

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

Operating and Operating Instructions

Gate valves medium and high pressure

Medium-pressure: PN63 - PN100
High pressure: PN160 - PN700

Receive:

lp	depart ment	date	signature
1	TKT		
2	HA		
3	KJ		

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
---------------	---	--

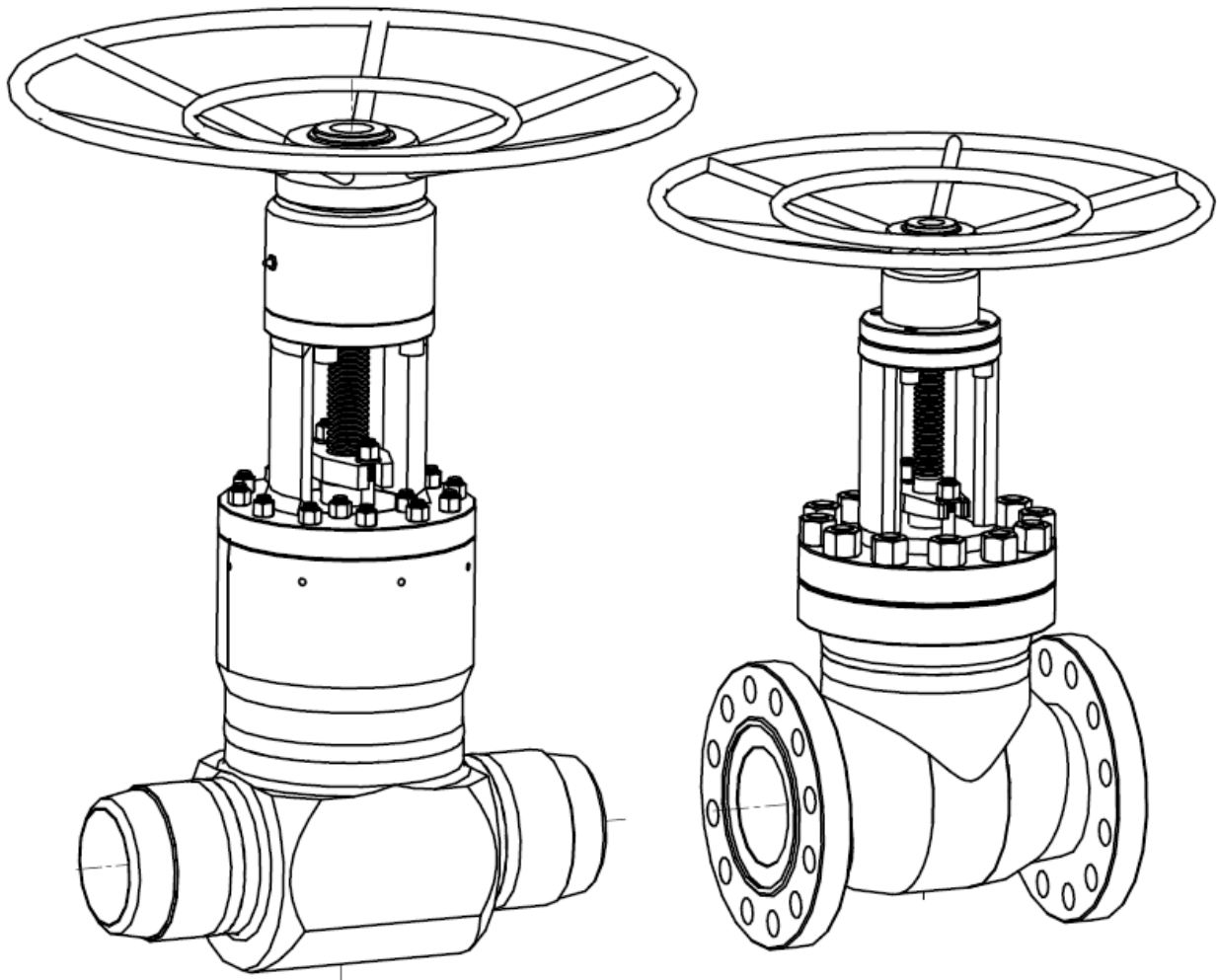


Table of contents:

1. Subject DTR
2. Application
3. Performance data
4. Materials for parts
5. Description of construction
6. Protection of the closed throat area
7. Maintenance and operation
8. Quick reference guide

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

1. subject matter of the DTR

The subject of this DTR are the guidelines for the operation, use and commissioning of medium and high-pressure gate valves manufactured by Fabryka Armatury Przemysłowej WAKMET in Bodzanów.

2. Application

Gate valves are designed for water, steam and other non-flammable, chemically non-aggressive and non-toxic media - in carbon and alloy steel version and for chemically aggressive and toxic media - in acid resistant version. They are manufactured with weld ends and side flanges. Gate valves are designed for two-position operation, i.e. they should operate in fully open or fully closed position. They cannot be used for flow regulation.

3 Performance data

Gate valves are manufactured for nominal pressures from 63 to 700 bar.

Gate valves are manufactured in nine material versions :

carbon and alloy steels

- P250GH steel for operation at max. 450°C (723K)
- U - 16Mo3 steel for max. temperature of 530°C (803K)
- A - 13CrMo4-5 steel for max. temperature of 560°C (833K)
- B - 10CrMo9-10 steel for operation at max. 600°C (873K)
- C - 14MoV6-3 steel for max. temperature of 570°C (843K)
- E - X10CrMoVNb9-1 steel for operation at max. 670°C (943K)
- E2 - X10CrWMoVNb 9-2 steel for operation at max. 650°C (923K)

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

The sealing surfaces in the hull and on the wedge are stellited.

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

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL	Issue: 13
	NR QT-2/114	Pages: 29
	medium and high-pressure gate valves	Date: 2023-10-31

Note: For other nominal pressures (not listed below), the temperature/pressure relationships in the data sheets apply.

PN 63	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	63	63	63	63	57	51	45	39	33	21																
16Mo3	1.5415	63	63	63	63	63	62	54	51	48	47	28	22	18	14														
13CrMo4-5	1.7335	63	63	63	63	63	63	63	60	57	54	41	35	28	23	18	15	12	10										
14MoV6-3	1.7715	63	63	63	63	63	63	63	63	63	61	60	58	45	39	34	30	26	22										
10CrMo9-10	1.7380	63	63	63	63	63	62	59	56	53	50	48	41	31	27	23	20	17	15	13	11	10							
X10CrMoVNb9-1	1.4903	63	63	63	63	63	63	63	63	63	63	63	63	63	60	55	50	45	40	36	32	28	25	22	20	17	15	13	11
X6CrNiTi18-10	1.4541	63	63	62	59	56	53	50	48	47	46	45	45	44	44	44	43	39	35	32	29	26							
X2CrNiMo17-12-2	1.4404	63	63	63	62	59	58	54	52	51	49	48	48	48	48	48	48												

PN 100	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	100	100	100	100	91	81	71	62	52	33																
16Mo3	1.5415	100	100	100	100	100	98	86	81	76	74	44	35	28	22														
13CrMo4-5	1.7335	100	100	100	100	100	100	100	95	90	86	65	55	45	37	29	23	19	16										
14MoV6-3	1.7715	100	100	100	100	100	100	100	100	100	97	96	92	71	62	54	47	41	35										
10CrMo9-10	1.7380	100	100	100	100	100	98	93	88	83	79	76	64	49	43	37	32	28	24	21	18	16							
X10CrMoVNb9-1	1.4903	100	100	100	100	100	100	100	100	100	100	100	100	100	96	87	79	71	64	57	51	45	40	35	31	27	23	20	17
X6CrNiTi18-10	1.4541	100	100	99	93	89	84	80	77	74	73	71	71	71	70	70	68	61	56	51	46	41							
X2CrNiMo17-12-2	1.4404	100	100	100	98	93	92	86	83	80	78	76	76	76	76	76	76												

PN 160	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	160	160	160	160	145	130	114	99	84	53																
16Mo3	1.5415	160	160	160	160	160	156	137	130	122	118	71	56	45	36														
13CrMo4-5	1.7335	160	160	160	160	160	160	160	152	144	137	104	88	71	59	46	37	30	25										
14MoV6-3	1.7715	160	160	160	160	160	160	160	160	159	155	153	147	114	100	86	76	66	56										
10CrMo9-10	1.7380	160	160	160	160	160	156	149	141	133	126	121	103	79	69	59	52	44	39	34	29	26							
X10CrMoVNb9-1	1.4903	160	160	160	160	160	160	160	160	160	160	160	160	160	153	139	127	114	102	91	81	72	63	56	50	43	37	32	27
X6CrNiTi18-10	1.4541	160	160	159	149	142	135	127	123	119	116	114	113	113	112	108	98	90	82	73	66								
X2CrNiMo17-12-2	1.4404	160	160	160	156	149	147	138	132	129	125	122	122	122	121	121	121												

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	250	250	238	226	214	163	138	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																

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	---	---

Electromechanical actuators delivered by FAP WAKMET together with the gate valve are set by the valve manufacturer (according to the gate valve operating parameters, i.e. temperature and 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 operating temperature is not exceeded! Exceeding the maximum permissible torque may damage the valve.

The table below shows the recommended torque $M_{obr/RT}$ (rotary actuators) required to close the gate valve. The values in the table refer to the nominal parameters, i.e. the operation of the valve at room temperature (20°C).

The permissible closing torque of the gate valve $M_{obr/t}$ for fittings operating at elevated temperatures should be calculated according to the relation:

$$M_{obr/t} = \frac{M_{obr/RT} * P_{s/t}}{PN} \quad \text{where } P_{s/t} \text{ - working pressure [bar]}$$

PN - nominal pressure [bar]

DN	PN63	PN100	PN160	PN250	PN320	PN400	PN500	PN630
	[Nm]							
40	13	19	28	49	65	81	121	152
50	18	27	43	70	89	116	141	177
65	34	52	80	128	162	211	287	359
80	46	71	110	174	221	285	381	478
100	71	108	204	323	411	527	685	859
125	109	188	302	492	661	822	1060	1331
150	158	242	542	835	1108	1379	1761	2212
175	222	343	667	1052	1368	1704	2272	2855
200	301	465	873	1403	1787	2591	3016	3790
250	597	928	1490	2382	3037	4279	6248	7855
300	928	1467	2316	2684	4968	6339	8658	10887
350	1418	2207	3563	5577	7859	9800	12605	15848
400	2077	3227	6102	9444	12043	15014	19461	24474
450	3037	4721	7922	12266	15645	24816	30953	38933

Gate valves are produced as weld-on versions and versions with side flanges . Endings are prepared in accordance with PN-EN 12627, flanges in accordance with PN-EN 1092-1 with PN marking and PN-EN 1759-1 with class marking. In the case of special requirements, it is possible to

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

produce end pieces and flanges according to customer documentation. This requires prior agreement with FAP WAKMET.

4. materials for parts

4.1 Medium-pressure gate valve PN63-100

	Carbon steel		Alloy steel				Austenitic steel	
		U	A	B	C	E	A	B
Hull	P250GH 1.0460	16Mo3 1.5415	13CrMo4-5 1.7335	10CrMo9-10 1.7380	14MoV6-3 1.7715	X10CrMoVNb9-1 1.4903	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Wedge	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Arbor	X39CrMo17-1 1.4122	X39CrMo17-1 1.4122	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
Gasket	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X2CrNiMo17-12-2
Cover	P250GH 1.0460	16Mo3 1.5415	13CrMo4-5 1.7335	10CrMo9-10 1.7380	14MoV6-3 1.7715	X10CrMoVNb9-1 1.4903	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Cover screw	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	X22CrMoV12-1 1.4923	X6CrNi18-10 1.4948	X6CrNi18-10 1.4948
Cover nut	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	21CrMoV5-7 1.7709	X5CrNi18-10 1.4301	X5CrNi18-10 1.4301
Choke bolt	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	X22CrMoV12-1 1.4923	X6CrNi18-10 1.4948	X6CrNi18-10 1.4948
Gland nut	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	21CrMoV5-7 1.7709	X5CrNi18-10 1.4301	X5CrNi18-10 1.4301
Choke	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
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	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Sealing ring	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

4.2 High-pressure gate valve PN160-700

	Carbon steel			Alloy steel				Austenitic steel	
		U	A	B	C	E	E2	A	B
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	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Wedge	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	X10CrWMoVNb9-2 1.4901	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Arbor	X39CrMo17-1 1.4122	X39CrMo17-1 1.4122	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
Inside cover	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	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Thrust ring	10CrMo9-10 1.7380	10CrMo9-10 1.7380	14MoV6-3 1.7715	14MoV6-3 1.7715	14MoV6-3 1.7715	X10CrMoVNb9-1 1.4903	X10CrWMoVNb9-2 1.4901	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Split ring	10CrMo9-10 1.7380	10CrMo9-10 1.7380	14MoV6-3 1.7715	14MoV6-3 1.7715	14MoV6-3 1.7715	X10CrMoVNb9-1 1.4903	X10CrWMoVNb9-2 1.4901	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Safety ring	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	10CrMo9-10 1.7380	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Gasket	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X5CrNi18-10	Graphite + X2CrNiMo17-12-2
Top 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	10CrMo9-10 1.7380	X6CrNiTi18-10 1.4541	X6CrNiTi18-10 1.4541
Cover screw	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X6CrNi18-10 1.4948	X6CrNi18-10 1.4948
Cover nut	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	X5CrNi18-10 1.4301	X5CrNi18-10 1.4301
Choke bolt	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	21CrMoV5-7 1.7709	X22CrMoV12-1 1.4923	X22CrMoV12-1 1.4923	X6CrNi18-10 1.4948	X6CrNi18-10 1.4948
Gland nut	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	42CrMo4 1.7225	21CrMoV5-7 1.7709	42CrMo4 1.7225	X5CrNi18-10 1.4301	X5CrNi18-10 1.4301
Choke	13CrMo4-5 1.7335	13CrMo4-5 1.7335	13CrMo4-5 1.7335	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	10CrMo9-10 1.7380	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
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	X6CrNiTi18-10 1.4541	X2CrNiMo17-12-2 1.4404
Sealing ring	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite	Graphite

5. description of gate valve construction

5.1 Medium-pressure gate valve PN 63-100

01	hull
04	wedge
03	cover
06	mandrel
07	choke
10	cover insert
11	sealing ring
13	gasket

18	cover screw
19	cover nut
20	choke screw
21	gland nut </td
22	pad
76	propeller
80	pad
750	drive housing

751	drive sleeve
752	drive sleeve screw
753	screw
754	keyway
755	bearing
756	circlip
757	wheel washer
758	lubricator

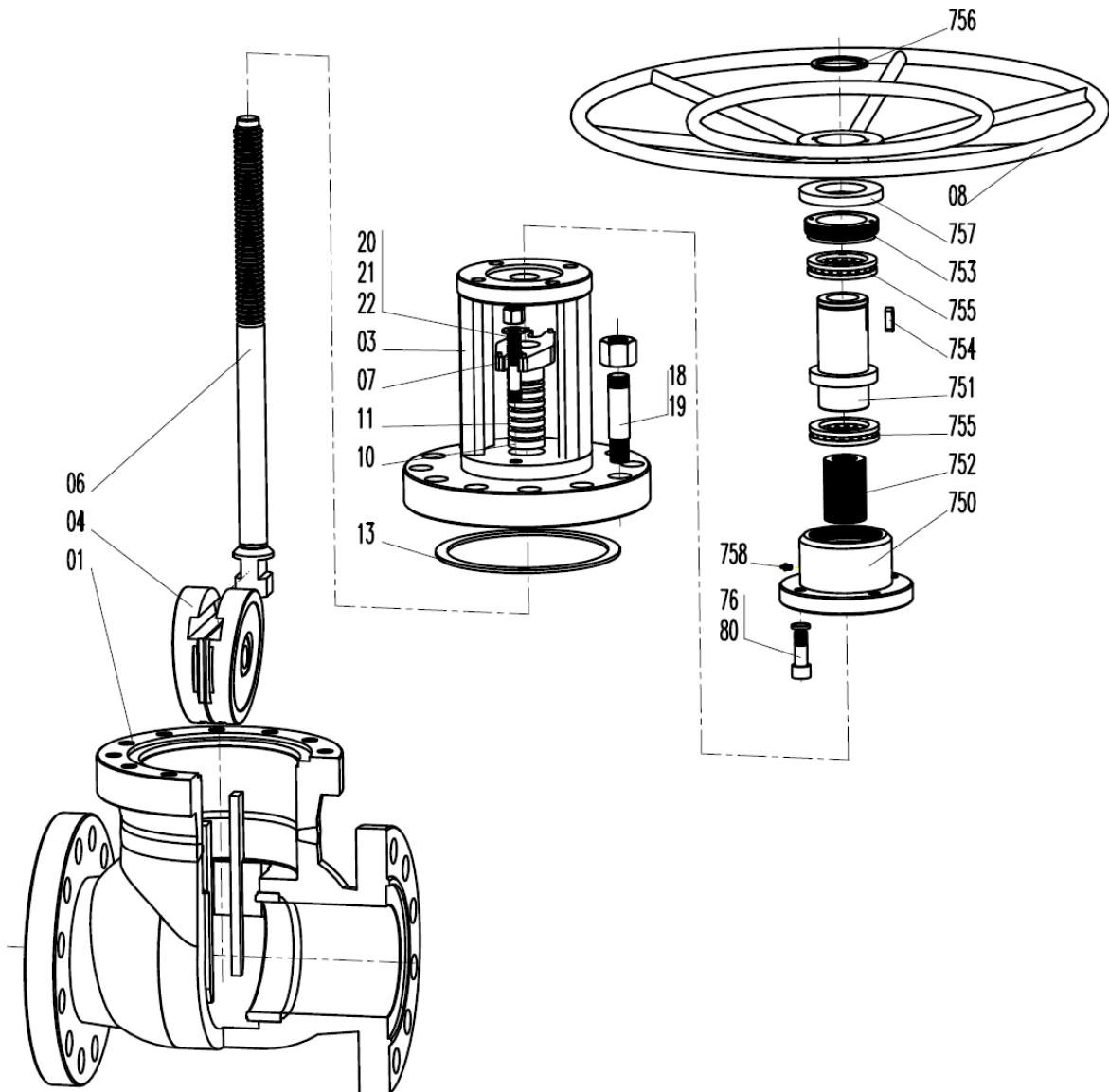


Figure 1: Medium-pressure wedge gate valve (PN63-100)

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

The medium-pressure wedge gate valve is shown in Figure 1. The basic element of the medium-pressure gate valve is the body [01] forged-welded. The housing body is closed from above with a cover [03], connected to the housing with studs [18] embedded in the body and sealed with a multi-edge gasket [13] protected against oxidation in the so-called closed space. The closing element of the gate valve is a pendulum wedge [04] (Figures 3, 4 and 5) , which is connected to the drive via a stem [06]. The stem is sealed in the cover by a so-called choke chamber, which contains graphite rings [11] pressed against the choke [07] by screws [20]. The stem in the upper part has a notched trapezoidal thread LH (left), thanks to which the rotary movement of the drive is converted into reciprocating movement of the spindle and the wedge connected to it. The gate drive is bolted to the cover using socket head cap screws [76]. The wedge seats of the hull, and the wedge have a stellite sealing groove.

The manual drive head consists of a housing [750] in which there is a drive sleeve [751] bearing two thrust ball bearings [755], pressed down by a screw [753]. A left trapezoidal thread is cut in the drive sleeve (matching the thread on the stem). The caster [08] is pushed onto the drive sleeve and secured against falling out with the circlip [756]. The wheel torque is transmitted to the drive sleeve via the key [754].

5.2 High-pressure gate valve PN 160-700

01	hull
04	wedge
03	cover
06	mandrel
07	choke
10	cover insert
11	sealing ring
13	trapezoidal seal
18	cover screw
19	cover nut

20	choke screw
21	gland nut
22	pad
36	safety ring
37	inside cover
39	thrust ring
40	split ring
64	inner cover screw
72	inner cover nut
76	propeller

80	spring washer
750	drive housing
751	drive sleeve
752	drive sleeve screw
753	screw
754	keyway
755	bearing
756	circlip
757	wheel washer
758	lubricator

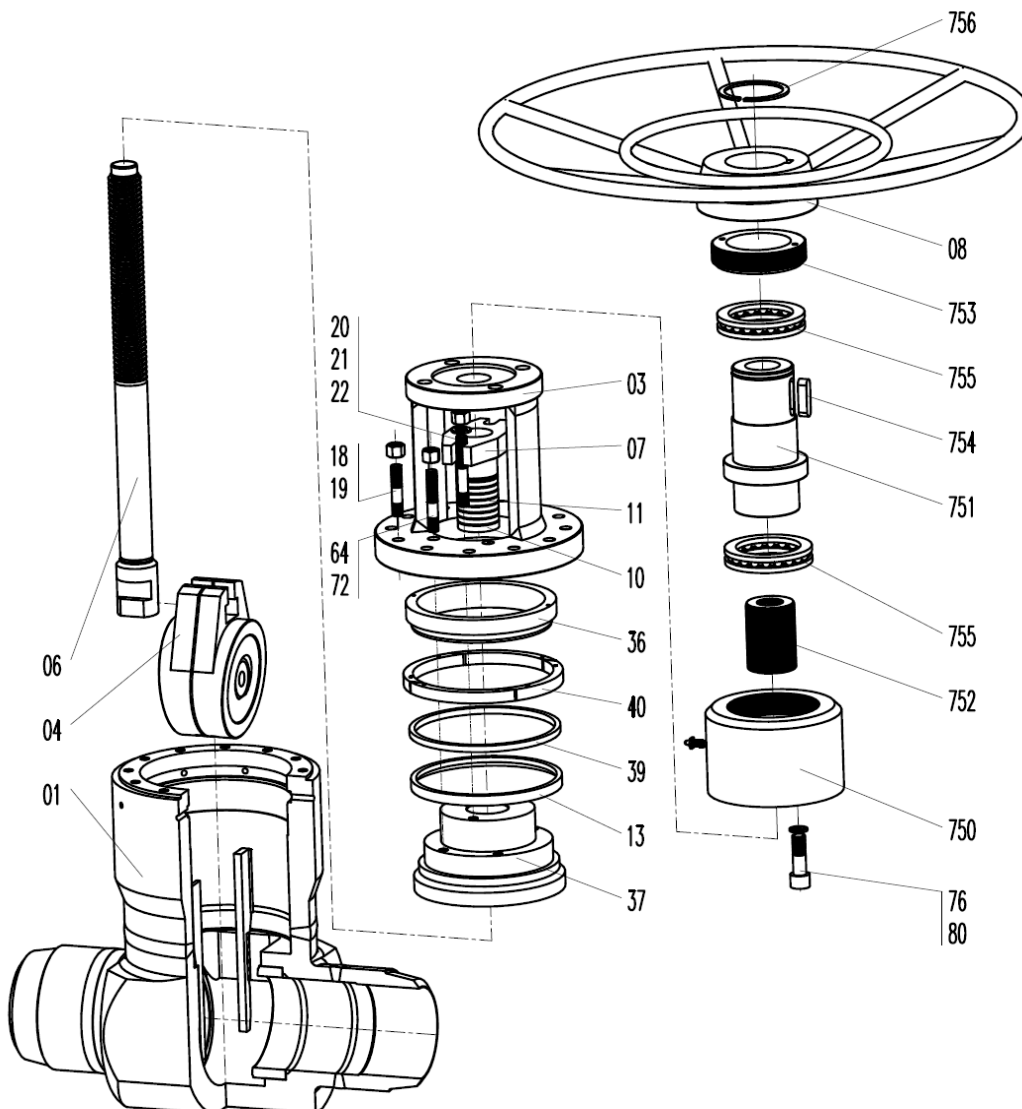
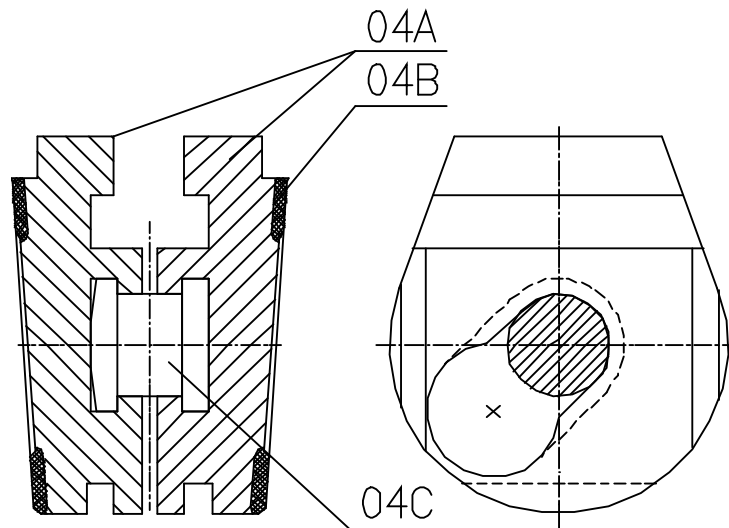


Figure 2: High-pressure wedge gate valve (PN160-700)

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	---

The high-pressure wedge gate valve is shown in Figure 2. The basic element of the high-pressure gate valve is a forged-welded body [01]. The body of the hull is closed from the top with a cover [03], connected to the hull with studs [18] embedded in the body. The tightness of the hull cover is achieved by using a self-sealing cover system consisting of: inner cover [37], trapezoidal gasket [13], stop ring [39], split ring [40] and retaining ring [36]. Screws [64] are used to seal the inner cover system. The closing element of the gate valve is a pendulum wedge [04](Figures 3,4 and 5) , which is connected to the drive via a stem [06]. The stem is sealed in the cover using a so-called choke chamber with graphite rings [11] pressed into the choke [07] by screws [20]. The upper part of the stem has a notched trapezoidal thread LH (left), thanks to which the rotary movement of the drive is converted into reciprocating movement of the spindle and the wedge connected to it. The gate drive is bolted to the cover using socket head cap screws [76]. The wedge seats of the hull, and the wedge have a stellite sealing groove.

Figure 3 Wedge version for nominal diameters DN50 and DN65



The manual drive head consists of a housing [750] in which there is a drive sleeve [751] bearing two thrust ball bearings [755], pressed down by a screw [753]. A left trapezoidal thread is cut in the drive sleeve (matching the thread on the stem). The caster [08] is pushed onto the drive sleeve and secured against falling out with the circlip [756]. The wheel torque is transmitted to the drive sleeve via the key [754].

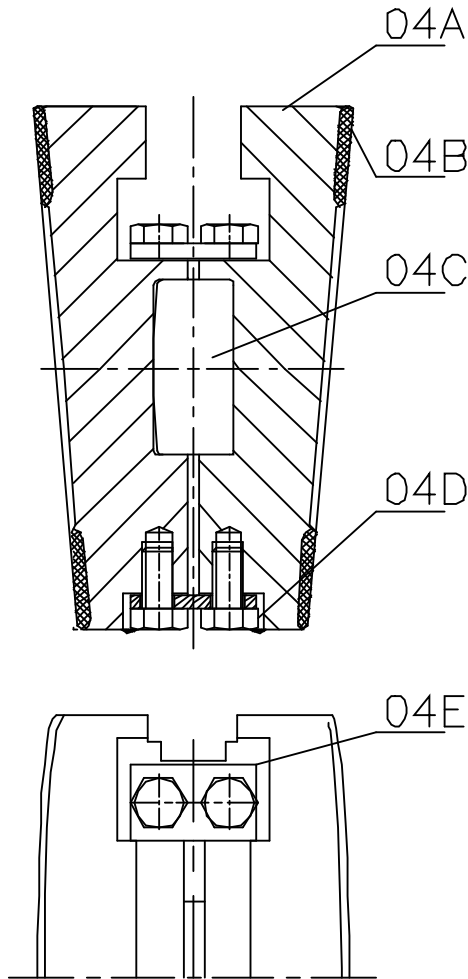


Figure 4 Wedge version for nominal diameters DN80 and DN100

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

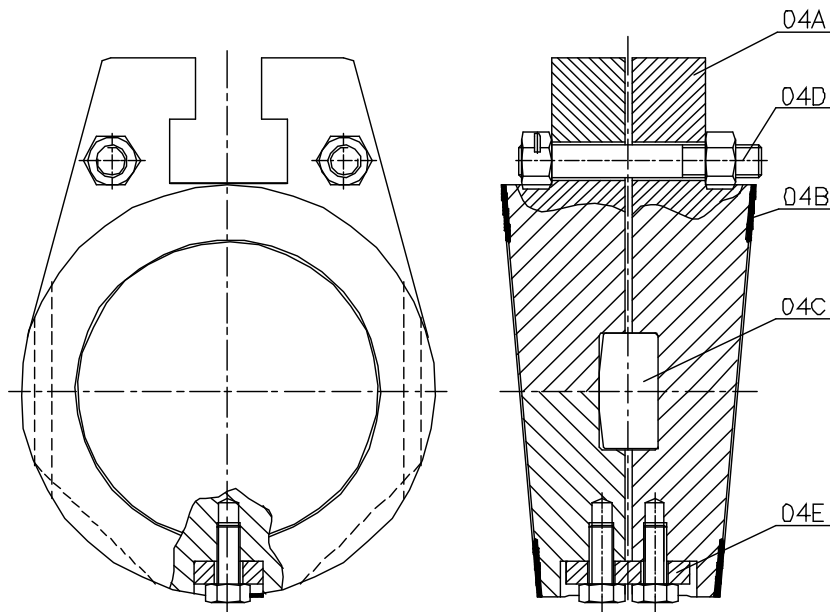


Figure 5 Wedge version for nominal diameters \geq DN125

6. Securing the closed throat area

During operation of the gate valve in the closed throat space (gate valve in the closed position), an uncontrolled increase in pressure may occur. This occurs when the throat (the space above the wedge) is filled with liquid (e.g. the residue from the acceptance test of the installation) and then heated up (pipeline heating). Under the influence of the temperature increase, the liquid causes a pressure increase in the solid throat space (every 1°C can cause a pressure increase of 6 bar).

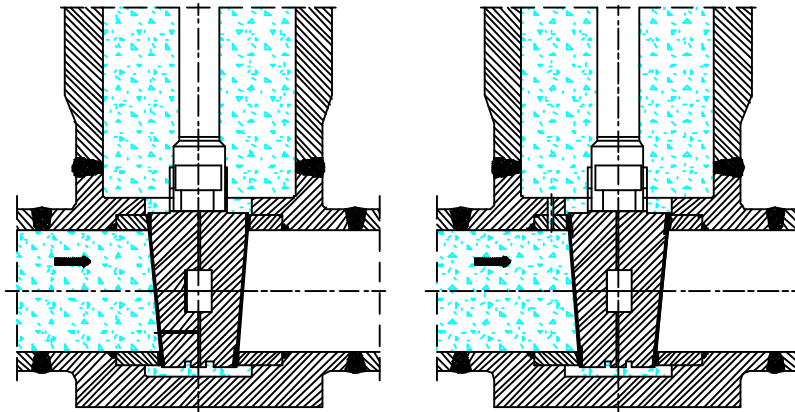
The problem of heating up the liquid inside the housing is particularly dangerous with gate valves with a self-sealing closure, as the cover seal becomes increasingly tight as the pressure increases.

In the case of flanged gate valves, with an unacceptable increase in pressure, leaks appear on the cover gasket causing a drop in pressure.

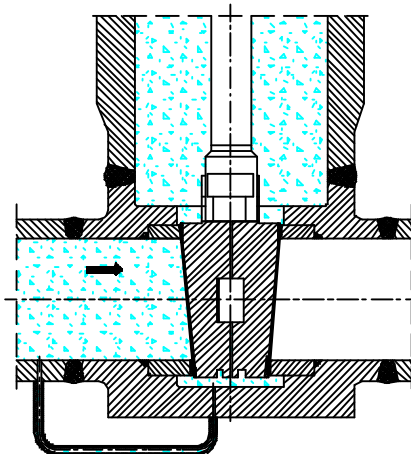
In order to protect the gate valve throat from uncontrolled pressure increase, the following are used:

- a) relief hole made in one half of the wedge,
- b) relief opening between throat and inlet,
- c) by-pass between throat and inlet,
- d) plate type safety valve.

a) b)



c)



d)

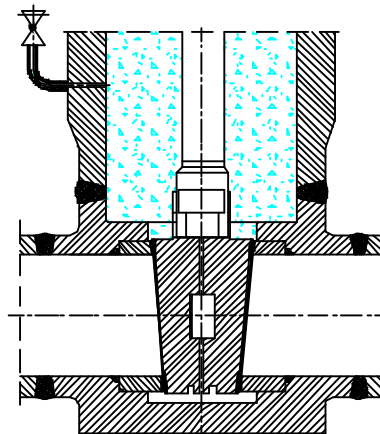


Figure 6: Protection of the throat space

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	---

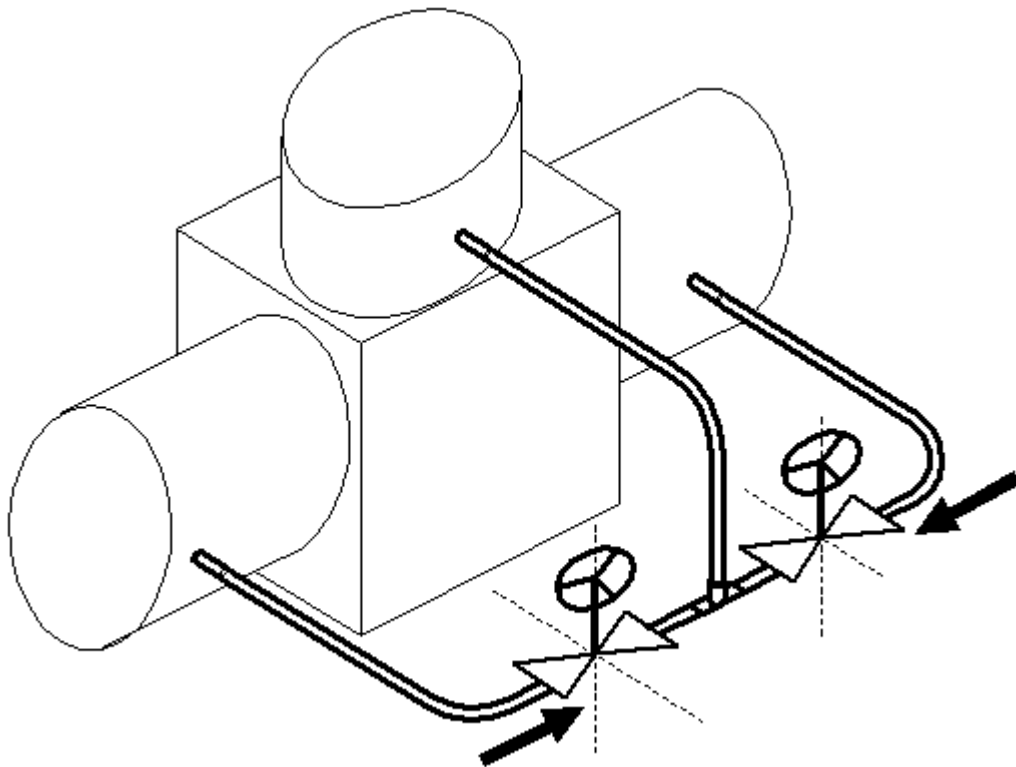


Figure 7

A modification of solution [c] according to figure no. 7 is to connect the inlet and outlet to the throat with a tee and two valves . In this case, one valve (on the inlet side) must always be **open**.

Solution "d" according to figure 8

The valve is mounted in the shut-off valve seat according to drawing No. 8 (factory sealed in the open position). The use of the shut-off valve in the safety valve unit allows the fuse to be replaced on plant movement. The seal must then be broken, the shut-off valve [90] closed, the outlet pipe [93] removed by first unscrewing the screw [94] and the fuse [92] replaced. After replacing the fuse, it is essential to open the shut-off valve!

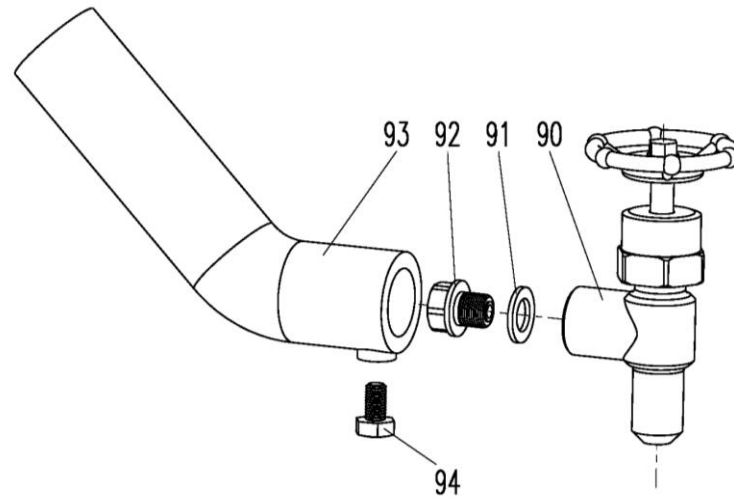
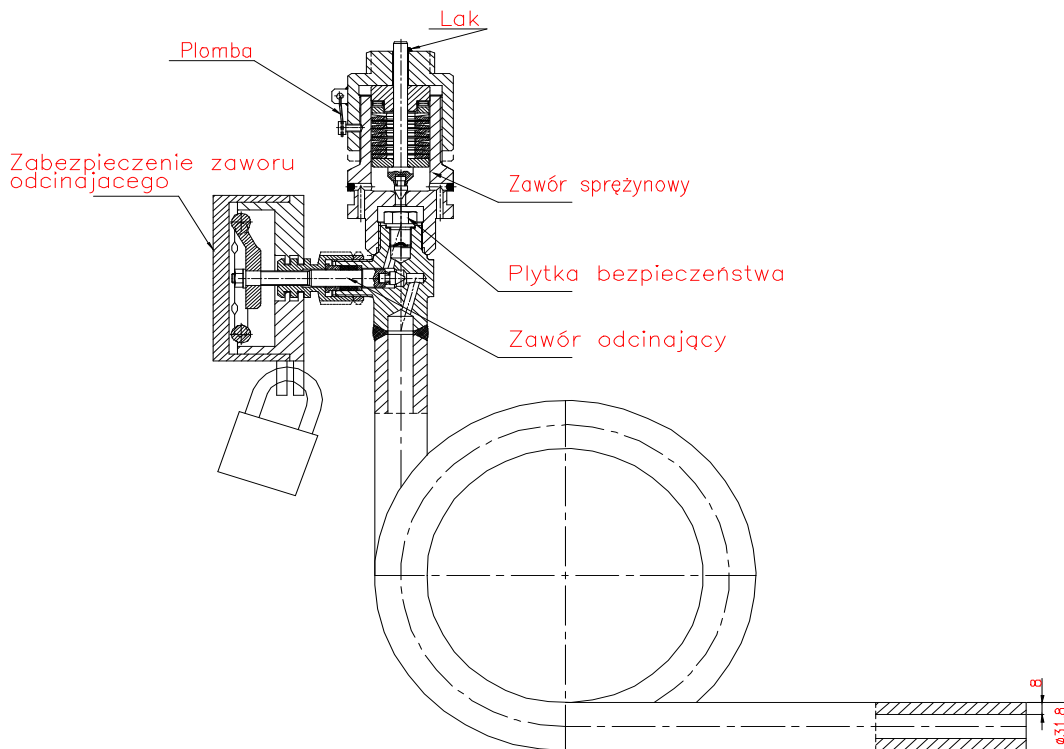


Figure 8: Safety valve

Caution: direct the outlet pipe [93] in a safe direction so that it does not scald the operator, or connect it to a special system that catches possible vapour outflow.

Solution "d" according to Figure 9



<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

A solution with triple security.

The basic element is the safety plate , in the event that it is punctured, the pressure will trip the spring valve plug , the spring pack balances a pressure of about 190 bar . There is a trip indicator on the spring valve , the stem end is coated with lacquer .

The leakage of lacquer indicates the tripping of two valves : the safety plate and the spring valve. In the event of continuous leakage through the safety valves, the fuse of the shut-off valve must be removed and the valve closed by shutting off the leakage. The use of the shut-off valve in the safety valve assembly allows the fuse to be replaced on plant movement.

7. Operation and maintenance

7.1 Transport and storage

The gate 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 fitting 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 fittings should be checked for damage during transport. Fittings must be stored so that their subsequent use is not affected. It must be protected against the damaging effects of moisture, dust, corrosion etc. The storage of fittings may take place in dry places protected from the harmful effects of precipitation and the effects of chemical substances or gases.

Fittings should always be stored in the closed position.

The fittings must be stored in such a way that their locking system is not damaged, the drive knobs or the wheel are not manipulated.

Gate valves stored for more than 4 months should be visually inspected before installation, paying particular attention to the following:

- preservation of internal surfaces,
- the quality of the paint finish,
- blank checks,

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

- checks on other safeguards,
- inspection documents attached to the fittings;

Fittings may 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.

7.2 Preparation for installation

Before installing the fittings:

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

The following marks (according to EN19) are affixed to the hull of the gate valve

- nominal diameter - marked with the DN symbol and the size of the diameter
 - nominal pressure - marked with the PN symbol for the nominal pressure value
 - 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 completeness check of the fittings and the required technical documentation, acceptance protocols, quality certificates, etc,
 - decontaminate surfaces and connections that are subject to welding,
 - remove safety devices and plugs,
 - check that the surfaces of the rebates are undamaged and metallic clean - free of paint and corrosion,
 - check the inside of the gate valve and the pipeline to ensure that it is free from any impurities.
 -

7.3 Installation on the pipeline

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

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

Fittings are not to be dismantled before installation on the system.

The gate 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 positioned 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 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. This and any necessary heat treatment is the responsibility of the owner (user) of the pipeline. The gate valve, when welded to the pipeline, should be open. During welding, special care must be taken not to contaminate the gate 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 to clean the system must not be aggressive towards the gate valve stem. Do not paint on the valve stem during painting work! The use of strainers before the gate valves is recommended.

As part of the preparation of the boiler for commissioning, blowdown of the steam pipe is required to ensure an adequate degree of cleanliness.

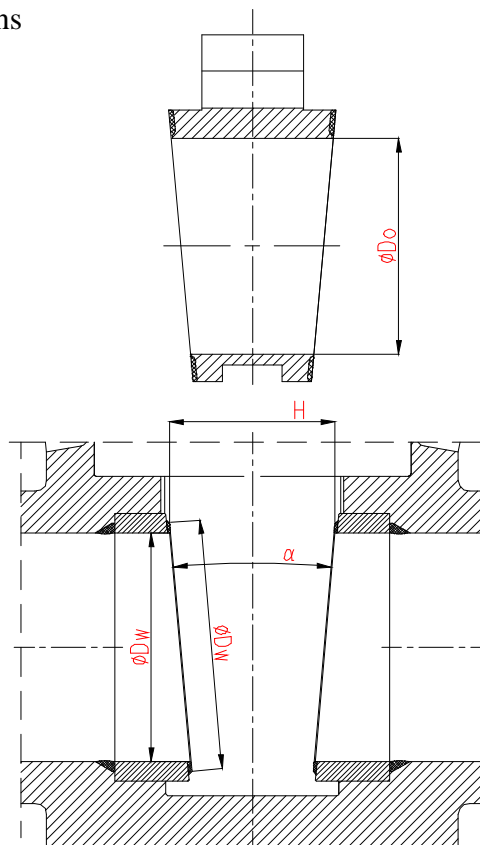
In order to protect the gate valve during the steam blowing process, it is recommended to use a wedge with a hole of the largest possible diameter. The dimensions are given in the table below (Figure 10)

It is forbidden to open or close the gate valve during blowing. Any movement will lead to the destruction of the sealing surfaces of the habitats. After the blowing process, the gate valve is subject to a new inspection and assessment of the condition of the habitats, after a positive assessment, carry out the installation of a full wedge. New sealant is required.

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

DN	α	OJ	Dw	To	H
40-50	8°	62	46	44	52,7
65	8°	78	62	60	58,3
80	10°	94	72	68	62,7
100	10°	114	94	90	79,6
125	10°	140	120	116	97,3
150	10°	164	142	138	108,3
175	10°	192	174	138	130,7
200	10°	220	200	185	144,2
250	10°	272	250	245	183
275	10°	303	274	269	189,4
300	10°	326	300	290	207
325	12°	370	330	324	202
350	12°	395	350	340	236

Figure 10: Seat dimensions



<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

7.4 Preparation for trial start-up

Functional tests of the sliders must be carried out prior to trial start-up.

Open and close. Check all connections and sealing, eliminate inadequacies. Check fixing and support of gate 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 the gate valve when filling the system. Vent the system after filling. During the tests, check the tightness of the body, the tightness of the inner cover [37], 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 the inner cover [37] rises (there is play in the nuts [64] lifting the inner cover [37]), the nuts [64] of the inner cover must be tightened to eliminate the play. After completion of the water starting tests, the gate valve must be opened to remove the liquid from the throat space before the pipeline is warmed up.

Note: A gate valve that is closed "cold" should also be opened "cold", otherwise if it is closed "cold" and then heated, stresses will be introduced which will cause the wedge to jam in the seat .

7.5 Maintenance

The gate valve must be inspected during operation. The frequency of inspection should be every 100 opening-closing cycles, but at least every 4 months. The tightness of the flange connections, the tightness between the body and the cover and the tightness of the gland chamber are to be checked. In case of leakage, tighten the gland bolts or the connecting bolts of the body and cover if possible. If it is not possible to tighten the sealing system because the gland is leaning against the cover, it is necessary to add sealant. This should be done by unscrewing the nuts, lifting the gland, refilling the packet (on request FAP WAKMET will supply a repair packet), lowering the gland and tightening the gland nuts again. 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].

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

Ensure that there is no pressure and the fitting is cooled down before any work is carried out on the fitting or before it is removed from the pipeline.

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

It is recommended that the sealing surfaces of the shut-off valve [90] in the safety valve unit be inspected during system shutdown (at least every two years).

Sealing surfaces should be cleaned and, in the case of minor damage, sanded. Serious damage should be reported to the manufacturer's service department.

After inspection, the valve [90] must be assembled. Open the shut-off valve at all times!

FAP WAKMET gate valves are designed to minimise their maintenance. However, to ensure their long and reliable operation and to reduce repair costs, they should be checked regularly every 4 months, 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 is not less than 4 months or 100 opening-closing cycles.

The proper functioning of the fittings can be prolonged by:

- regular lubrication of the threaded surface of the stem (every 4 months)
- resealing the gate valve gland or replacing the sealing pack (depending on the leakage)
- opening and closing the gate valve at least twice a year,
- Seal replacement Each time the gate valve is removed and installed, the seal and gland pack must be replaced.
- Should it be necessary to replace components such as the wedge, spindle, glands or stop rings, use parts recommended by the manufacturer. After repair, and before fitting to the installation, the gate valve should be checked for tightness according to EN 12266-1.

Lubrication of fittings, lubrication is subject to:

- roller bearings (if the gate valve is fitted with a manual drive head).

The manual drive head housing is fitted with a grease nipple through which 10 g of bearing grease must be injected every 3 years.

- the trapezoidal threaded spindle element , for proper operation of this gate valve motion system, it should be coated with the necessary dose of 2 - 3 g grease , seeded with a brush.

Assessment of component wear and tear:

Note: once the 1,000 opening-closing cycles have been exceeded, it is necessary to analyse

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

the wear on the fitting walls.

- spindle (spindle) - observe the mating surface of the graphite and gland; if there are cracks deeper than 0.3 mm, this component should be replaced with a new one.
- sealing surfaces of wedges and seats if there are blockages and cracks exceeding 0.005 mm these surfaces are subject to lapping, if the cracks on the wedge are deeper than 1.0 mm the wedge is replaced.
- Wall thickness control - the wall thickness control is carried out using the ultrasonic method in relation to pipe diameter, working pressure and material grade (material strength) taking into account the following formula from EN12516-2

$$e_{0(1)} = \frac{d_{0(1)} \cdot PC}{(2 \cdot f - PC) \cdot k_C} + c_1 + c_2$$

7.6 Installation and removal of sliders

Medium-pressure gate valve PN63-100 (Figure 1)

❖ DISMANTLING

1. Fix (immobilise) the gate valve.
2. For gate valves with electromechanical or pneumatic drive - disconnect the drive from the gate valve. Suspend the drive. Unscrew bolts [76] (nuts in case of other mounting). Unscrew the drive from the stem [06] by turning the drive handwheel.
3. For manually operated gate valves - remove the manual drive head [75] - remove the screws [76],
4. Disconnect the cover component [03] from the hull [01] by unscrewing the nuts [19] from the studs [18]. The reinforced seal [13] can be removed from the hull and the studs [13] can be unscrewed if necessary,
5. Remove the wedge [04] from the stem [06],
6. Secure the removed cover component in a soft-jawed vice. Fasten by gripping the mandrel [06] from the wedge side, taking care not to damage its surface. Now we can unscrew the pin from the cover subassembly by twisting the cover.

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

7. Fix the cover in a vice. Unscrew the nuts [21], remove the washers [22], then unscrew the studs [20] of the choke. The choke [07] can now be pulled out. Then, using a special tool, pull out the packing [11] together with the inserts [10].

❖ MONTAGE

1. Screw in the stud bolts of the gland [20].
2. Position the cover on the special mounting mandrel fixed in the vice. Insert the sealing pack [11] together with the inserts [10] **into the gland** chamber of the cover [03]. Tighten the packing - the packet should be flush with the edge of the gland chamber. Remove the cover subassembly from the mounting stud.
3. Apply a thin layer of high-temperature lubricant to the trapezoidal thread of the mandrel. Insert the stem into the cover while applying the gland [07].
4. Place washers [22] on the choke bolts [20], screw on the nuts [21] and lightly tighten them.
5. Fix the fuselage in a vise (in the case of large flights set on stands - prisms). Screw in the studs [18] of the fuselage. Insert the gasket [13] into the lock.
6. Place the cover assembly on the hull so that the cover bails are in the longitudinal plane of the valve. Pay special attention that the markings cast or forged on the body and the cover are on the same side of the gate valve. Screw on the nuts (alternately - crosswise), and check that the flanges of the bonnet and body are parallel, with a minimum gap of 0.5 mm between them.
7. For manually operated gate valves - place the manual drive head [75] (or, depending on the design, a connection for another type of drive) on the stem, tighten screws [76].
8. For gate valves with electromechanical drive - fix the gate valve in a vertical position (large prismatic gate valves). Suspend the drive above the gate valve with the connection pointing towards the gate valve. While slowly lowering the drive, screw its sleeve into the stem [06] by turning the drive handwheel. Now the slider can be connected to the drive with screws [76].

7.6.2. High-pressure gate valve PN160-700 (Figure 2)

❖ DISMANTLING

1. Fix the gate valve (immobilise).
2. For gate valves with electromechanical or pneumatic drive - disconnect the drive from the gate valve. Suspend the drive. Unscrew bolts [76] (nuts in case of other mounting). Unscrew the

<p>FAP WAKMET</p>	<p>OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
-----------------------	--	--

drive from the stem [06] by turning the drive handwheel.

3. For manually operated gate valves - remove the manual drive head [75] - remove the screws [76],
4. Disconnect the cover component [03] from the hull [01]: unscrew the gland nuts [21] **from the** gland screws [20], unscrew the hexagon nuts [64] from the stud bolts [72], unscrew the hexagon nuts [19] from the stud bolts [18]. Lift the cover component together with the choke [07].
5. Pull up the retaining ring [36] (it has 4 tapped holes M6 or M8)
6. Remove split ring segments [40] (through the slot in the top of the throat)
7. Pull out the inner cover [37] together with the stop ring [39] and the trapezoidal seal [13]
8. Remove the wedge [04] from the stem [06],
9. Secure the removed inner cover component in a soft-jawed vice. Fasten by gripping the mandrel [06] from the wedge side, taking care not to damage its surface. Now we can unscrew the pin from the cover subassembly by twisting the cover.
10. Push the used sealing packet [11] together with the inserts [10] out of the inner cover.

❖ MONTAGE

1. Screw the gland screws [20] and the stud bolts [72] into the inner cover [37].
2. Position the cover on the special mounting mandrel fixed in the vice. Insert the sealing pack [11] together with the inserts [10] **into the gland** chamber of the cover [03]. Tighten the packing - the packet should be flush with the edge of the gland chamber. Remove the cover subassembly from the mounting stud.
3. Apply a thin layer of high-temperature lubricant to the trapezoidal thread of the mandrel [06]. Insert the mandrel into the inner cover [37].
4. Assemble mandrel [06] with wedge [04].
5. Place the trapezoidal seal [13] and the stop ring [39] on the inner cover.
6. Insert the inner cover with the stem and plug sub-assembly into the fuselage throat and push it down as far as it will go, paying attention to the correct position of the individual details.
7. Insert the split ring and distribute it evenly.
8. Place the choke [07] and possibly the choke sleeve on the stem.
9. Fix the fuselage in a vise (in the case of large flights set on stands - prisms). Screw in the studs [18] of the fuselage.

<p style="text-align: center;">FAP WAKMET</p>	<p style="text-align: center;">OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
--	---	--

10. Place the cover assembly on the hull ensuring that all details are positioned correctly. Pay particular attention that the markings cast or forged on the hull and the cover are on the same side of the gate valve.
11. Screw on the nuts [19] (alternately - crosswise),
12. Screw on the nuts [64] and use them to tighten the inner cover upwards.
13. Put on the washers [22] and screw on the gland nuts [21].
14. For manually operated gate valves - place the manual drive head [75] (or, depending on the design, a connection for another type of drive) on the stem, tighten screws [76].
15. For gate valves with electromechanical drive - fix the gate valve in a vertical position (large prismatic gate valves). Suspend the drive above the gate valve with the connection pointing towards the gate valve. While slowly lowering the drive, screw its sleeve into the stem [06] by turning the drive handwheel. Now the gate valve can be connected to the drive with screws [76].

7.7 Safety and guarantee

This instruction 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.

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

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

FAP WAKMET carries out post-warranty repairs against payment.

<p style="text-align: center;">FAP WAKMET</p>	<p style="text-align: center;">OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves</p>	<p>Issue: 13 Pages: 29 Date: 2023-10-31</p>
--	---	--

8. quick reference guide

Attention!!!

Failure to follow the instructions in this manual may result in damage to the fittings, great material loss and may cause danger to personnel or the environment.

A) Installation of the gate valve on the installation

Welding work to connect fittings to the pipeline may be carried out by certified and appropriately approved personnel in accordance with recognised and approved welding technology. After welding, heat treatment must be carried out.

Fittings manufactured by FAP WAKMET are not to be dismantled before welding. Carry out the welding process itself with the wedge (heart) raised.

B) Treatment after hydraulic tests of fittings.

Applies to steam gate valves !!!

After hydraulic testing (UDT test), it is imperative that the gate valve is emptied of water, this applies to the entire volume. By this is meant the necessary lifting of the wedge (heart) above the seat. It is not sufficient to empty the inlet or outlet pipe. Leaving water in the space above the wedge is not acceptable.

C) Control of electromechanical drives.

Fittings factory fitted with an electromechanical actuator have the closing system set in sequence:

Closing the slider:

- the first one disconnects the momentary circuit breaker protects the road switch

Opening the slider:

- the first circuit breaker disconnects the road switch and secures the torque switch

The use of a closing force (torque) other than that provided for in the gate valve's operating documentation or the use of a different method of closing the gate valve may cause permanent damage to the closing components, resulting in the loss of its tightness or in the immobilisation of the drive unit.

D) Shutting down fittings.

Valves that are taken out of service after the system has been drained should be opened; the gate valve should not be allowed to cool down in the closed position.

E) Repair work - inspections

The disassembly of the gate valve for inspection or repair may be carried out by personnel whose knowledge and experience allows it. The disassembly should be done on the basis of the technical and operation documentation. During the guarantee period, permission to dismantle the gate valve or its drive system is given by the valve manufacturer.

FAP WAKMET	OPERATING AND MAINTENANCE MANUAL NR QT-2/114 medium and high-pressure gate valves	Issue: 13 Pages: 29 Date: 2023-10-31
-----------------------	--	---

F) Closing the gate valve - an important rule of thumb followed by operating personnel at energy facilities on high-temperature installations is to keep an eye on the rule that only the gate valve that was also hot closed can be opened.

(G) The heating of the gate valve should be done with the gates open. This is because it is difficult to heat a large gate valve symmetrically from both sides.