Operating and Operating Instructions

Documentation topic:

Straight stop valves high pressure PN250, PN320, PN400, PN420, PN500, PN700 DN10÷15, DN20÷25, DN32÷65, DN80÷100

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1. Subject of the Manual

The subject of this manual are the guidelines for operation, use and commissioning of high-pressure valves, i.e. with nominal pressure PN250, PN320, PN400, PN420, PN500, PN700 manufactured by Fabryka Armatury Przemysłowej WAKMET in Bodzanów.

2. General information

The design, manufacture and testing of the valves is carried out in accordance with the Quality Assurance System to ISO 9001:2000 and the European Pressure Directive No.2014/68/EU. Proper installation, use and repair will ensure the correct functioning of the valves. The manufacturer will not assume any liability in case of non-compliance with these instructions.

The descriptions and instructions in this document apply to standard products, but are also applicable to variant products.

The instructions in this document do not take into account:

- any incidents that may occur during installation, use and repair,
- local regulations; the user must ensure that these regulations are strictly adhered to by all, including the personnel carrying out the installation.

The fittings must be operated by appropriately trained personnel. Incorrect use of the valves (fittings) may have a significant effect on the entire system such as leakage of the medium, restriction in system operation, etc.

This manual complies with the requirements of Directive 2014/68/EU

3. Application

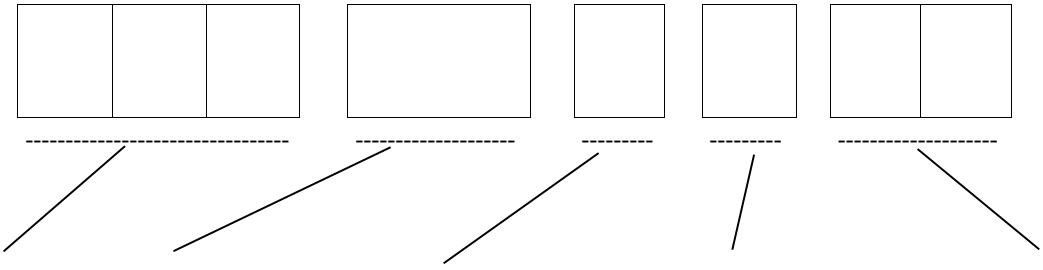
The valves are designed for:

- water, steam and other non-flammable, chemically non-aggressive and non-toxic media - in carbon and alloy steels,
- and for chemically aggressive and toxic media - in acid-resistant versions.

They are manufactured with weld ends and also with side flanges. The valves are designed for two-position operation, i.e. they should operate in the fully open or fully closed position. For flow control, regulating valves or valves with a regulating plug should be used. High-pressure globe valves may only be operated within the permissible temperature and pressure range. The use of valves outside the permissible parameter range may cause serious damage to the valve.

4. Valve systematic (part number construction)

Designation (part number) of valves in carbon and alloy steels:



Cat.	PN [bar]
648	250
649	320
650	400
659	420
669	500
694	500
689	700
714	700

Connection	
-	to wel. "S"
K	Flanges
SW	with threaded socket

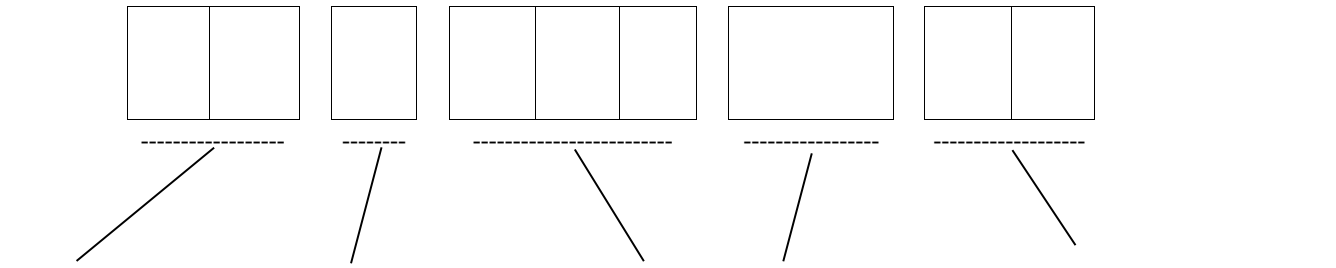
Material version [for operation at max. j.n. temperature].	
-	P250GH [450°C (723K)]
U	16Mo3 [530°C (803K)]
A	13CrMo4-5 [560°C (833K)]
B	10CrMo9-10 [600°C (873K)]
C	14MoV6-3 [570°C (873K)]
E	X10CrMoVNb9-1 [670°C (943K)]
E2	X10CrWMoVNb 9-2 [650°C (923K)]
F	15NiCuMoNb5-6-4 [500°C (773K)]

Hull ring / contains	
-	Titanium / X22CrMoV12-1
-	Titanium / X39CrMo17-1
T	Titan / Titanium
L	Stellit / Stellite

Adapted to drive	
NA	Electric AUMA,INTEC,...
NM	Electric MODACT
NW	Electric CHEMAR
NP	Pneumatic

Note: the "-" in the part number is omitted.

Designation (part number) of valves in acid-resistant execution (austenitic steels)



Cat.	Connection
ZS	for welding "S" or other
ZK	Flanges

Material version*	
A	X6CrNiTi18-10
B	X2CrNiMo 17122

PN [bar]
250
320
400
420

Other connections	
SW	SW socket
...	...

Adapted to drive	
NA	Electric AUMA, INTEC,...
NM	Electric MODACT
NW	Electric CHEMAR
NP	Pneumatic

(*) austenitic steels (acid resistant)

A - X6CrNiTi 18-10 steel for max. 250°C (523K) for chemically aggressive media and 600°C (873K) for chemically neutral media

B - X2CrNiMo 17-12-2 steel for max. 250°C (523K) for chemically aggressive media and 550°C (823K) for chemically neutral media.

5. Performance data

High-pressure valves cover nominal pressures of 250 , 320, 400 bar.

The following tables show the permissible operating pressure [bar] depending on the operating temperature [°C] for the various material versions. The valve must be matched to the installation so that its maximum permissible parameters are not exceeded under any circumstances.

PN 250	Werkstoff	**20° C**	**50° C**	**100 °C**	**150 °C**	**200 °C**	**250 °C**	**300 °C**	**350 °C**	**400 °C**	**450 °C**	**500 °C**	**510 °C**	**520 °C**	**530 °C**	**540 °C**	**550 °C**	**560 °C**	**570 °C**	**580 °C**	**590 °C**	**600 °C**	**610 °C**	**620 °C**	**630 °C**	**640 °C**	**650 °C**	**660 °C**	**670 °C**
P250GH	1.0460	250	250	250	250	226	202	179	155	131	82																		
16Mo3	1.5415	250	250	250	250	250	244	214	202	191	185	111	88	70	56														
13CrMo4-5	1.7335	250	250	250	250	250	238	220	208	202	191	187	163	112	93	73	58	48	39										
14MoV6-3	1.7715	250	250	250	250	250	250	250	250	249	242	240	230	177	156	135	119	102	87										
10CrMo9-10	1.7380	250	250	250	250	250	244	232	220	208	196	189	161	123	107	93	81	69	61	52	45	41							
X10CrMoVNb9-1	1.4903	250	250	250	250	250	250	250	250	250	250	250	250	250	239	218	198	179	160	143	126	112	99	87	77	67	58	50	43
X6CrNiTi18-10	1.4541	250	250	248	233	221	211	199	192	186	182	177	177	176	176	175	169	154	141	127	114	102							
X2CrNiMo17-12-2	1.4404	250	250	250	244	232	229	216	207	201	196	191	190	190	190	189	189												

PN 320	Werkstoff	**20° C**	**50° C**	**100 °C**	**150 °C**	**200 °C**	**250 °C**	**300 °C**	**350 °C**	**400 °C**	**450 °C**	**500 °C**	**510 °C**	**520 °C**	**530 °C**	**540 °C**	**550 °C**	**560 °C**	**570 °C**	**580 °C**	**590 °C**	**600 °C**	**610 °C**	**620 °C**	**630 °C**	**640 °C**	**650 °C**	**660 °C**	**670 °C**
P250GH	1.0460	320	320	320	320	290	259	229	198	168	105																		
16Mo3	1.5415	320	320	320	320	320	313	274	259	244	236	142	113	90	72														
13CrMo4-5	1.7335	320	320	320	320	320	305	282	267	259	244	239	209	143	119	93	75	61	50										
14MoV6-3	1.7715	320	320	320	320	320	320	320	320	319	309	307	294	227	200	172	152	131	111										
10CrMo9-10	1.7380	320	320	320	320	320	312	297	282	267	251	242	206	157	137	119	104	88	78	67	58	52							
X10CrMoVNb9-1	1.4903	320	320	320	320	320	320	320	320	320	320	320	320	320	306	279	253	229	204	183	162	143	127	111	99	85	75	64	55
X6CrNiTi18-10	1.4541	320	320	317	299	283	270	254	245	238	233	227	226	226	225	225	217	197	180	163	146	131							
X2CrNiMo17-12-2	1.4404	320	320	320	313	297	293	276	265	257	251	244	243	243	243	242	242												

PN 400	Werkstoff	**20° C**	**50° C**	**100 °C**	**150 °C**	**200 °C**	**250 °C**	**300 °C**	**350 °C**	**400 °C**	**450 °C**	**500 °C**	**510 °C**	**520 °C**	**530 °C**	**540 °C**	**550 °C**	**560 °C**	**570 °C**	**580 °C**	**590 °C**	**600 °C**	**610 °C**	**620 °C**	**630 °C**	**640 °C**	**650 °C**	**660 °C**	**670 °C**
P250GH	1.0460	400	400	400	400	362	324	286	248	209	131																		
16Mo3	1.5415	400	400	400	400	400	391	343	324	305	295	177	141	112	89														
13CrMo4-5	1.7335	400	400	400	400	400	381	352	333	324	305	299	261	179	149	116	93	76	63										
14MoV6-3	1.7715	400	400	400	400	400	400	400	400	398	387	383	368	284	250	215	190	164	139										
10CrMo9-10	1.7380	400	400	400	400	400	391	371	352	333	314	303	257	196	171	149	130	111	97	84	72	65							
X10CrMoVNb9-1	1.4903	400	400	400	400	400	400	400	400	400	400	400	400	400	383	349	316	286	255	229	202	179	158	139	124	107	93	80	69
X6CrNiTi18-10	1.4541	400	400	396	373	354	337	318	307	297	291	284	283	282	281	281	271	246	225	204	183	164							
X2CrNiMo17-12-2	1.4404	400	400	400	391	371	367	345	331	321	313	305	304	304	303	303	302												

PN 500	Werkstoff	**20°C**	**530°C**	**540°C**	**550°C**	**560°C**	**570°C**	**580°C**	**590°C**	**600°C**	**610°C**	**620°C**	**630°C**	**640°C**	**650°C**
X10CrWMoVNb 9-2	1.4901	500,0	500,0	500,0	500,0	500,0	500,0	500,0	454,0	404,0	357,0	311,0	268,0	232,0	200,0

PN 500	Werkstoff	**20°C**	**100°C**	**150°C**	**200°C**	**250°C**	**300°C**	**350°C**	**400°C**	**420°C**	**450°C**	**460°C**	**470°C**	**480°C**	**490°C**	**500°C**
15NiCuMoNb5-6-4	1.6368	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	500,0	416,0	330,0	247,0	164,0

PN 700	Werkstoff	**20°C**	**530°C**	**540°C**	**550°C**	**560°C**	**570°C**	**580°C**	**590°C**	**600°C**	**610°C**	**620°C**	**630°C**	**640°C**	**650°C**
X10CrWMoVNb 9-2	1.4901	700	700	673,3	623,3	573,3	523,6	472,0	423,1	376,3	333,5	290,0	250,0	216,1	186,7

Control of the fittings is by means of:

- Handwheel (standard version).
  - valves DN10÷15 - direct wheel drive
  - valves DN20÷25 - direct wheel drive or indirectly by means of a drive sleeve and bearings reducing resistance to opening and closing of the valve.
  - valves DN32÷65 - indirectly by means of a drive sleeve and bearings reducing resistance to opening and closing of the valve.
  - valves DN80÷100 - indirectly by means of manual drive head (GNR)
- Electromechanical drive or pneumatic drive (customer-specific)

Electromechanical actuators, which are delivered by FAP WAKMET together with the valves, are set by the valve manufacturer (according to the valve operating parameters, i.e. temperature as a function of pressure) and it is not necessary to adjust them (closing is controlled by the torque switch, opening by the travel switch). If it is necessary to adjust the actuator, it must be ensured that the maximum permissible torque required to close the valve at the given operating temperature is not exceeded! Exceeding the maximum permissible torque may damage the valve.

The table below shows the recommended torque (Mo) required to close the valves and the axial force (Q). The values in the table refer to the nominal parameters, i.e. for valve operation at 20°C.

In cases where the operating or design parameters are significantly lower than nominal, the following table should not be used when selecting actuators.

	PN250		PN320		PN400		Direction of fluid flow
	Q	Mo	Q	Mo	Q	Mo	
DN	[kN].	[Nm]	[kN].	[Nm]	[kN].	[Nm]	
10	5,3	10,6	6,7	13,4	7,4	14,8	under the fungus
15	5,3	10,6	6,7	13,4	25,4	69,5	under the fungus
20 , 25	16,9	46,0	21,4	58,0	25,1	68,0	under the fungus
20*	17,2	47,0	21,9	59,7	25,4	69,5	under the fungus
25*	17,2	47,0	21,9	59,7	25,4	69,5	under the fungus
32, 40,50	50,3	178,0	64,0	266,0	76,9	272,0	under the fungus
32*	51,4	182,0	65,4	231,5	77,4	274,2	under the fungus
40*	51,4	182,0	65,4	231,5	77,4	274,2	under the fungus
50*	51,4	182,0	65,4	231,5	77,4	274,2	under the fungus
65	97,8	485,8	124,6	619,2	148,4	737,0	under the fungus
80	72,3	312,0	90,8	392,1	109,9	474,5	on a fungus
100	113,3	562,7	142,3	707,0	172,8	858,5	on a fungus

*) valid for conventional version (without drive sleeve and bearing)

Valves are produced in the version for welding and version with side flanges. Weldable endings are prepared according to PN-EN 12627 standard, flanges with PN marking according to PN-EN 1092-1 standard and with class marking according to PN-EN 1759-1 standard. In case of special requirements, it is possible to produce endings and flanges according to customer's documentation. This requires prior agreement with FAP WAKMET.

6. Basic component materials

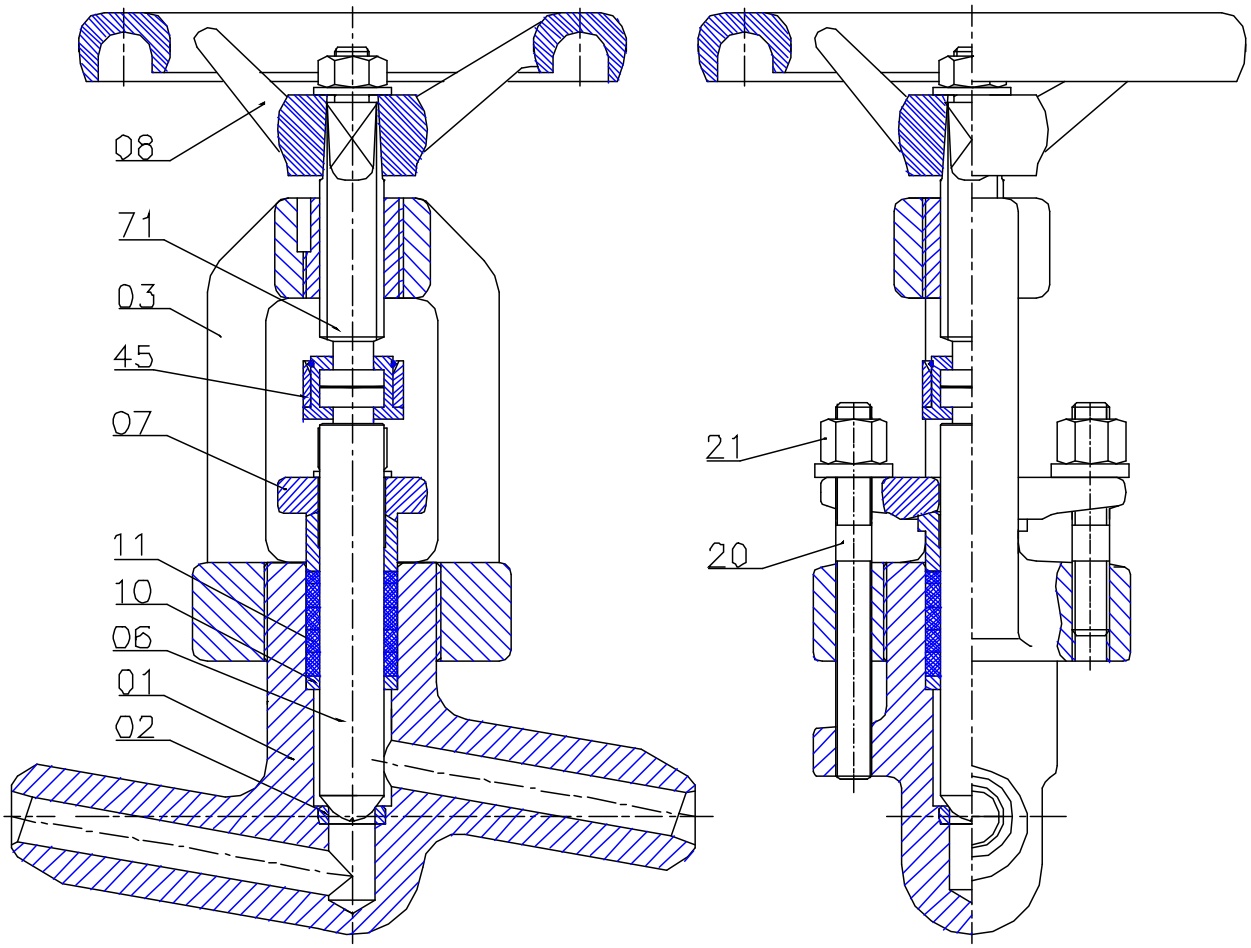
No.	Part of	Carbon steel		Alloy steel						Austenitic steel	
			U	A	B	C	E	E2	F	A	B
01	**Hull**	P250GH 1.0460	16Mo3 1.5415	13CrMo4-5 1.7335	10CrMo9-10 1.7380	14MoV6-3 1.7715	X10CrMoVNb9-1 1.4903	X10CrWMoVNb9-2 1.4901	15NiCuMoNb5-6-4 1.6368	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
02	**Hull ring**	Stellit	Stellit	Stellit	Stellit	Stellit	Stellit	Stellit	Stellit	-	-
03	**Cover**	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	11CrMo9-10 1.7383	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
06	**Arbor /mushroom**	X39CrMo17-1 1.4122	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
07	**Choke**	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
10	**Cover insert**	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X17CrNi16-2 1.4057	X5CrNi18-10 1.4301	X2CrNiMo17-12-2 1.4404
11	**Gland seal**	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite
20	**Screws**	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	X22CrMoV12-1 1.4923	X2CrNiMo17-12-2 1.4404	21CrMoV5-7 1.7709	X6CrNi18-10 1.4948	X6CrNi18-10 1.4948
21	**Caps**	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	21CrMoV5-7 1.7709	42CrMo4 1.7225	42CrMo4 1.7225	X5CrNi18-10 1.4301	X5CrNi18-10 1.4301

Description of valve construction

The basic element of each valve is a forged or forged-welded body [**01**] equipped with a seat [**02]** and a bail cover [**03**]. The stem is sealed in the bonnet using the so-called gland chamber, which contains graphite rings [**11**] and guide rings (so-called bonnet inserts)[**10]** pressed against the gland [**07]** using screws [**20]** and nuts [**21**]. The construction of the valves is shown in the figures (Figure 1 ÷ Figure 5).

a) Valves DN 10÷15 - standard version

Figure 1.



The closing element of the valve is the stem (plunger) [**06]**. The lower stem and the upper stem [**71**] are connected by a coupling [**45**]. The upper stem has a notched trapezoidal thread allowing the reciprocating movement to be transmitted to the closing element. The driving element of the valve is an ascending handwheel [**08**].

b) Valves DN 20÷25 - traditional version

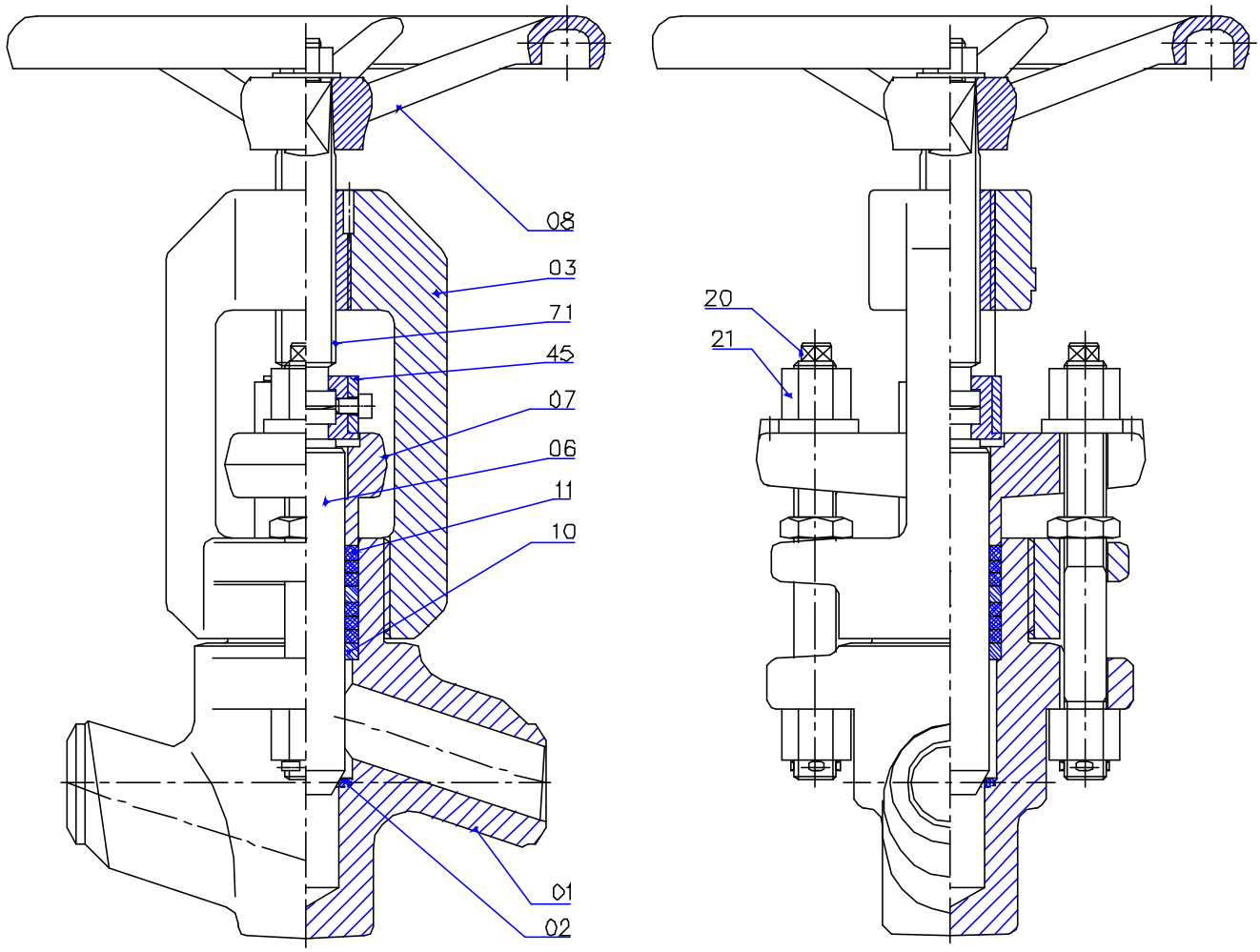


Figure 2.

The closing element of the valve is the stem (plunger) [**06**]. The lower stem and the upper stem [**71**] are connected by a coupling [**45**]. The upper stem has a notched trapezoidal thread allowing the reciprocating movement to be transmitted to the closing element. The driving element of the valve is an ascending handwheel [**08**].

c) Valves DN 20÷25 - standard version

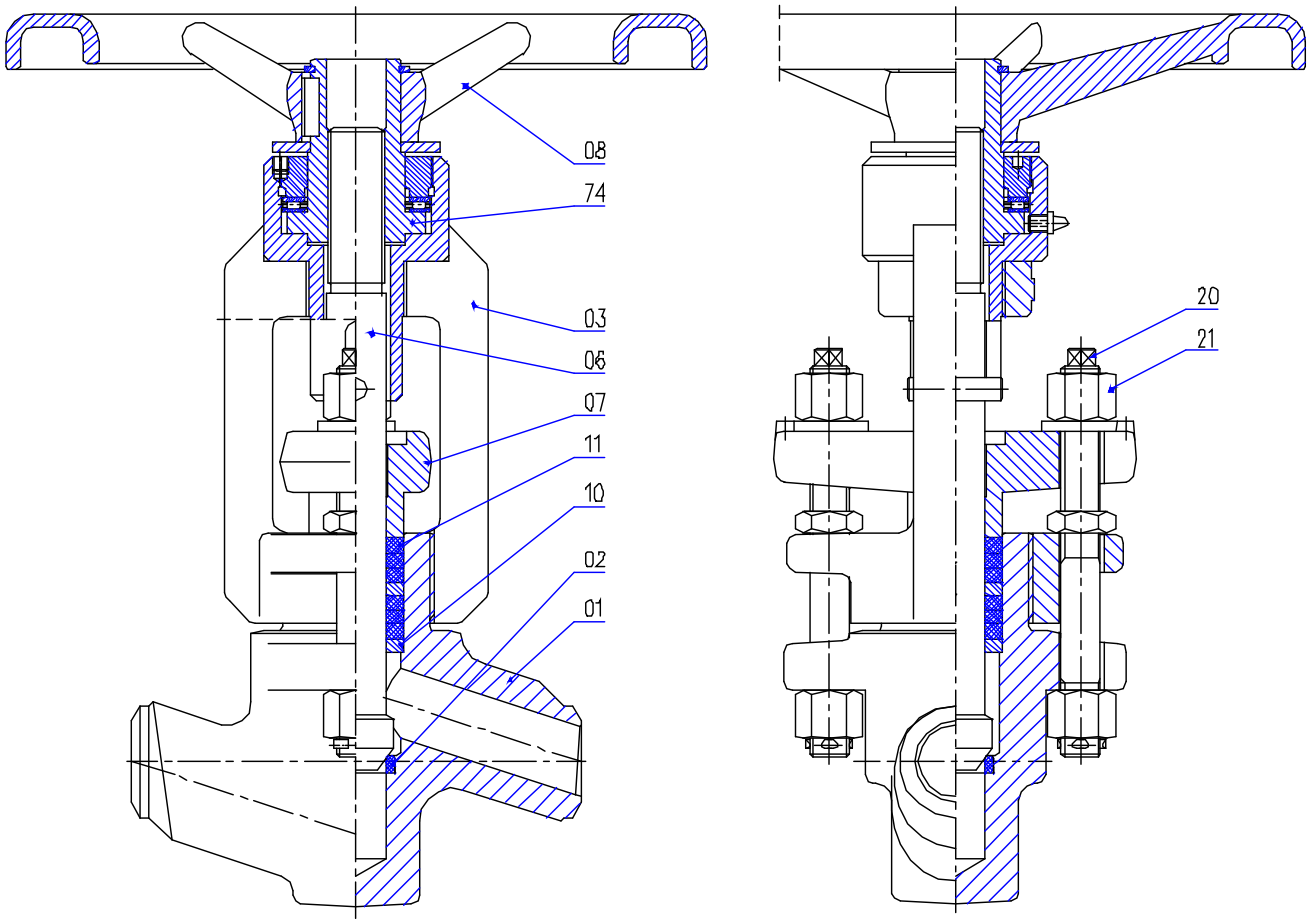


Figure 3.

The closing element of the valve is a uniform stem (stem and plug) [**06**]. The driving element of the valve is a non-lifting handwheel [**08**]. The handwheel torque is transmitted to the drive sleeve [**74**] bearing on a thrust needle bearing, which reduces the valve closing resistance.

d) Valves DN 32÷65 - standard version

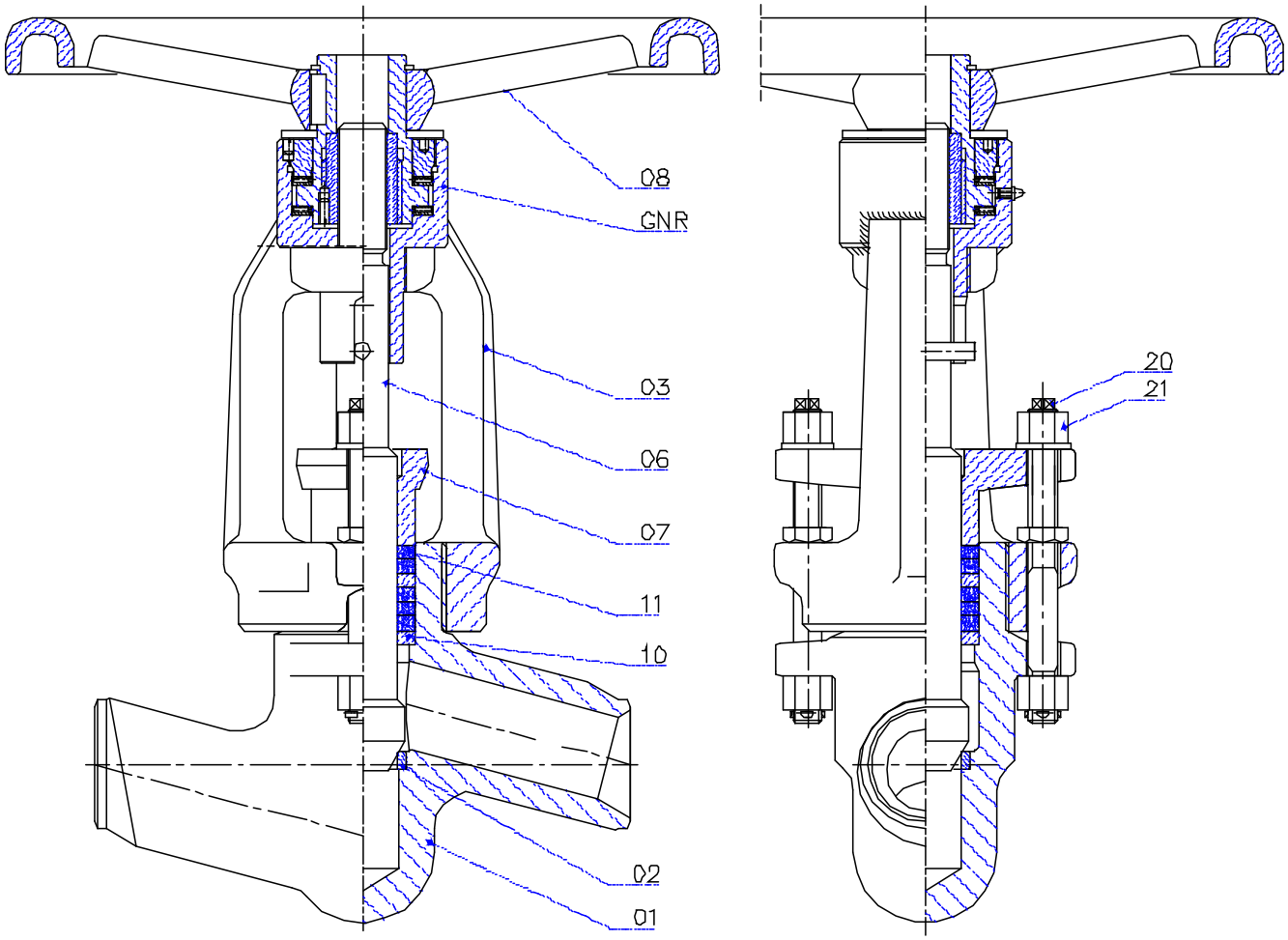


Figure 4.

The closing element of the valve is a uniform stem (stem and plug) [**06**]. The driving element of the valve is a non-lifting handwheel [**08**]. The handwheel torque is transmitted to the drive sleeve [**74**] bearing on two thrust needle bearings, which reduces the resistance to closing and opening the valve.

e) Valves DN 80÷100 - standard version

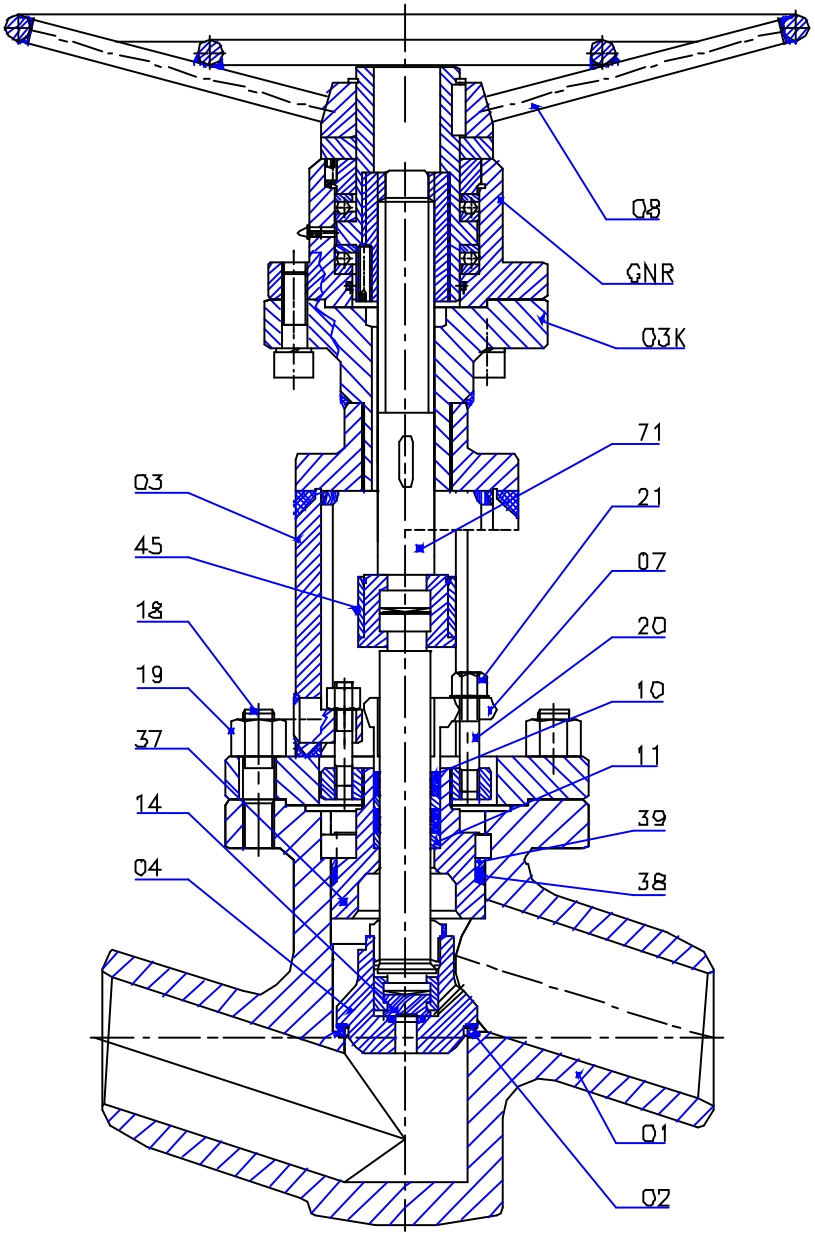


Figure 5.

In valves with nominal diameters DN80 and above, the tightness of the bonnet and body is achieved by using a self-sealing bonnet system, consisting of: inner bonnet [**37],** trapezoidal gasket [**38]**, thrust ring [**39]** and split ring [**40]**. The closing element of the valve is the plug [**04**]. In order to reduce the force required to close the valve and to prevent the plug from rupturing, a plug relief system was used by means of a relief plug [**14**]. The bottom stem [**06**] and the top stem [**71]** are connected by a coupling [**45]**. The stem in the upper part has a notched trapezoidal thread LH (left), so that the typical rotary motion (clockwise) of the caster or actuator is converted into reciprocating motion of the stem and the connected plug. The driving element of the valve is a non-lifting handwheel [**08**] mounted on the handwheel drive head [**GNR**]. The

GNR head together with the handwheel can be disassembled from the valve by unscrewing 4 screws connecting the cover flange and head flange, thus obtaining a ready connection to an electric actuator of the same size. For example, after removing the GNR F14, it is possible to connect an actuator of size F14 (according to DIN).

7. Transport and storage

The valves are delivered "closed" and are ready for use. The inlet and outlet are secured with plugs. Appropriate safety measures should be taken to protect the fittings from damage during transport.

Heavy fittings should be transported using ropes hooked behind the cover arms or the top flange. The weight of the fitting is specified in the data sheets. The armature must never be hooked by a wheel or other drive components. After delivery to the site and before installation, the fitting should be checked for damage during transport.

Fittings must be stored so that their subsequent use is not affected. They must be protected against the damaging effects of moisture, dust, corrosion, etc. Fittings may only be stored in places which are dry and protected from the damaging effects of precipitation and the effects of chemical substances or gases.
Fittings should always be stored in the closed position. The fittings should be stored in such a way that the closing system is not damaged, the actuator knobs or the wheel are not manipulated.

Valves stored for more than 4 months must be visually inspected before installation, paying particular attention to the following:

- preservation of internal surfaces,
- the quality of the paint finish,
- blank checks,
- checks on other safeguards,
- inspection documents attached to the fittings;

Fittings can be stored for up to 12 months if the above recommendations are followed. If the storage period exceeds 1 year - the fittings must be de-preserved, pressure tested and then preserved again.

8. Preparing the valve for installation

Before installing the fittings:

- on the basis of the marking on the valve body, carry out the identification of the fitting with the attached documentation.

  The following marks (according to EN19) are displayed on the valve body
  - nominal diameter - marked with the DN symbol and the size of the diameter
  - nominal pressure - marked with PN symbol with a pressure value sign nominal [bar]
  - arrow indicating direction of flow
  - hull material - is marked with the material grade according to the material list
  - gate valve identification number (manufacturer's number)
  - CE labelling in accordance with Directive 2014/68/EU
- check the connections of the fittings to ensure that they correspond to the intended dimensions,
- carry out a test of the completeness of fittings and the required technical documentation, acceptance protocols, quality certificates, etc,
- remove safety devices and plugs,
- decontaminate surfaces and connections that are subject to welding,
- check that the surfaces of the rebates are undamaged and metallic clean - free of paint and corrosion,
- check the inside of the valve and the pipeline to ensure that it is free from any impurities.

9. Installation on the installation

Correct installation has a fundamental effect on the functioning of the valves. Installation work must be carried out by qualified personnel who are familiar with the use and purpose of the valves. Assembly work must be carried out under supervision, observing health and safety regulations.

Fittings should be installed as assembled by the manufacturer.

The valves can be installed in any position, but the position with the stem pointing upwards is recommended. In case of a different setting, an additional actuator fixing (support or suspension) must be used. If the valve body is marked with a flow direction sign, it should be set according to the medium flow direction.

The flanged fittings are to be assembled in such a way that the holes on the flanges and counter-flanges are opposite each other. The required gasket must be inserted between the flanges, paying particular attention that the gasket between the flanges is correctly centred. When fixing the fitting to the pipeline, all bolt holes located on the flange must be used. Installation of the bolts is to be carried out with the principle of screwing in two opposite bolts. Tighten the bolts crosswise to the correct torque. The bolts, nuts and washers used for fixing must be made of suitable and certified materials of the required strength class.

Welded joints may only be carried out by qualified personnel, using appropriate equipment. The responsibility for this and for any necessary heat treatment lies with the owner (user) of the pipeline. The design of the valve and the materials used allow the valve to be welded to the pipeline and heat-treated without taking the valve apart. The valve, when welded to the pipeline, should be open. During welding, special care must be taken not to contaminate the valve and the pipeline.

The fittings must not be installed in such a way as to create axial stresses and/or bending moments in the fitting body.

When cleaning the system before operation, the seal must be protected from dirt. The cleaning agent used for the installation must not be aggressive towards the valve content. We recommend the use of strainers on the installation (before valves). Do not paint the valve stem during the painting work!

10.Preparation for trial start-up

Carry out functional tests on the valves before test commissioning. Open and close. Check all connections and sealing, eliminate inadequacies. Check the fixing and support of the valve.

Carry out the necessary inspection of the respective section and pipeline. Carry out inspection and commissioning tests in accordance with user instructions. Carry out commissioning tests with neutral medium. Open valve during system filling. During the tests, check the tightness of the body, the tightness of the gland, the flange connections and the welded joints.

If there is a leak in the stuffing box, tighten the gland nuts [**21**] until the leak stops.

If there is a leak between the fuselage flange and the cover flange, the inner cover system [**37]** must be tightened, i.e. the slack in the nuts [**64]** (which raise the inner cover [**37**]) must be eliminated by tightening the nuts [**64]**.

After completion of the water commissioning tests, carry out tests in accordance with the fitting's intended use.

11.Maintenance

The valve must be inspected during operation. The control should be carried out every 100 opening-closing cycles but at least every 4 months. Check the tightness of the flange connections and the tightness of the gland chamber. In the event of leakage, tighten the gland screws with nuts if possible [**21**]. If it is not possible to tighten the sealing system because the gland is leaning against the cover, it is necessary to add packing. This should be done by unscrewing the nuts, lifting the gland, adding a packet (on request FAP WAKMET will supply a repair packet), lowering the gland and retightening the gland nuts. The tension of the stud bolts [**72**] , which tighten the inner cover system, should also be checked. If any play is found, it should be removed by tightening the nuts [**64**].

Before carrying out any work on the fitting, or before removing it from the pipeline, ensure that there is no pressure and that the fitting is cooled down !

If the medium is toxic or flammable, the fittings must be drained and then flushed or blown out.

FAP WAKMET valves are designed to minimise maintenance. However, to ensure their long and reliable operation and to reduce repair costs, they should be checked regularly, especially those that are rarely used and those that are difficult to access.

The operator of the installation is responsible for establishing regular inspections, the frequency of which depends on the operating conditions of the fitting.

The proper functioning of the fittings can be prolonged by:

- regular lubrication of the stem (topping up of grease in the grease nipples)
- resealing of the valve gland or replacement of the sealing pack,
- opening and closing of the valve at least twice a year,
- replacing the seal in good time,

Each time the valve is disassembled and assembled, the packing and gland pack must be replaced. If components need to be replaced, the manufacturer's recommended parts should be used. After repair, and before fitting to the installation, the valve should be checked for leaks.

12.Safety and guarantee

This manual contains basic recommendations that must be followed during installation, operation and repair work. Fitters and operating personnel should read it and understand it well before the installation is put into operation. All personnel involved in the installation, operation, supervision and servicing of the fittings should be qualified. The competence and responsibility of personnel must be clearly and unambiguously defined by the user of the installation.

Failure to follow the instructions may result in damage or even destruction of the fitting and cause danger to personnel and the environment.

Any modifications to the fittings supplied are only possible with the manufacturer's approval.

To ensure safety, only original spare parts should be used.

Warranty claims will not be accepted if unsuitable spare parts and materials are used. Claims concerning the functionality and safety of the valve will only be considered if the maximum permissible operating parameters have not been exceeded (see operating data).

The manufacturer assumes no responsibility for the setting, installation and correct operation of the actuator for valves in which the actuator was not fitted at the factory.

FAP WAKMET carries out post-warranty repairs against payment.

13.Dismantling valves for repair

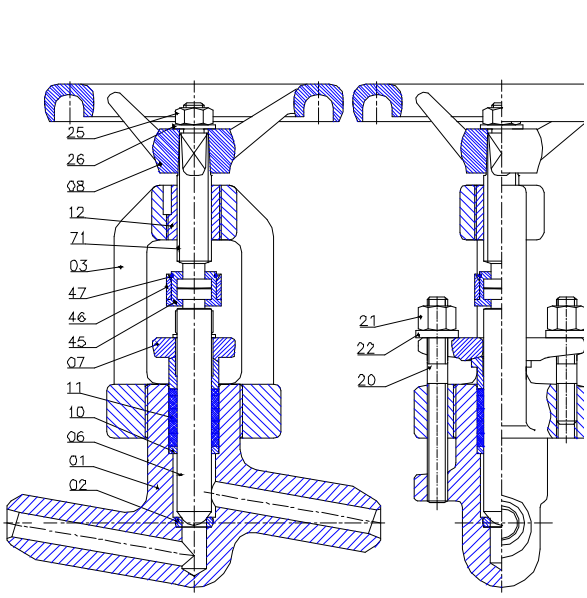
The valves manufactured by FAP WAKMET are made of high-quality materials and with high manufacturing tolerances, which guarantees their long-term operation.

If a major overhaul is necessary, it is advisable to return the valve to the manufacturer. If the user decides to do the repair himself, he must reckon with the necessity of replacing some parts of the valve. The extent of the replacement depends on the amount of wear and tear, therefore this should be preceded by disassembly of the valve and verification of the parts.

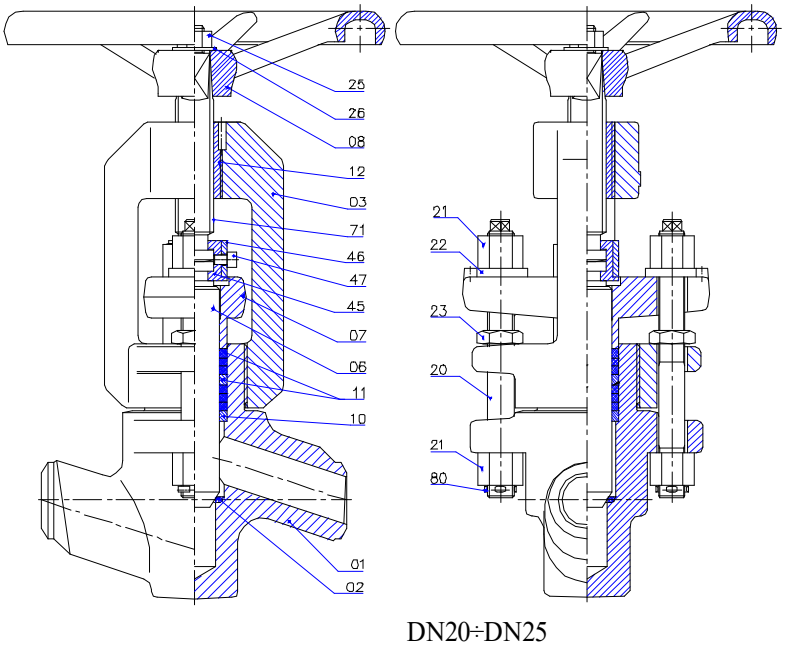
When assessing the wear of parts, particular attention should be paid to the lower stem [**6**] (stem and plug) and the sealing ring in the housing, as the tightness of the closure depends on these components. The stem is most likely to wear on the part that mates with the stuffing box seal. If there is a little wear on the stem, the surface can be sanded with fine-grained sandpaper. The body sealing ring and the arbor-plunger should be lapped. If there is a lot of wear, the mandrel-fungus should be replaced with a new one and the hull ring (usually plastic pressed) should be made anew. On the other hand, the surfaced ring must be resurfaced and machined anew. Therefore, in both cases, if deep pitting occurs on this surface, the valve is eligible for reconditioning by the manufacturer.

After disassembly or repair, new graphite gaskets must be used on assembly [**11**]. After repair, the valve needs to be checked and adjusted on a special stand (test station)

a) Dismantling and assembly of valves DN10÷25 (not bearing-mounted)



DN10÷DN15



DN20÷DN25

❖ DISMANTLING

1. Fix the valve (immobilise).
2. Unscrew the nut [**25]** with a spanner, pull out the washer [**26]**, then knock the wheel [**08**] out of the stem [**06**].
3. Remove the coupling subassembly connecting the upper stem [**71**] to the lower stem [**06**].
   - DN10÷15-> Using a flat-blade screwdriver or a pointed tool, lever and push upwards the safety "spring" ring [**47**]. After sliding the clutch sleeve [**46**] and the ring [**47] upwards, the** two halves of the clutch split sleeve [**45**] can be removed. After separating the clutch, turn the top pin [**71**] upwards. The clutch sleeve and spring ring can now be removed.
   - For DN20÷25, first remove the screw [**47**] securing the coupling and then proceed as above.
4. Remove the nuts [**21**], pull out the washers [**22**], remove (or unscrew) the studs [**20**]. Now we can pull out the choke [**07**].
5. Unscrew the cover [**03**], which is screwed onto the hull [**01**].
6. Pull the bottom pin [**06**] out of the fuselage [**01**].
7. Using a special tool (FAP WAKMET design), pull out the packing [**11**] together with the inserts [**10**].

❖ MONTAGE

1. Insert sealant [**11**] with inserts [**10]** into the fuselage [**01]** (order as shown in the drawing).
2. Screw the top pin [**71**] into the cover [**03]** from below until the head rests on the screw [**12**].
3. Insert the bottom pin [**06**] into the gland chamber of the hull so that it rests all the way on the seat [**02**].
4. Lightly tighten the packing through the gland [**07**], using a special sleeve.
5. Screw the cover [**03**] onto the fuselage [**01**] in such a way that the holes for the cover studs are in the extension of the axis of the fuselage holes.
6. Insert the gland [**07**] into the gland chamber (matching the position of the holes for the stud bolts with the cover and fuselage).

7* Place the coupling sleeve [**46**] in the axis of the mandrel with the chamfer upwards, place the spring ring [**47]** over it and, holding them with one hand, unscrew the upper mandrel [**71] with the** other until it contacts the lower mandrel [**06**].

7** Place the coupling sleeve [**46**] in the axis of the mandrel, screw in the upper mandrel [**71] with the** other hand until it makes contact with the lower mandrel [**06**].

8* Lift the coupling sleeve [**46**] with the ring [**47] upwards**, place both halves of the coupling split sleeve [**45] on the** exposed pin heads, and then slide the coupling sleeve [**46**] onto them. Insert (push) the ring [**47**] into the groove of the split sleeve [**45**] securing the coupling.

8** Lift the coupling sleeve [**46**] upwards onto the exposed bolt heads.

Insert the two halves of the split sleeve coupling [**45**] and push the sleeve [**46**] onto them so that the radial hole of one of the halves is aligned with the tapped hole of the coupling sleeve. Secure the coupling with a washer and screw [**47**].

9* Insert studs [**20**] through the holes in the gland and screw into the tapped holes of the cover. Insert the washers [**22**] and screw on the nuts [**21**].

9** Screw nuts [**21**] onto the studs [**20**] and secure with lynch pins [**88**].

Insert the secured studs [**20**] through the holes in the hull and cover while screwing in the low nuts [**23**]. Place the washers [**22**] and screw on the remaining nuts [**21**]. Holding the bolts with a spanner (square 10), tighten the low nuts [**23**] and the gland nuts [**21**].

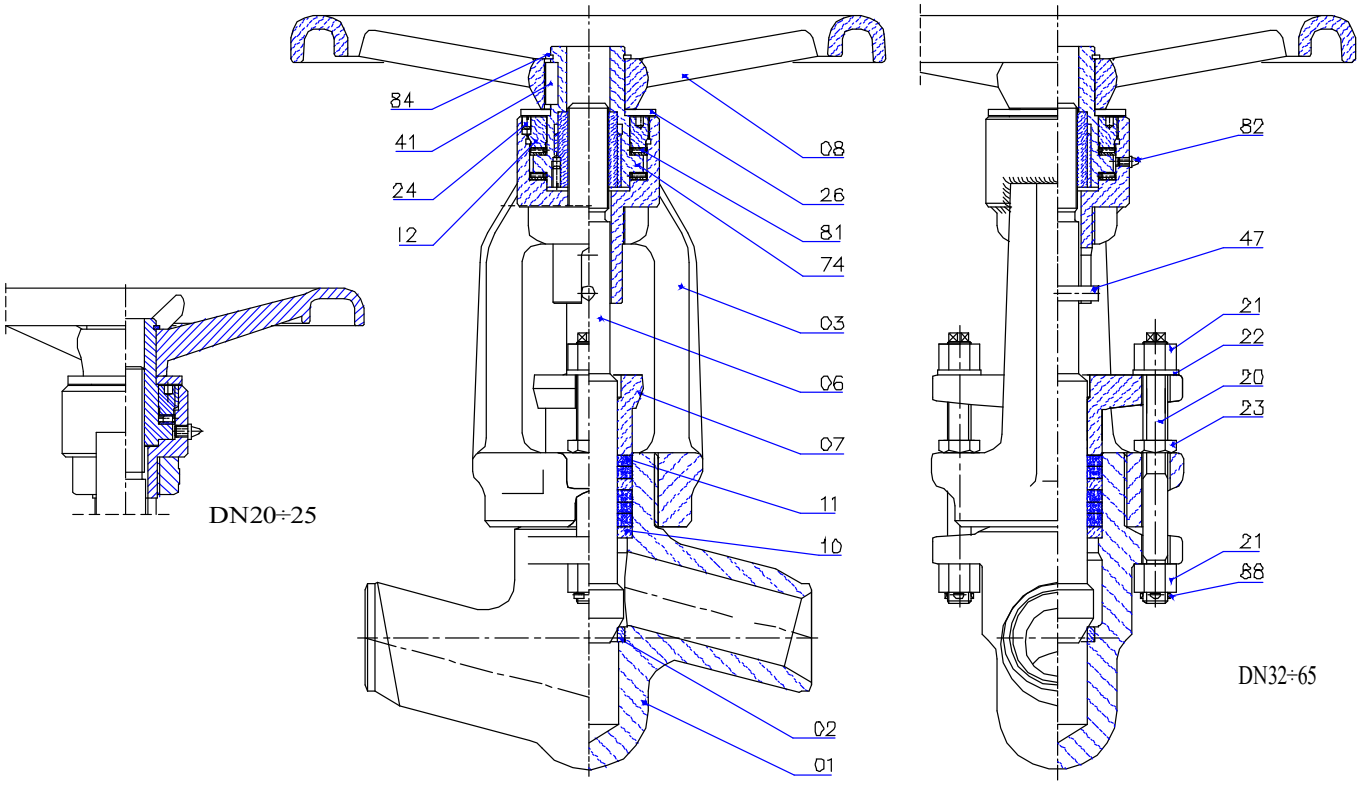
10. Place the wheel [**08**] on the stem, tap it lightly, place the washer [**26**] and screw on the nut [**25**].

Attention:

*Applies to installation of valves DN10÷15.

** Applies to installation of valves DN20÷25.

b) Removal and installation of valves DN20÷65 (bearing valves)



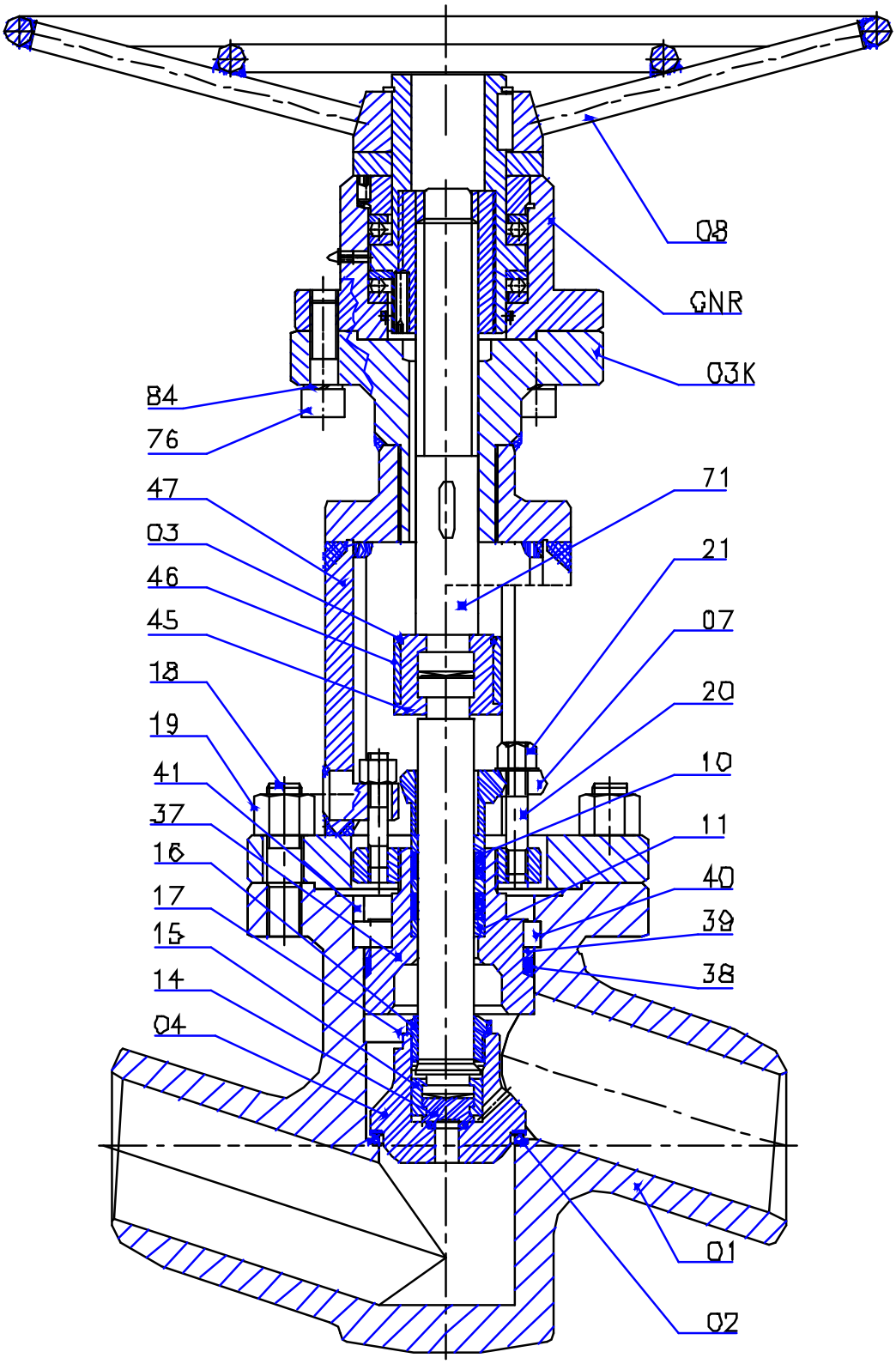
❖ DISMANTLING

1) Fix the valve (immobilise).
2) Remove the handwheel [**08**] by first removing the circlip [**84**].
3) Pull the key [**41**] out of the cover sleeve [**74**].
4) Remove the wheel washer [**26**].
5) Unscrew the grease nipple [**82**].
6) Remove the grub screws [**24**] securing the drive screw [**12**].
7) Remove the drive screw [**12**] (lug nut spanner)
8) Remove the drive sleeve [**74**] together with the bearing/needle bearing set [**81**].
9) Knock the spring pin [**47**] out of the stem [**06**].
10) Remove the upper gland nuts [**21**], pull out the washers [**22**].
11) Remove studs[**20**] from nuts[**23]**.
12) Unscrew the cover [**03**], which is screwed onto the hull [**01**].
13) Pull out the choke [**07**].
14) Remove the bottom pin [**06**] from the fuselage [**01**] together with the sealant [**11]** and the inserts [**10]**.

❖ MONTAGE

1) Place the stem [**06**] in the hull [**01**].
2) Insert the packing [**11**] together with the inserts [**10]** (order as shown in the drawing) and the choke [**07]** into the hull [**01]** (overlapping the stem).
3) Lightly tighten the packing through the gland [**07**], using a special sleeve.
4) Screw the cover [**03**] onto the fuselage [**01**] in such a way that the holes for the cover studs are in the extension of the axis of the fuselage holes.
5) Screw nuts [**21**] onto the studs [**20**] and secure with lynch pins [**88**].
6) Insert the secured studs [**20**] through the holes in the hull and cover while screwing in the low nuts [**23**]. Put on the washers [**22**] and screw on the remaining nuts [**21**]. Holding the bolts with a spanner, tighten the low nuts [**23**] to secure the cover from the hull. Tighten the gland nuts [**21**] until the gland is tight.
7) Drive the spring pin [**47**] into the pin hole [**06**] (beforehand, rotate the pin to align the pin hole and the bump in the cover in one axis).
8) Insert the needle bearing subassembly [**81**] into the head of the cover (applies to valves DN32÷65 only).
9) Screw the bushing [**74**] onto the stem [**06**] until the stem is raised.
10) Insert the needle bearing subassembly [**81**] into the cover head.
11) Screw in the screw [**12**] until it stops slightly, then loosen (unscrew) by approx. ¼ turn).
12) Secure the screw [**12**] against unscrewing. Drill, thread the holes for the grub screws [**24**]. Screw in the setscrews.
13) Screw in grease nipple [**82**].
14) Apply caster pad [**26**].
15) Insert key [**41**] into the bore of the cover sleeve [**74**].
16) Apply handwheel[**08**] and secure with circlip [**84**].

c) Removal and installation of valves DN80 ÷ 100



❖

❖ DISMANTLING

1. Remove the manual drive head [**GNR**] - remove the screws [**76**], unscrew the head from the stem.
2. Fix the valve (immobilise).
3. Remove the coupling subassembly connecting the upper stem [**71**] to the lower stem [**06**]. Using a flat-blade screwdriver or a pointed tool, lever and push upwards the retaining "spring" ring [**47**]. After sliding the clutch sleeve [**46**] and the ring [**47] upwards, the** two halves of the clutch split sleeve [**45**] can be removed. After disengaging the clutch, lift the top pin [**71**] upwards (or pull it out completely). The clutch sleeve and the spring ring can now be removed.
4. Remove the fuselage nuts [**19**], and the cover and choke nuts [**20**].
5. Remove cover [**03**].
6. Pull out the choke [**07**].
7. Unscrew the flange [**30**] from the inner cover [**37**].
8. Slide the fuselage key [**41**] and the subsequent split ring elements [**40**] out of the fuselage channel [**01**].
9. Pull the inner cover [**37**] together with the sealant and rings. Remove the cover from the stem.
10. Using a special tool (FAP WAKMET design), pull out the packing [**11**] together with the inserts [**10**].
11. Pull the bottom pin [**06**] out of the fuselage together with the fitted plug [**04**].
12. Fix the mandrel [**06**] in the soft jaws of the vice.
13. Unbend the lock washer [**17**].
14. Remove the plug screw [**16**]. Remove the plug [**04**], strain relief plug [**14]** and stem clamp halves [**15]** from the stem [**06**].

❖ MONTAGE

1. Connect the stem with the plug - put the plug [**14] on the stem** end [**06]**, connect it with the split clamp halves [**15],** put the whole into the plug hole [**04**]. Place the lock washer [**17] on the** stem [**06]** and the plug [**04]**. Screw in place with screw [16]. Secure against unscrewing by bending the washer [**17**] over the milled parts of the plug and the screw.
2. Place the assembled lower stem sub-assembly with the plug in the hull [**01**].
3. Place the inner cover [**37**] on the bottom pin [**06**] and insert into the fuselage.
4. Insert trapezoidal gasket [**38**] and ring [**39] in the** space between the hull and inner cover [**37**].
5. Slide the inner cover towards the fuselage seat so that the split ring elements can be inserted in the fuselage selection. Pull the inner cover upwards. Slide the fuselage groove [**41**] into the vertical fuselage groove and between the split ring elements [**40**].
6. Screw on the inner cover flange [**30**] in such a way that the stud bolts [**20**] of the cover and also of the gland are in the main axes of the fuselage.

7. Insert the sealant [**11]** together with the inserts [**10] into the** inner cover [**37**] (overlapping the stem) (sequence as shown in the figure). Insert the gland [**07**].
8. Lightly tighten the packing through the gland [**07**], using a special sleeve.
9. Place the cover subassembly [**03**] on the hull. Screw on the nuts [**19**].
10. Screw the two nuts [**20**] onto the flange bolts [**30**]. Tightening the nuts will create an initial seal between the hull and the inner cover. The pressure of the medium during operation will seal the cover.
11. Put on the washers [**22**] and screw the nuts [**20**] onto the gland screws. Tighten the nuts until a seal is achieved between the stem and the inner cover.
12. Place the coupling sleeve [**46**] in the axis of the mandrel with the chamfer upwards, place the spring ring [**47]** above it and, holding them with one hand, with the other move the upper mandrel [**71**] until it makes contact with the lower mandrel [**06**].
13. Lift the coupling sleeve [**46**] with the ring [**47] upwards**, place both halves of the split coupling sleeve [**45]** on the exposed pin heads and then slide the coupling sleeve [**46**] onto them. Insert
14. (push) the ring [**47**] into the groove of the split sleeve [**45**] securing the coupling.
15. Apply a thin layer of high-temperature lubricant to the trapezoidal thread of the mandrel [**71**].
16. Place the manual drive head [GNR] on the cover [**03]** and screw it onto the trapezoidal thread of the upper stem[**71**]. Screw in the allen bolts [**76**] together with the washers [**84]**.