquid or a gas, no visible leakage is allowed.
- For the seat tightness test, the selection of rates A to G is specified in the corresponding valve product standards.
 - The leakage rates measured during the test period shall not exceed the rate specified in the following table (Table A.5 - Maximum allowable seat leakage for each leakage rate - in mm³/s) :

Test medium	Rate A	Rate B	Rate C	Rate D	Rate E	Rate F	Rate G
Liquid	No visually detectable leakage during the test period	0,01 x DN	0,03 x DN	0,1 x DN	0,3 x DN	1 x DN	2 x DN
Gas		0,3 x DN	3 x DN	30 x DN	300 x DN	3000 x DN	6000 x DN

Note 1 - Leakage rates apply only for discharge at room temperature.

Note 2 - "No visually detectable leakage" means no visible seepage or formation of drops or bubbles.

If leakage rate measurements are made by automatic means, they must be qualified by the manufacturer's quality system.

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■ API 598

Valve Inspection and Testing

1 - Scope

The API 598, from the American Petroleum Institute, provides industry standards for valve ratings and valve leakage allowance. The standard is currently in the 10th edition (2016). It covers inspection, examination, and pressure test requirements for resilient-seated, nonmetallic-seated, and metal-to-metal-seated valves of the gate, globe, plug, ball, check, and butterfly types.

API 598 specifies the following tests and examinations :

- **Shell resistance** tests to validate the pressure containing structures of the valve.
- **Backseat tests** to verify the leakage through the sealing of the stem.
- **Low-pressure & high pressure closure tests** to verify the leakage through the closure mechanism.

2 - Pressure tests (Tables 1 & 2 - Pressure tests according to valve type)

Test description	Valve type					
	Gate	Globe	Plug	Check	Floating ball	Butterfly ^(B)
shell	required	required	required	required	required	required
backseat ^(A)	required	required	n/a	n/a	n/a	n/a
low-pressure closure	up to Class1500 (≤DN100) & Class600 (>DN100)	required	optional	required	optional	required
	above to Class1500 (≤DN100) & Class600 (>DN100)	optional	optional	optional	optional	required
high-pressure closure	up to Class1500 (≤DN100) & Class600 (>DN100)	optional	required	optional	required	optional
	above to Class1500 (≤DN100) & Class600 (>DN100)	required	required	required	required	optional

(A) The backseat test is required for all valves, except for bellows seal valves, that have the backseat feature. / (B) Also applies to trunnion mounted ball valves.

The test medium shall be air, inert gas, kerosene, water (or a noncorrosive liquid with a viscosity no higher than that of water) at temperature between 5°C and 50°C. The test pressures depend on the valve type, the pressure class and the DN of the valve according to tables 3 & 4.

3 - Duration of test (Tables A.2 & A.4 - Minimum duration of test)

Valve size		Minimum test duration ^(A)			
DN	NPS	Shell	Backseat ^(B)	Closure check valves ^(C)	Closure other valves
≤ 50	≤ 2"	15	15	60	15
65 to 150	2"1/2 to 6"	60	60	60	60
200 to 300	8" to 12"	120	60	120	120
≥ 350	≥ 14"	300	60	120	120

(A) In seconds. The test duration is the period of inspection after the valve is fully prepared and is under full pressure. / (B) For valves with backseat feature. / (C) API 594.

4 - Acceptance criteria

- For the **shell** and **backseat** tests:
 - Whether the test is performed with a liquid or a gas, no visual detectable leakage is permitted.
- For the **low-pressure closure** test, the table 6 defines the maximum allowable leakage rates for closure tests.

Valve size ^(A)		All resilient seated valves	Metal seated valves		Metal seated check valves		
DN (mm)	NPS (in.)		Liquid test ^(B) (drops/min)	Gas test (bubbles/min)	Liquid test (cc/min)	Gas test (m ³ /h)	Gas test (ft ³ /h)
≤ 50	≤ 2"	0	0 ^(B)	0 ^(B)	6	0,08	3
65	2"1/2	0	5	10	7,5	0,11	3,75
80	3"	0	6	12	9	0,13	4,5
100	4"	0	8	16	12	0,17	6
125	5"	0	10	20	15	0,21	7,5
150	6"	0	12	24	18	0,25	9
200	8"	0	16	32	24	0,34	12
250	10"	0	20	40	30	0,42	15
300	12"	0	24	48	36	0,5	18
350	14"	0	28	56	42	0,59	21
400	16"	0	32	64	48	0,67	24
450	18"	0	36	72	54	0,76	27
500	20"	0	40	80	60	0,84	30

(A) For valve size above DN500 (NPS20), please refer to the API 598 standard for rates values. / (B) For the liquid test, 1 mL is considered equivalent to 16 drops. / (C) There shall be no leakage for the minimum specified test duration (see Table 5). For liquid test, 0 drop means no visible leakage. For gas test, 0 bubbles means less than 1 bubble.

■ ISO 5208:2015

Industrial valves - Industrial valves - Pressure testing of metallic valves

Specifies examinations and tests that a valve manufacturer needs to act upon in order to establish the integrity of the pressure boundary of an industrial metallic valve and to verify the degree of valve closure tightness and the structural adequacy of its closure mechanism.

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Ingress Protection rating (IP code)

Degree of protection provided by the product enclosure; marked on the product in the form of an "IP" code.

First digit: solid particle protection		Second digit: liquid ingress protection					
4	Element $\varnothing \geq 1 \text{ mm}$	0	Not protected	3	Protected against spraying water & rain up to 60° from vertical	6	Protected against heavy seas & high pressure water jets
5	Dust protected	1	Protected against vertical dripping water	4	Protected against splashing water from all directions	7	Protection against the effects of immersion inferior of 1 m
6	Dust tight	2	Protected against dripping water up to 15° from vertical	5	Protected against water jets	8	Protection against submersion superior of 1 m

Example: IP 54 would indicate a dust protected (first digit 5) piece of equipment which is protected against splashing water (second digit 4).

SIL - Safety Integrity Level certification (IEC EN 61508)

The International Electrotechnical Commission defines the different SIL levels for electric and electronic devices as follows:

For low demand operation:

PFH (Probability of Failure on Demand) and RRF (Risk Reduction Factor)

SIL	PFH	RRF
1	0.1-0.01	$10^{-1} - 10^{-2}$
2	0.01-0.001	$10^{-2} - 10^{-3}$
3	0.001-0.0001	$10^{-3} - 10^{-4}$
4	0.0001-0.00001	$10^{-4} - 10^{-5}$

For continuous operation:

PFH (Probability of Failure per Hour) and RRF (Risk Reduction Factor)

SIL	PFH	RRF
1	0.00001-0.000001	$10^{-5} - 10^{-6}$
2	0.000001-0.0000001	$10^{-6} - 10^{-7}$
3	0.0000001-0.00000001	$10^{-7} - 10^{-8}$
4	0.00000001-0.000000001	$10^{-8} - 10^{-9}$

Pressure ratings

Standard	Temp.	Pressure												
		20 bar	50 bar	63 bar	69 bar	100 bar	138 bar	150 bar	207 bar	250 bar	420 bar			
Max. allowable pressure														
ISO	20°C	PN20	PN50	PN63	-	PN100	-	PN150	-	PN250	PN420			
ANSI B 16.34	454°C	150 lbs (300°C)	300 lbs	-	400 lbs	600 lbs	-	900 lbs	-	1500 lbs	2500 lbs			
API 602 (forged)	454°C	-	-	-	-	-	-	800 lbs	-	-	1500 lbs	-		
API 6A / CWP (Cold Water Pressure)	16°C	-	-	-	API 1000	API 1500	API 2000	-	API 3000	-	API 6000			
WOG (Water Oil Gas)	16°C	-	-	-	1000 psi	1500 psi	2000 psi	-	3000 psi	-	6000 psi			

Steam table

Relative pressure / Temperature correlation table for saturated steam (rounded to 1 decimal).

bar	°C	bar	°C	bar	°C	bar	°C	bar	°C	bar	°C	bar	°C	bar	°C
0,5	111,6	6	165,0	11,5	189,9	19	212,4	30	235,7	45	258,8	100	311,7	155	345,3
1	120,4	6,5	167,8	12	191,6	20	214,9	31	237,5	50	265,2	105	315,3	160	347,9
1,5	127,6	7	170,5	12,5	193,4	21	217,3	32	239,2	55	271,1	110	318,8	165	350,4
2	133,7	7,5	173,0	13	195,1	22	219,6	33	240,9	60	276,7	115	322,1	170	352,8
2,5	139,0	8	175,4	13,5	196,7	23	221,9	34	242,6	65	281,9	120	325,3	175	355,1
3	143,7	8,5	177,7	14	198,3	24	224,0	35	244,2	70	286,8	125	328,4	180	357,5
3,5	148,0	9	179,9	14,5	199,9	25	226,1	36	245,8	75	291,5	130	331,5	185	359,7
4	151,9	9,5	182,0	15	201,4	26	228,1	37	247,4	80	295,9	135	334,4	190	361,9
4,5	155,6	10	184,1	16	204,4	27	230,1	38	248,9	85	300,1	140	337,2	195	364,1
5	158,9	10,5	186,1	17	207,2	28	232,0	39	250,4	90	304,2	145	340,0	200	366,2
5,5	162,1	11	188,0	18	209,8	29	233,9	40	251,8	95	308,0	150	342,7	210	370,2

Technical guide

Main chemical compatibility chart for pressure gauges

Concerns the wetted parts of our pressure gauges (pages 210 to 213).

Fluid	Wetted part	Fluid	Wetted part	Fluid	Wetted part
Acetic Acid	B	Ethyl Acetate	A	Nitrogen	A
Acetone	B	Ethyl Cellulose	B	Oxygen	A
Acetylene	B	Ethylene	A	Ozone	A
Air	A	Ethylene Dibromide	B	Paraffin	A
Alcohol	A	Ethylene Glycol	A	Phosphoric Acid	B
Alums	B	Ferric Nitrate	B	Pickling Solutions	B
Aluminium Sulfate	B	Ferric Sulfate	B	Picric Acid	B
Ammonia	B	Formaldehyde	B	Potassium Cyanide	B
Ammonium Carbonate	B	Freon	A	Potassium Permanganate	B
Beer	A	Fuel Oil	B	Prestone	A
Benzene	A	Gallic Acid	B	Refined Oil	B
Benzol	A	Gasoline	A	Salicylic Acid	A
Benzyl Alcohol	B	Gasoline (refined)	B	Silver Nitrate	B
Bleach Liquors	B	Glycerine	A	Sodium Nitrate	B
Brine	B	Helium	B	Sodium Peroxide	B
Butane	B	Hydrocyanic Acid	B	Sodium Phosphate	B
Butanol	A	Hydrogen	B	Sodium Sulfate	B
Butyric Acid	B	Hydrogen Peroxide	B	Sodium Sulfite	B
Calcium Bisulfite	B	Kerosene	A	Sulfur Dioxide (dry)	B
Calcium Hydroxide	B	Lacquers	A	Sulfuric (75%)	B
Carbon Dioxide (dry)	B	Lactic Acid	B	Sulfurous Acid	B
Carbon Bisulfide	B	Lysol	B	Toluene	A
Casein	B	Magnesium Sulfate	B	Vegetable Oils	B
Chloroform	B	Mercury	B	Vinegar	B
Chromic Acid	B	Methane	A	Water	A
Citric Acid	B	Mineral Oils	A	Water (carbonated)	B
Coal Gas	A	Naphtha	A	Water (demineralized)	A
Copper Sulfate	B	Natural Gas	A	Whisky	B
Cottonseed Oil	B	Nickel Acetate	B	Wines	B
Dextrine	A	Nitric Acid (pure)	B	Zinc Sulfate	B

A = Brass **B = F316 Stainless Steel**

IMPORTANT NOTICE: Data provided for informational purpose only. We recommend our customers to specify the materials they consider adapted to their actual service conditions.

Threaded connection standards

BSPP parallel thread ISO 228 & ISO 7 Rp for female thread		BSPT conical thread ISO 7 for male thread only		NPT conical thread ANSI B1.20 for both male & female thread	
H = 0,9604 x pitch		H = 0,9604 x pitch		H = 0,866 x pitch	
h = 0,6043 x pitch		h = 0,6043 x pitch		h = 0,800 x pitch	
r = 0,1373 x pitch		r = 0,1373 x pitch		conicity: 6,25 %	

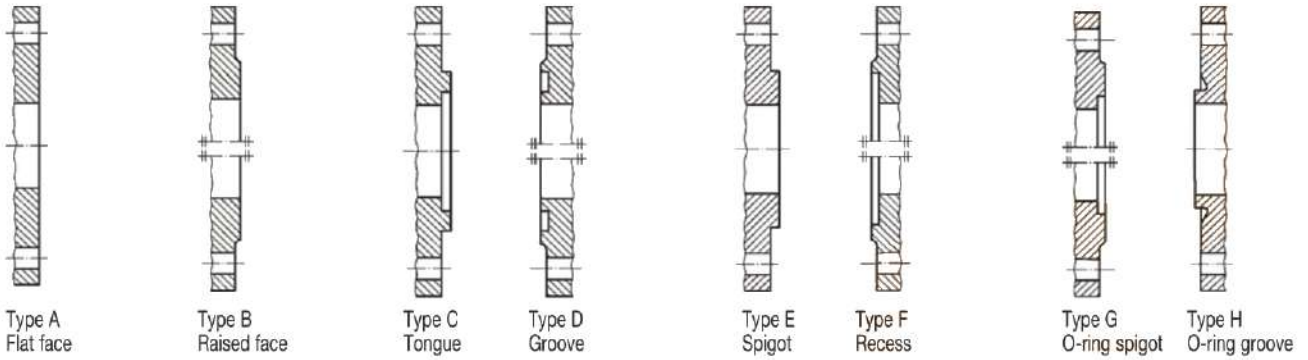
Ø		1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"
		BSP thread	threads per inch	19	19	14	14	11	11	11	11	11
	pitch (mm)	1.337	1.337	1.814	1.814	2.309	2.309	2.309	2.309	2.309	2.309	2.309
NPT thread	threads per inch	18	18	14	14	11.5	11.5	11.5	11.5	8	8	8
	pitch (mm)	1.411	1.411	1.814	1.814	2.209	2.209	2.209	2.209	3.175	3.175	3.175

Diameter equivalences table

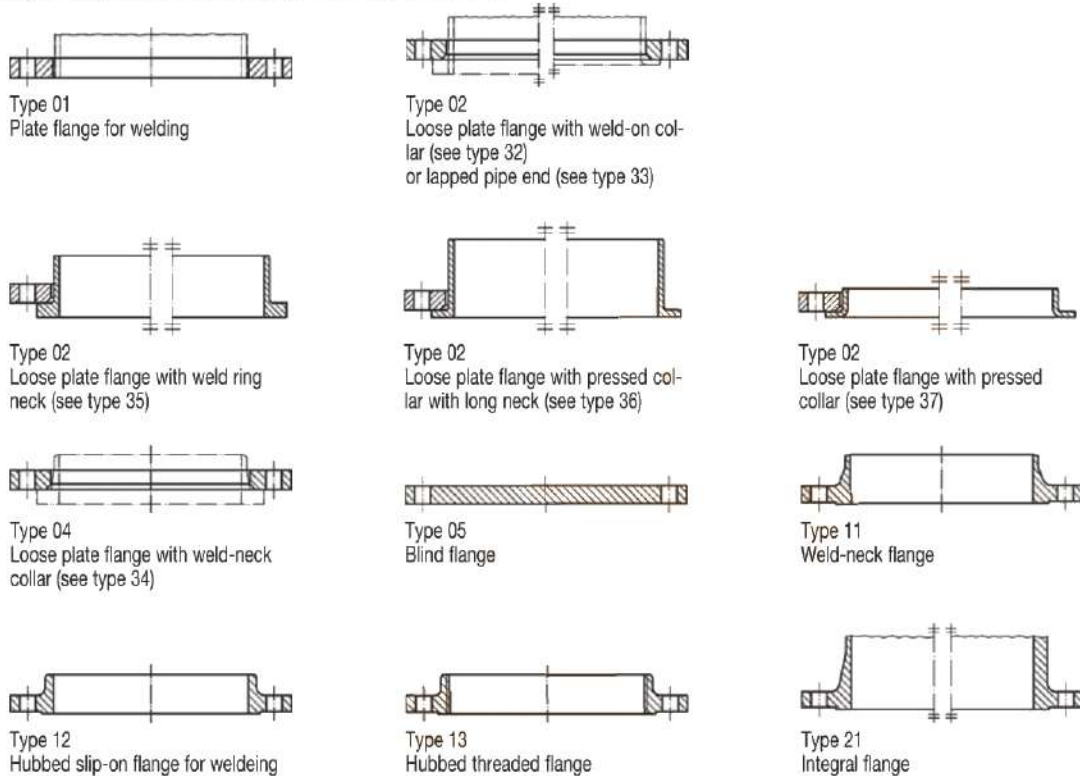
DN	8	10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400
NPS	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	4"	5"	6"	8"	10"	12"	14"	16"
Metric	8/13	12/17	15/21	20/27	26/34	33/42	40/49	50/60	66/76	80/88	102/114	125/139	150/168	200/219	-	-	-	-
Plastic pipes	-	-	20	25	32	40	50	63	75	90	110	-	-	-	-	-	-	-

Technical guide

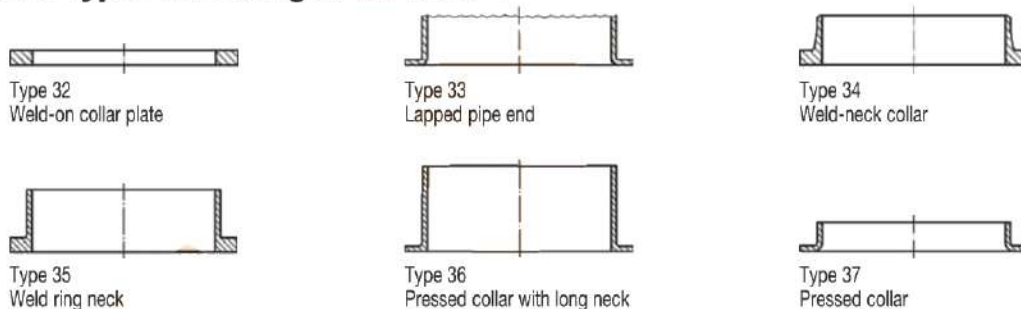
Flange facing types according to EN 1092-1



Flange types according to EN 1092-1



Collars types according to EN 1092-1



Usual standards for valves – API standards (continued from page 7)

API standards		
API 6FA	Standard for Fire Test of Valves	January 2020 (5th)
API 6D	Specification for Pipeline and Piping Valves	November 2021 (25th)
API 598	Valve Inspection and Testing	October 2016 (10th)
API 600	Steel Gate Valves-Flanged and Butt-welding Ends, Bolted Bonnets	May 2021 (14th)
API 602	Gate, Globe, and Check Valves for Sizes DN 100 (NPS 4) and Smaller for the Petroleum and Natural Gas Industries	May 2015 (10th)
API 607	Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats	June 2016 (7th)
API 608	Metal Ball Valves - Flanged, Threaded, and Welding Ends	January 2020 (6th)
API 609	Butterfly Valves: Double-flanged, Lug- and Wafer-type, and Butt-welding Ends	April 2021 (9th)
API 622	Type Testing of Process Valve Packing for Fugitive Emissions	July 2018 (3rd)
API 623	Steel Globe Valves - Flanged and Butt-welding Ends, Bolted Bonnets	January 2021 (2nd)

Technical guide

Face to face dimensions (EN 558)

Main basic series

(dimensions in mm)

DN	10	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	600
Series 1	130	130	150	160	180	200	230	290	310	350	400	480	600	730	850	980	1100	1200	1250	1450
Series 2	210	210	230	230	260	260	300	340	380	430	500	550	650	775	900	1025	1150	1275	1400	1600
Series 3	102	108	117	127	140	165	178	190	203	229	254	267	292	330	356	381	406	432	457	508
Series 4	-	140	152	165	178	190	216	241	283	305	381	403	419	457	502	762	838	914	991	1143
Series 5	-	165	190	216	229	241	292	330	356	432	508	559	660	787	838	889	991	1092	1194	1397
Series 7	108	108	117	127	146	159	190	216	254	305	356	406	521	635	749	-	-	-	-	-
Series 10	-	108	117	127	140	165	203	216	241	292	330	356	495	622	698	787	914	978	978	1295
Series 12	130	130	130	140	165	165	203	222	241	305	356	394	457	533	610	686	762	864	914	1067
Series 13	-	-	-	-	-	106	108	112	114	127	140	140	152	165	178	190	216	222	229	267
Series 14	115	115	120	125	130	140	150	170	180	190	200	210	230	250	270	290	310	330	350	267
Series 15	-	-	-	120	140	240	250	270	280	300	325	350	400	450	500	550	600	650	700	800
Series 16	-	-	-	-	-	33	43	46	64	64	70	76	89	114	114	127	140	152	152	178
Series 18	80	80	90	100	110	120	135	165	185	229	-	-	-	-	-	-	-	-	-	-
Series 19	-	140	152	165	178	190	216	241	283	305	381	403	419	457	502	572	610	660	711	787
Series 20	-	-	-	-	-	33	43	46	46	52	56	56	60	68	78	78	102	114	127	154
Series 21	-	152	178	216	229	241	267	292	318	356	400	444	533	622	711	838	864	978	1016	1346
Series 25	-	-	-	-	-	-	-	-	49	56	64	70	71	76	83	92	102	114	127	154
Series 26	-	-	-	-	-	240	250	290	310	350	400	450	550	650	750	850	950	1050	1150	1350
Series 27	115	115	120	125	130	140	150	170	180	190	325	350	400	450	500	550	762	-	914	-
Series 28	130	130	150	160	180	200	230	290	310	350	400	450	550	650	750	850	950	-	1150	-
Series 29	108	108	117,5	127	127	136	142	154	160	172	186	200	228	255	285	315	340	360	380	425
Series 33	-	-	-	-	-	152	178	216	254	305	381	457	584	711	813	889	991	1092	1194	1397
Series 47	-	-	75	80	90	100	110	130	150	160	200	210	-	-	-	-	-	-	-	-
Series 48	-	-	-	-	-	180	200	240	260	300	350	400	500	600	700	800	900	1000	1100	1300
Series 49	-	16	19	22	28	31,5	40	46	50	60	90	106	140	-	-	-	-	-	-	-
Series 52	25	31,5	35,5	40	45	56	63	71	80	110	125	160	200	250	280	-	-	-	-	-
Series 54	-	-	229	254	279	305	368	419	381	457	551	610	737	838	965	1029	1130	1219	1321	1549
Series 55	-	216	229	254	279	305	368	419	470	546	673	705	832	991	1130	1257	1384	1537	1664	1943
Series 56	-	264	273	308	349	384	451	508	578	673	794	914	1022	1270	1422	-	-	-	-	-
Series 69	-	-	-	140	165	178	216	254	305	356	432	508	660	787	914	991	1092	-	-	-
Series 70	-	-	-	140	165	178	216	254	305	406	483	559	711	864	991	1067	1194	1346	1473	-
Series 71	-	-	-	186	232	232	279	330	368	457	533	610	762	914	1041	1118	1245	1397	-	-
Series 77	-	318	318	318	-	381	400	441	660	737	-	864	1022	1372	1575	1803	-	-	-	-
Series 91	-	-	-	-	-	310	350	425	470	550	650	750	950	1150	1350	1550	1750	1950	2150	-
Series 92	230	230	260	260	300	300	350	400	450	520	600	700	800	900	1050	-	-	-	-	-
Series 99	-	-	-	-	-	270	300	360	390	450	525	600	750	900	1050	1200	1350	1500	1650	-
Series 105	-	292	292	292	-	333	375	410	441	511	-	714	914	991	1130	1257	1422	1727	-	-
Series 106	-	292	292	292	-	333	375	410	460	530	-	768	972	1067	1219	1257	1422	1727	-	-
Series 107	-	50	50	60	65	80	95	110	145	170	-	-	-	-	-	-	-	-	-	-
Series 108	-	-	-	-	-	-	-	-	48	54	-	57	64	71	81	92	102	114	127	154
Series 109	-	-	-	-	-	-	-	-	48	54	-	59	73	83	92	117	133	149	159	181
Series 110	-	-	-	-	-	-	-	-	54	64	-	78	102	117	140	155	178	200	216	232

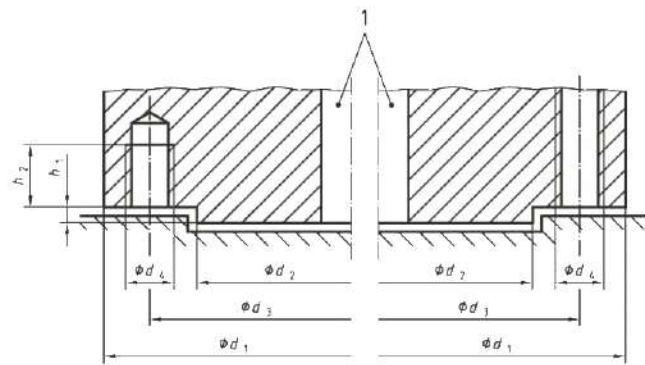
Origin of basic series

1	DIN 3202-1, series F1	19	ANSI B16.10, table 2, column 1	55	ANSI B16.10, table 6, column 5
2	DIN 3202-1, series F2	20	ANSI B16.10, table 9, column 3 & 4	56	ANSI B16.10, table 7, column 1 & 2
3	ANSI B16.10, table 1, column 8 & 9	21	ANSI B16.10, table 10, column 16 & 18	69	ANSI B16.10, table 5, column 2 & 6
4	ANSI B16.10, table 2, column 11	25	BS 2080, table 1, series 64	70	ANSI B16.10, table 6, column 2 & 6
5	ANSI B16.10, table 4, column 5	26	ANSI B16.10, table 9, column 4	71	ANSI B16.10, table 7, column 2 & 5
7	BS 2080, table 1, series 7	27	DIN 3357-2 ff	77	ANSI/ISA S75.16-1994 table 1
10	ANSI B16.10, table 1, column 16	28	DIN 3357-2 ff	91	DIN 3202-1, series F9
12	ANSI B16.10, table 1, column 3 BS 2080, table 1, series 12	29	NFE 29 - 377	92	DIN 3202-1, series F3
13	BS 2080, table 1, series 13	33	ANSI B16.10, table 4, column 6	99	DIN 3202-1, series F8
14	DIN 3202-1, series F4	47	DIN 3202-1, series F19	105	ANSI/ISA S75.16 table 1
15	DIN 3202-1, series F5	48	DIN 3202-1, series F6	106	ANSI/ISA S75.16 table 1
16	BS 2080, table 1, series 16	49	DIN 3202-3, series F4	108	API 609, table 2 - Class 150
18	BS 2080, table 1, series 18	52	DIN 3202-3, series F5	109	API 609, table 2 - Class 300
		54	ANSI B16.10, table 5, column 5	110	API 609, table 2 - Class 600

Usual standards for valves – Standards for actuation (continued from page 7)

Actuation standards		
EN 15081	Industrial valves - Mounting kits for part-turn valve actuator attachment	December 2007
EN 15714-1	Industrial valves - Actuators - Part 1: Terminology and definitions	December 2009
EN 15714-2	Industrial valves - Actuators - Part 2: Electric actuators for industrial valves (**Replaced by ISO 22153**)	December 2009
EN 15714-3	Industrial valves - Actuators - Part 3: Pneumatic part - Turn actuators for industrial valves - Basic requirements	December 2009
EN 15714-4	Industrial valves - Actuators - Part 4: Hydraulic part-turn actuators for industrial valves - Basic requirements	December 2009
ISO 22153	Electric actuators for industrial valves - General requirements	January 2020
ISO 5211	Industrial valves - Part-turn actuator attachments	March 2017

Pad dimensions for actuation according to ISO 5211



Legend

1 Part-turn actuator

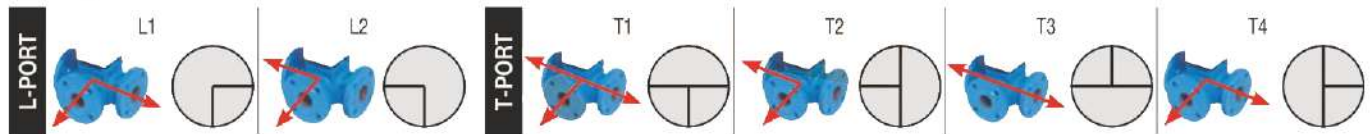
Dimensions in millimetres

Flange type	Dimensions							Number of screws, studs or bolts <i>n</i>
	d_1 min.	d_2^a	d_3	d_4	h_1 max.	h_2 min.	h_3 min.	
F03	Ø46	Ø25	Ø36	M5	3	8	5	4
F04	Ø54	Ø30	Ø42	M5	3	8	5	4
F05	Ø65	Ø35	Ø50	M6	3	9	6	4
F07	Ø90	Ø55	Ø70	M8	3	12	8	4
F10	Ø125	Ø70	Ø102	M10	3	15	10	4
F12	Ø150	Ø85	Ø125	M12	3	18	12	4
F14	Ø175	Ø100	Ø140	M16	4	24	16	4
F16	Ø210	Ø130	Ø165	M20	5	30	20	4
F25	Ø300	Ø200	Ø254	M16	5	24	16	8
F30	Ø350	Ø230	Ø298	M20	5	30	20	8
F35	Ø415	Ø260	Ø356	M30	5	45	30	8
F40	Ø475	Ø300	Ø406	M36	8	54	36	8
F48	Ø560	Ø370	Ø483	M36	8	54	36	12
F60	Ø686	Ø470	Ø603	M36	8	54	36	20
F80	Ø900	Ø670	Ø813	M42	10	63	42	20
F100	Ø1 200	Ø870	Ø1 042	M42	10	63	42	32

^a d_2 shall be manufactured within the diameter tolerance f8.

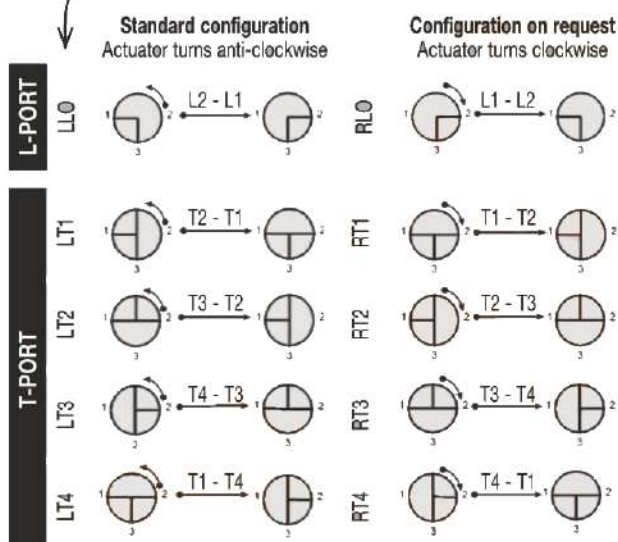
3 way actuated ball valves

Configuration and rotation of the ball



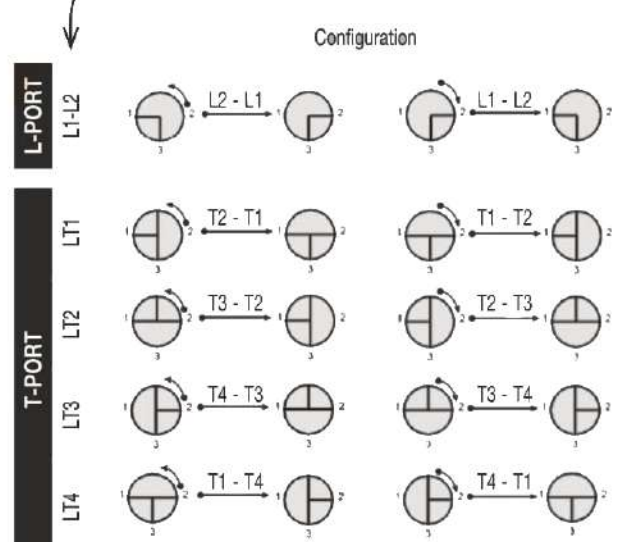
With spring return actuator

Mention the positioning code



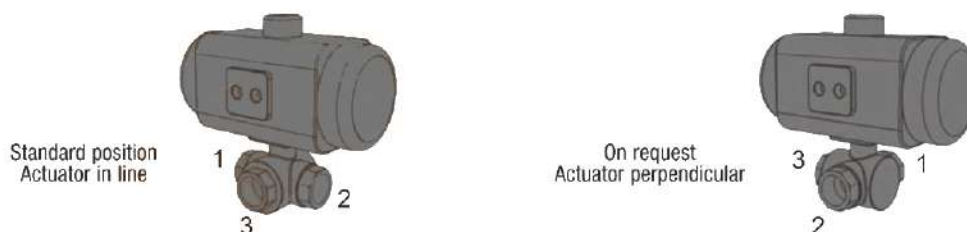
With double acting actuator

Mention 2 consecutive positions



⚠ For spring return actuators, the first position is the fail safe position in case of air failure.

Mounting position of the actuator



Technical guide

Materials

■ Carbon steel

Forged carbon steel (EN 10222-2)

NF A 36-605	EN 10222	DIN 2528	WN°	ASTM	Min. temp.	Max. temp.
A48 AP	P 245 N	C22.8	1.0460	A 105 A 350 LF2	-20°C -46°C	+425°C +425°C

Cast steel (EN 10213-2)

NF	EN 10213-2	DIN	WN°	ASTM	Min. temp.	Max. temp.
A48 CM	GP 240 GH	GSC-25	1.0619 1.1156	A 216 WCB A 352 LCB	-29°C -45°C	+425°C +345°C

■ Stainless steel

Forged stainless steel (EN 10222-5)

NF A 36-607	EN/DIN	WN°	ASTM A182	Min. temp.	Max. temp.
AF Z6 CN18-09	X5 CrNi 18-10	1.4301	F304	-196°C	+815°C
AF Z2 CN18-10	X2 CrNi 19-11	1.4306	F304L	-196°C	+425°C
AF Z6 CND17-11	X5 CrNiMo 17-12-2	1.4401	F316	-196°C	+815°C
AF Z2 CND17-12	X2 CrNiMo 17-12-2	1.4404	F316L	-196°C	+455°C

Cast stainless steel (EN 10213-4)

NF A	EN/DIN	WN°	ASTM A351	Min. temp.	Max. temp.
Z6 CN 18.10 N	GX5 CrNi 19-10	1.4308	CF8	-196°C	+815°C
	GX2 CrNi 19-11	1.4309	CF3	-196°C	+425°C
Z6 CND18.12N	GX5 CrNiMo 19-11-2	1.4408	CF8M	-196°C	+815°C
	GX2 CrNiMo 19-11-2	1.4409	CF3M	-196°C	+455°C

■ Cast iron & ductile iron

Cast iron

NF A 32-101	EN 1561	DIN 1691	WN°	ASTM	Min. temp.	Max. temp.
FGL 200	EN-GJL 250	GG 25	0.6020	A 48 class 308	-10°C	+200°C
FGL 250	EN-GJL 200	GG 20	0.6023	A 48 class 358	-10°C	+200°C

Ductile iron

NF A 32-201	EN 1563	DIN 1693	WN°	ASTM	Min. temp.	Max. temp.
FGS 500-7	EN-GJS-500-7	GGG 50	0.7050	A 536 Gr 80-55-06	-15°C	+350°C
FGS 400-15	EN-GJS-400-15	GGG 40	0.7040	A 536 Gr 65-45-12	-15°C	+350°C
FGS 400-18	EN-GJS-400-18	GGG 40.3	0.7043	A 536 Gr 60-40-18	-20°C	+350°C

■ Brass (EN 12165)

	EN 12420	DIN	WN°	ASTM	Min. temp.	Max. temp.
	CW 617N	Cu Zn40Pb2	2.0402	B 124 C37700	-10°C	+200°C
	CW 614N	Cu Zn39Pb3	2.0372	B 124 C38500	-10°C	+200°C
	CW 615N	CuZn39Pb3Sn	-	-	-10°C	+200°C
	CW 510L	Cu Zn42	-	B 124 C28500	-10°C	+200°C

■ Bronze

	EN 1982	DIN	WN°	ASTM	Min. temp.	Max. temp.
	CC 491K	CuSn5Zn5Pb5-C	2.1096	B 62 C83600	-10°C	+260°C
	CB 491K	CuSn5Zn5Pb5-B	2.1097	B 30 C83600	-10°C	+260°C

Usual working conditions for elastomeres on our butterfly valves

Elastomere	Min. / Max. temperature		Use	Not recommended
	S-First range (see page 90)	TTV range (see page 98)		
EPDM	-15°C/+110°C	-20°C/+110°C	Cold and hot water, sea water, alkaline products, sodium hydroxide.	Hydrocarbons, steam, gases, acids, oil, freon.
NBR	-10°C/+80°C	-10°C/+90°C	Non aromatic hydrocarbons, natural gas, greases, oil, compressed air, glycol, water.	Atmospheric environment, petrol, solvents.
FKM	-	-5°C/+180°C	Acids, greases, hydrocarbons, petrol, fuel, oil, gases.	Steam and hot water (max. 130°C), freon, alkaline products.
Natural rubber	-	-10°C/+60°C	Spirit, acetone, food, abrasive powders.	Acids and hydrocarbons.
Silicone	-	-40°C/+150°C	High temperature, air or inert gases.	Steam and hot water (max. 100°C), solvents.
Food silicone	-	-40°C/+150°C	Food.	Other applications.

General information provided for informational purpose only. Please check on data sheets for appropriate restrictions.

Technical guide

TRIM number chart acc. to API 600 (gate valves), API 623 (globe valves) & API 602 (compact gate valves)

Nominal seating surface materials

Trim Number	Part (if differ)	Nominal Trim	Seat Surface Hardness (HB*)	Seat Surface Material Type	Typical Specifications Grade		Stem / Bushing	Stem Hardness (HB*)
					Cast	Forged		
1		F6	250 min.	13Cr	A217 CA15	A182 F6a	13Cr	200 min. - 275 max.
2		304	Mfr. Std	18Cr-8Ni	A351 CF8	A182 F304	18Cr-8Ni	
3		F310	Mfr. Std	25Cr-20Ni	n/a	A182 F310	25Cr-20Ni	
4		Hard F6	750 min.	Hard 13Cr	n/a		13Cr	200 min. - 275 max.
5		Hardfaced	350 min.	Co-Cr A**	n/a	n/a	13Cr	200 min. - 275 max.
5A		Hardfaced	350 min.	Ni-Cr	n/a	n/a	13Cr	200 min. - 275 max.
6	shutter	F6 &	250 min.	13Cr	A217 CA15	A182 F6a	13Cr	200 min. - 275 max.
	body seat	Cu-Ni	175 min.	Cu-Ni	n/a			
7	shutter	F6 &	250 min.	13Cr	A217 CA15	A182 F6a	13Cr	200 min. - 275 max.
	body seat	Hard F6	750 min.	Hard 13Cr	n/a			
8	shutter	F6 &	250 min.	13Cr	A217 CA15	A182 F6a	13Cr	200 min. - 275 max.
	body seat	Hardfaced	350 min.	Co-Cr A**	n/a	n/a		
8A	shutter	F6 &	250 min.	13Cr	A217 CA15	A182 F6a	13Cr	200 min. - 275 max.
	body seat	Hardfaced	350 min.	Ni-Cr	n/a	n/a		
9		Monel	Mfr. Std	Ni-Cu Alloy	n/a	Mfr. Std	Ni-Cu Alloy	
10		316	Mfr. Std	18Cr-8Ni-Mo	A351 CF8M	A182 F316	18Cr-8Ni-Mo	
11	shutter	Monel &	Mfr. Std	Ni-Cu Alloy	n/a	Mfr. Std	Ni-Cu Alloy	
	body seat	Hardfaced	350 min.	Co-Cr A**	n/a	n/a		
11A	shutter	Monel &	Mfr. Std	Ni-Cu Alloy	n/a	Mfr. Std	Ni-Cu Alloy	
	body seat	Hardfaced	350 min.	Ni-Cr	n/a	n/a		
12	shutter	316 &	Mfr. Std	18Cr-8Ni-Mo	A351 CF8M	A182 F316	18Cr-8Ni-Mo	
	body seat	Hardfaced	350 min.	Co-Cr A**	n/a	n/a		
12A	shutter	316 &	Mfr. Std	18Cr-8Ni-Mo	A351 CF8M	A182 F316	18Cr-8Ni-Mo	
	body seat	Hardfaced	350 min.	Ni-Cr	n/a	n/a		
13	shutter	Alloy 20	Mfr. Std	19Cr-29-Ni	A351 CN7M	B473	19Cr-29Ni	
14	shutter	Alloy 20 &	Mfr. Std	19Cr-29-Ni	A351 CN7M	B473	19Cr-29Ni	
	body seat	Hardfaced	350 min.	Co-Cr A**	n/a	n/a		
14A	shutter	Alloy 20 &	Mfr. Std	19Cr-29-Ni	A351 CN7M	B473	19Cr-29Ni	
	body seat	Hardfaced	350 min.	Ni-Cr	n/a	n/a		
15		304 Full Hardfaced	350 min.	Co-Cr A**	n/a	n/a	18Cr-8Ni	
16		316 Full Hardfaced	350 min.	Co-Cr A**	n/a	n/a	18Cr-8Ni-Mo	

* HB is the symbol for the Brinell hardness as per ASTM E10.

** Co-Cr A. This alloy classification includes such trademarked materials as Stellite 6™, Stoddy 6™ and Wallex 6™.

Note: Cr = Chromium; Ni = Nickel; Co = Cobalt; Cu = Copper; Mo = Molybdenum; n/a = not applicable; Mfr. Std = manufacturer's standard.

Typical service

Trim Number	Typical service
1	For general very low erosive or non-corrosive service between -100°C and 320°C. Steam & gas up to 370°C. Oil & oil vapor up to 480°C.
2	For moderate pressure in corrosive, low erosive service between -265°C and 450°C.
3	For moderate pressure in corrosive or non corrosive service between -265°C and 450°C.
4	As Trim 1 but for medium pressure and more corrosive service.
5	For high pressure slightly erosive & corrosive service between -265°C and 650°C. Excellent for high pressure water & steam service.
5A	As Trim 5 where Co is not allowed.
6	As Trim 1 but for more corrosive service.
7	As Trim 1 but for higher pressure and more corrosive or erosive service.
8	Universal Trim for general service requiring long service life. As Trim 5 for moderate pressure & more corrosive service. Steam, gas & general service up to 540°C.
8A	As Trim 8 where Co is not allowed.
9	For corrosive service up to 450°C such as acids, alkalis, salt solutions, etc. For very corrosive fluids. For erosive & corrosive service between -240°C and 480°C. Resistant to sea water, acids, alkalis. Excellent corrosion resistance in chlorine & alkylation service.
10	For superior resistance to corrosion for fluids corrosive to F6. As Trim 2 but for more corrosive service. Excellent resistance to corrosive fluids at high temperatures. Excellent toughness for low temperature service. Usual Trim for F316 valves at low temperature service.
11	As Trim 9 but for medium pressure & more corrosive service.
11A	As Trim 11 where Co is not allowed.
12	As Trim 10 but for medium pressure & more corrosive service.
12A	As Trim 12 where Co is not allowed.
13	For very corrosive service at moderate pressure between -45°C and 320°C.
14	As Trim 13 but for medium pressure & more corrosive service.
14A	As Trim 14 where Co is not allowed.
15	As Trim 2 but for more erosive service & higher pressure.
16	As Trim 10 but for more erosive service & higher pressure.

IMPORTANT NOTICE: Data provided for informational purpose only. Please, always consult latest API specifications to check Trim data.

We recommend our customers to analyse the service requirements and specify the materials they consider adapted to their actual service conditions.

Technical guide

Chemical resistance guide

for selected plastics & elastomers

Medium	Concentration	Formula	T°C	Solution	PVC-U	PP	PVDF	PTFE	EPDM	FPM
Hydrochloric acid	30	HCl	40	Aqueous	+	o	+	+	+	+
Hydrochloric acid	30	HCl	20	Aqueous	+	+	+	+	+	+
Hydrochloric acid	30	HCl	60	Aqueous	o	o	+	+	o	o
Hydrochloric acid	30	HCl	80	Aqueous		-	+	+		
Hydrochloric acid	30	HCl	100	Aqueous			+	+		
Hydrochloric acid	30	HCl	120	Aqueous						
Hydrofluoric acid	70	HF	20	Aqueous	o	o	+	+	-	o
Hydrofluoric acid	70	HF	40	Aqueous			+	+		
Hydrofluoric acid	70	HF	60	Aqueous			+	+		
Hydrofluoric acid	70	HF	80	Aqueous			+	+		
Hydrofluoric acid	70	HF	100	Aqueous			+	+		
Hydrofluoric acid	70	HF	120	Aqueous						
Ammonia	25	NH ₃ OH	20	Aqueous	+	+	-	+	+	+
Ammonia	25	NH ₃ OH	40	Aqueous	+	+		+	+	o
Ammonia	25	NH ₃ OH	60	Aqueous	o	+		+	+	
Ammonia	25	NH ₃ OH	80	Aqueous				+		
Ammonia	25	NH ₃ OH	100	Aqueous				+		
Ammonia	25	NH ₃ OH	120	Aqueous						
Sulphuric acid	96	H ₂ SO ₄	20	Aqueous	+	-	+	+	-	+
Sulphuric acid	96	H ₂ SO ₄	40	Aqueous	o		+	+		
Sulphuric acid	96	H ₂ SO ₄	60	Aqueous			+	+		
Sulphuric acid	96	H ₂ SO ₄	80	Aqueous			o	+		
Sulphuric acid	96	H ₂ SO ₄	100	Aqueous			-	+		
Sulphuric acid	96	H ₂ SO ₄	120	Aqueous						
Sulphuric acid	50	H ₂ SO ₄	20	Aqueous	+	+	+	+	+	+
Sulphuric acid	50	H ₂ SO ₄	40	Aqueous	+	+	+	+	+	+
Sulphuric acid	50	H ₂ SO ₄	60	Aqueous	o	+	+	+	o	+
Sulphuric acid	50	H ₂ SO ₄	80	Aqueous			+	+		o
Sulphuric acid	50	H ₂ SO ₄	100	Aqueous			+	+		
Sulphuric acid	50	H ₂ SO ₄	120	Aqueous						
Ferric chloride	50	FeCl ₃	20	Aqueous	+	+	+	+	+	+
Ferric chloride	50	FeCl ₃	40	Aqueous	+	+	+	+	+	+
Ferric chloride	50	FeCl ₃	60	Aqueous		+	+	+	+	+
Ferric chloride	50	FeCl ₃	80	Aqueous		+	+	+	+	+
Ferric chloride	50	FeCl ₃	100	Aqueous			+	+	o	+
Ferric chloride	50	FeCl ₃	120	Aqueous						
Methyl alcohol	100	CH ₃ O	20	Pure	+	+	+	+	+	o
Methyl alcohol	100	CH ₃ O	40	Pure	+	+	+	+	+	o
Methyl alcohol	100	CH ₃ O	60	Pure	o	+	+	+	+	o
Methyl alcohol	100	CH ₃ O	80	Pure			+	+		
Methyl alcohol	100	CH ₃ O	100	Pure			+	+		
Methyl alcohol	100	CH ₃ O	120	Pure						
Sodium hydroxide	30	NaOH	20	Aqueous	+	+	-	+	+	o
Sodium hydroxide	30	NaOH	40	Aqueous	+	+		+	+	-
Sodium hydroxide	30	NaOH	60	Aqueous		+		+	+	
Sodium hydroxide	30	NaOH	80	Aqueous				+		

Medium	Concentration	Formula	T°C	Solution	PVC-U	PP	PVDF	PTFE	EPDM	FPM
Sodium hydroxide	30	NaOH	100	Aqueous				+		
Sodium hydroxide	30	NaOH	120	Aqueous				+		
Sodium hypochlorite	12,5% Cl	NaClO	20	Aqueous	+	o	o			
Sodium hypochlorite	12,5% Cl	NaClO	40	Aqueous	+	-	o	+	o	+
Sodium hypochlorite	12,5% Cl	NaClO	60	Aqueous	o		-	+		
Sodium hypochlorite	12,5% Cl	NaClO	80	Aqueous				+		
Sodium hypochlorite	12,5% Cl	NaClO	100	Aqueous				+		
Sodium hypochlorite	12,5% Cl	NaClO	120	Aqueous				+		
Hydrogen sulfide	100	H ₂ S	20	Gas	+	+	+			
Hydrogen sulfide	100	H ₂ S	40	Gas	+	+	+	+	+	-
Hydrogen sulfide	100	H ₂ S	60	Gas	+	+	+	+	o	
Hydrogen sulfide	100	H ₂ S	80	Gas			+	+	-	
Hydrogen sulfide	100	H ₂ S	100	Gas			+	+		
Hydrogen sulfide	100	H ₂ S	120	Gas				+		
Demineralsed water	100	H ^o O	20	Pure	+	+	+			
Demineralsed water	100	H ^o O	40	Pure	+	+	+	+	+	+
Demineralsed water	100	H ^o O	60	Pure	+	+	+	+	+	+
Demineralsed water	100	H ^o O	80	Pure		+	+	+	o	+
Demineralsed water	100	H ^o O	100	Pure			+	+	-	+
Demineralsed water	100	H ^o O	120	Pure			+	+		+
Calcium hydroxide	SAT	Ca(OH) ₂	20	Aqueous	+	+	o	+		+
Calcium hydroxide	SAT	Ca(OH) ₂	40	Aqueous	+	+	o	+	+	+
Calcium hydroxide	SAT	Ca(OH) ₂	60	Aqueous	+	+	o	+	+	o
Calcium hydroxide	SAT	Ca(OH) ₂	80	Aqueous		+	-	+	+	o
Calcium hydroxide	SAT	Ca(OH) ₂	100	Aqueous				+	+	o
Calcium hydroxide	SAT	Ca(OH) ₂	120	Aqueous				+		o
Nitric acid	70	HNO ₃	20	Aqueous	o	-	+			
Nitric acid	70	HNO ₃	40	Aqueous	o		+	+	-	+
Nitric acid	70	HNO ₃	60	Aqueous	-		+	+		o
Nitric acid	70	HNO ₃	80	Aqueous				+		-
Nitric acid	70	HNO ₃	100	Aqueous				+		
Nitric acid	70	HNO ₃	120	Aqueous				+		
Sodium chloride	SAT	NaCl	20	Aqueous	+	+	+			
Sodium chloride	SAT	NaCl	40	Aqueous	+	+	o	+	+	+
Sodium chloride	SAT	NaCl	60	Aqueous	+	+	o	+	+	+
Sodium chloride	SAT	NaCl	80	Aqueous		+		+	+	+
Sodium chloride	SAT	NaCl	100	Aqueous				+	+	
Sodium chloride	SAT	NaCl	120	Aqueous				+		
Citric acid	SAT	C ₆ H ₈ O ₇	20	Aqueous	+	+	+			
Citric acid	SAT	C ₆ H ₈ O ₇	40	Aqueous	+	+	+	+	+	+
Citric acid	SAT	C ₆ H ₈ O ₇	60	Aqueous	o	+	+	+	+	+
Citric acid	SAT	C ₆ H ₈ O ₇	80	Aqueous		+	+	+	+	+
Citric acid	SAT	C ₆ H ₈ O ₇	100	Aqueous			+	+		
Citric acid	SAT	C ₆ H ₈ O ₇	120	Aqueous			+	+		

+ = resistant - = non-resistant
o = limited resistance empty = not tested at the specified temperature

The above manual is not binding and does not imply Syveco's responsibility.

Technical guide

Lexicon

Main standardisation organisations

AFNOR	Association Française de Normalisation
ANSI	American National Standard Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing Materials
DIN	Deutsches Institut für Normung
ISO	International Organisation for Standardisation
JIS	Japanese Industrial Standards
NACE	National Association of Corrosion Engineers
SMS	Swedish Metric Standard

Usual abbreviations

DN	Nominal size
NPS	Nominal pipe size
PS	Maximum allowable pressure
TS	Minimum/maximum allowable temperature
BSP	British Standard Pipe thread (BSPP: Parallel, acc. to ISO 228 / BSPT: Tapered, acc. to ISO 7)
NPT	National Pipe Tapered, acc. to ANSI B1.20
BW	Butt Weld, acc. to ASME B16.9
SW	Socket Weld, acc. to ASME B16.11
RF	Raised flange, acc. to ISO 1092-1 & ANSI B16.5
M	Male
F	Female
IP	Ingress Protection (see page 12)
ATEX	Explosive Atmosphere (see page 9)

Specific measurement units





V AC	Volts Alternating Current
V DC	Volts Direct Current
Nm	Newton metre
PSI	Pounds per Square Inch
ΔP	Differential pressure

Common material abbreviations

ABS	Acrylonitrile Butadiene Styrene
CR	Polychloroprene (such as Neoprene®)
CSM	Chlorosulphonated Polyethylene (such as Hypalon®)
ECO	Epichlorhydrin Rubber
EPDM	Ethylene Propylene Diene Monomer
FKM	Fluorinated Propylene Monomer (such as Viton®)
HDPE	High Density Polyethylene
NBR	Nitrile Butadiene Rubber
NR	Natural Rubber
PA	Polyamide
PE	Polyethylene
PEEK	Polyether Ether Ketone
PEX	Cross-linked Polyethylene
POM	Polyoxymethylene
PP	Polypropylene
PTFE	Polytetrafluoroethylene
PU	Polyurethane
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene Fluoride
RTFE	Reinforced Polytetrafluoroethylene (with 15% glass fiber)
SBR	Styrene Butadiene Rubber

Main pictograms used in this publication










General standards connections

	BSP threaded, see usual abbreviations above.
	NPT threaded, see usual abbreviations above.
	Socket weld, see usual abbreviations above.
	Butt weld, see usual abbreviations above.







Food standards connections (see page 280)

	SMS threaded.		DIN threaded.
	SMS BW/male.		DIN BW/male.
	SMS BW/BW.		DIN BW/BW.
	Clamp.		

General certifications

	Products certified in conformity with the 2014/68/EU Directive. Apply only for valve above 1". May refer to other EU Directives when apply.
	Products certified in conformity with the 2014/68/EU Directive by a notified body (XXXX: ID of the NB). Apply only for valve above 1".
	Products certified in conformity with the API-6D Standard (XXXX: certificate number).
	Product delivered by an API Spec Q1 registered company.
	Product certified in conformity with the 2014/34/EU Directive (see page 9).
	Fire safe certified products (different standards may apply).
	Fugitive emission tests certification in conformity with the ISO 15848 or API 622.
	Product certified in conformity with German TA Luft regulation (Technische Anleitung zur Reinhaltung der Luft).
	Materials for use in H2S containing environments.



Specific certifications on products

	3.1 Certification available on request. When ordered along with the order: flat rate of 10€ for the first 10 pcs/DN, 20€ for above quantities/DN. ⚠ 50€/DN when ordered afterwards.
	Compatible: ATEX zone (1, 21, 2 & 22) compatible product that has no own potential source of ignition. Manual valves are excluded from the scope of the 2014/34/EU Directive.
	ATEX marking & certification available. 10€/pc, to be ordered along with the products.
	On request, products certified in conformity with Regulation (EC) 1935/2004. Full traceability certification 30€ per product type.
	Safety Integrity Level certification under IEC EN 61508 (grades from 1 to 4, see page 12).
	Ingress protection rating (XX: grade, see page 12).

Specific approvals on products

	NF ROB-GAZ, French approval for gas.
	French approval for drinkable water.
	UK approval for drinkable water.
	German approval for drinkable water.
	Polish approval for drinkable water.
	U.S. Food & Drugs Administration. Complies with the FDA positive list of Food Contact Substances.
	US National Sanitary Foundation Approval.

Marine approval on products

	Bureau Veritas Marine recognition MODE II.
	Bureau Veritas Type Approval.
	Lloyd's Register Type Approval.
	DNV-GL Type Approval.
	American Bureau of Shipping Type Approval.