ARMATUREN
free of cavities & maintenance

engineered.
fast.
dynamic.

Type F-2 / F-3 ISO-EXTRA

Plug valves with full bore design



Product leaflet

Type ISO-EXTRA
Full bore plug valves



- **Flange connections**
- **2-way up to 3-way**

DN 15 - 600 / PN 10 - 100
NPS ½ - 24 / Class 150 - 600
(higher pressure: type HDS)

Range of application:
-60 < T < 230/320°C
vacuum-capable

EXTRA design
- minimal pressure drop: K_{VS}-value similar to straight pipe
- body suitable for abrasive media
- no clogging of crystallizing or polymerizing media

Design characteristics
- easy accessible adjustment of the plug
- PED 2014/68/EU
- low fugitive emission in line with TA LUFT, ISO 15848 & API 641 requirements
- mounting-flange for actuators acc. to ISO 5211
- Fire-Safe - API 607 / ISO 10497
- SIL 3 certified

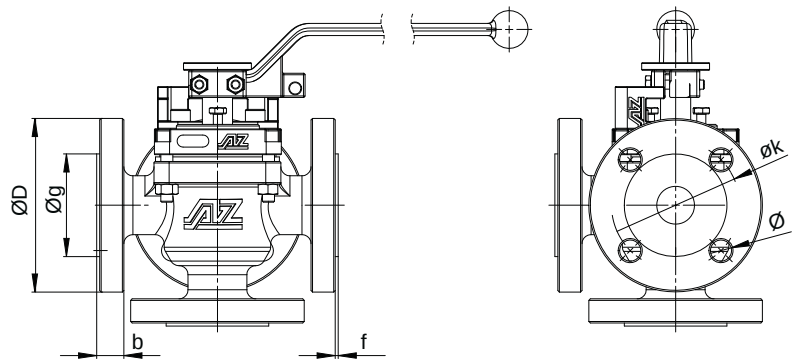
Options
- multiport valves
- heating jacket
- oversize design
- flushing device
- FDA compliant
- painting
- oil and grease-free assembly
- piggable (type ISO-EXTRA-M)

Recommendation for high torques:
AZ actuator **type AIR-GEAR**



PT diagram, plug types, sealing systems, material selection: see catalogue part ENGINEERING

Flange dimensions acc. to DIN EN / ASME



DIN EN 1092-1

DN	PN	øD [mm]	flange bore [mm] øk	no.	Ø	øg [mm]	b [mm]	f [mm]
15	10-40	95	65	4	14	45	16	2
20	10-40	105	75	4	14	58	18	2
25	10-40	115	100	4	14	68	18	2
32	10-40	140	100	4	18	78	18	2
40	10-40	150	110	4	18	88	18	2
50	10-40	165	125	4	18	102	20	3
65	10-16 25-40	185	145	4 8	18	122	22	3
80	10-40	200	160	8	18	138	24	3
100	10-16 25-40	220 235	180 180	8	18 22	158 162	20 24	3

DIN EN 1092-1

DN	PN	øD [mm]	flange bore [mm] øk	no.	ø	øg [mm]	b [mm]	f [mm]
125	10-16 25-40	250 270	210 220	8	18 26	188 188	22 26	3
150	10-16 25-40	285 300	240 250	8	22 26	212 218	22 28	3
200	10-16 25 40	340 360 375	295 310 320	8/12 12	22 26 30	268 278 285	24 30 34	3
250	10 16 25 40	395 405 425 450	350 355 370 385	12	22 26 30 33	320 335 345	26 32 38	3
300	10 16 25 40	445 460 485 515	400 410 430 450	12 16	22 26 30 33	370 378 395 410	26 28 34 42	4
350	10 16 25 40	505 520 555 580	460 470 490 510	12 16	22 26 33 36	430 438 450 465	26 30 38 46	4
400	10 16 25 40	565 580 620 660	515 525 550 585	16	26 30 36 39	482 490 505 535	26 32 40 50	4
450	10 16 25 40	615 640 670 685	565 585 600 610	20	26 30 36 39	532 550 555 560	28 36 46 57	4
500	10 16 25 40	670 715 730 755	620 650 660 670	20	26 33 36 42	585 610 615 615	28 38 48 57	4
600	10 16 25 40	780 840 845 890	725 770 770 795	20	30 36 39 48	685 725 720 735	30 47 58 72	5

ASME B16.5

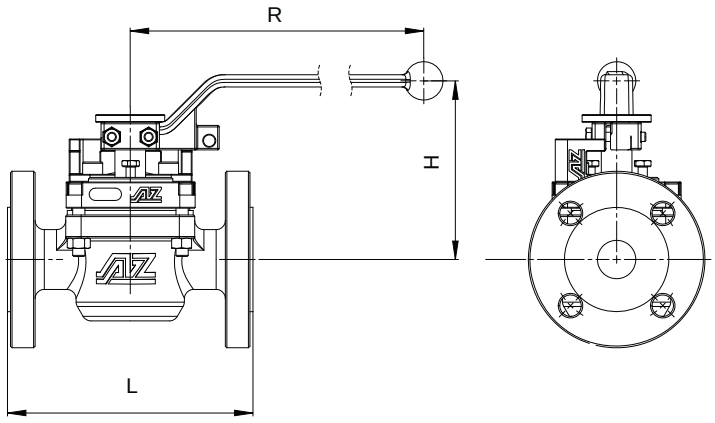
NPS	Class	øD [mm]	flange bore [mm] øk	no.	ø	øg [mm]	b [mm]	f [mm]
½	150 300	90 95	60,3 66,7	4	15,7	34,9	10,0 14,7	2
¾	150 300	100 115	69,9 82,5	4	15,7 19,1	42,9	10,9 16,3	2
1	150 300	110 125	79,4 88,9	4	15,7 19,1	50,8	11,6 17,9	2
1¼	150 300	115 135	88,9 98,4	4	15,7 19,1	63,5	13,2 19,5	2
1½	150 300	125 155	98,4 114,3	4	15,7 22,3	73,0	14,7 21,1	2
2	150 300	150 165	120,7 127,0	4 8	19,1 19,1	92,1	16,3 22,7	2
2½	150 300	180 190	139,7 149,3	4 8	19,1 22,3	104,8	17,9 25,9	2
3	150 300	190 210	152,4 168,3	4 8	19,1 22,3	127	19,5 29,0	2
4	150 300	230 255	190,5 200,0	8	19,1 22,3	157,2	24,3 32,2	2

ASME B16.5

NPS	Class	øD [mm]	flange bore [mm] øk	no.	ø	øg [mm]	b [mm]	f [mm]
5	150 300	255 280	215,9 235	8	22,3	185,7	24,3 35,4	2
6	150 300	280 320	241,3 269,9	8 12	22,3	215,9	25,9 37,0	2
8	150 300	345 380	298,5 330,2	8 12	22,4 25,4	269,9	29,0 41,7	2
10	150 300	405 445	362 387,4	12 16	25,4 28,4	323,8	30,6 48,1	2
12	150 300	485 520	431,8 450,8	12 16	25,4 31,7	381	32,2 51,3	2
14	150 300	535 585	476,3 514,4	12 20	28,4 31,7	412,8	35,4 54,4	2
16	150 300	595 650	539,8 571,5	16 20	28,4 35	469,9	37,0 57,6	2
18	150 300	635 710	577,9 628,6	16 24	31,8 35	533,4	40,1 60,8	2
20	150 300	700 775	635 685,8	20 24	31,8 35	584,2	43,3 64	2
24	150 300	815 915	749,3 812,8	20 24	35,1 41,1	692,2	48,1 70,3	2

Type F-2 / F-3 ISO-EXTRA

Technical information DN 15 - 40 / NPS ½ - 1½



	DN	PN	L [mm]	L/2 [mm]	R [mm]	H [mm]	AZ flange	SW [mm]	torque** [Nm] M_{BT}	$M_{1,3}$	$M_{1,5}$	weight [kg]	F-2 K_{VS}	F-2 C_V	F-3-S (L) K_{VS}	F-3-S (L) C_V	F-3-W (L4) K_{VS}	F-3-W (L4) C_V
DIN EN 558-1 / ISO 5211	15	10-40	130	65	200	102,2	F05	11	28	36	42	6,8	19	22	7	8	8	9
	20	10-40	150	75	200	102,2	F05	11	28	36	42	7,9	36	42	*	*	*	*
	25	10-40	160	80	320	119	F07	14	60	78	90	9,1	70	81	20	24	22	25
	32	10-40	180	90	420	137	F07	19	110	143	165	10,1	113	130	34	39	36	42
	40	10-40	200	100	600	145	F10	22	185	241	165	13,7	193	223	53	61	57	66

	NPS	Class	L*** [mm]	L/2 [mm]	R [mm]	H [mm]	AZ flange	SW [mm]	torque** [Nm] M_{BT}	$M_{1,3}$	$M_{1,5}$	weight [kg]	F-2 K_{VS}	F-2 C_V	F-3-S (L) K_{VS}	F-3-S (L) C_V	F-3-W (L4) K_{VS}	F-3-W (L4) C_V
ASME B16.10 / ISO 5211	½	150	108	54	200	102,5	F05	11	28	36	42	4,5	20	23	*	*	*	*
		300	140	70								6,1	18	21	*	*	*	*
	¾	150	117	58,5	200	102,5	F05	11	28	36	42	5,2	41	48	*	*	*	*
		300	152	76								6,7	36	42	*	*	*	*
	1	150	160/176	80	320	119	F07	14	60	78	90	7,3	70	81	20	24	22	25
		300	230/190	115								8,2	53	62	20	23	21	24
	1¼	150	180/222	90	420	137	F07	19	110	143	165	*	113	130	34	39	36	42
		300	260/241	130								*	95	110	33	38	35	41
	1½	150	200	100	600	145	F10	22	185	241	278	17,5	193	223	58	61	57	66
		300	260	130								18,2	170	196	52	60	57	66

*) on request

**) M_{BT} breakaway torque for actuator sizing, without safety.

$M_{1.3}$ values include a manufacturer recommended safety factor of 1.3 applied to the breakaway torque for actuator sizing.

$M_{1,5}$ values include a manufacturer recommended safety factor of 1,5 applied to the breakaway torque for actuator sizing, for example, for safety-related applications (SIS/SIL).

Valid for PTFE sleeves and the sealing systems STANDARD, FS2 and CA2. For other configurations see **catalogue part ENGINEERING, page 37**

***) available lengths acc. to EN / ASME for 2-way valves (all other data apply to EN versions)

K_{VS} [m^3/h] / C_V [US.gal/min] values determined by flow simulation (VDO/VDE 2173, (medium = water 20°C, pressure loss Δp = 1 bar)

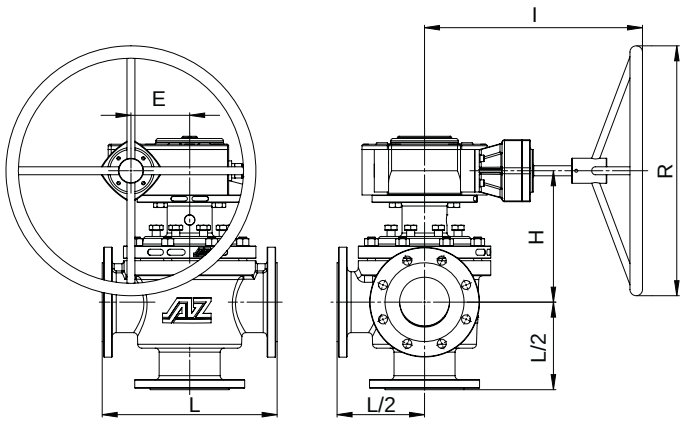
In accordance with the standard, we reserve the right to provide threaded holes in flanges in case of space constraints.

Higher pressure rating on request.

Specifications for AZ flange (console type), SW, torque and weight apply to F-2.

Type F-2 / F-3 ISO-EXTRA

Technical information DN 50 - 350 / NPS 2 - 14



	DN	PN	L [mm]	L/2 [mm]	E [mm]	R [mm]	H [mm]	I [mm]	gear (Pro-Gear)	AZ-flange	SW [mm]	torque** [Nm] M_{BT}	$M_{1,3}$	$M_{1,5}$	weight [kg]	F-2 K_{VS}	F-2 C_V	F-3-S (L) K_{VS}	F-3-S (L) C_V	F-3-W (L4) K_{VS}	F-3-W (L4) C_V
DIN EN 558-1 / ISO 5211	50	10-40	230	115	52,5	300	195	240	Q 400-S	F10	22	270	351	405	28	323	374	85	98	90	105
	65	10-40	290	145	68,75	400	243	265	Q 800-S	F12	22	385	501	578	41	569	658	143	166	154	179
	80	10-40	310	155	68,75	400	248	365	Q 800-S	F14	27	460	598	690	51	947	1095	222	257	233	269
	100	10-40	350	175	137,5	600	270	365	Q 6500-S	F16	55	1500	1950	2250	111	1446	1672	338	391	361	417
	150	10-40	480	240	137,5	600	315	365	Q 6500-S	F25	□55	3080	4004	4620	199	3338	3859	775	895	816	943
	200	10-40	600	300	180	700	355	520	Q 12000-S	F25	□55	5000	6500	7500	359	6362	7356	1385	1601	1470	1698
	250	10-40	730	365	180	700	385	520	Q 12000-S	F30	□75	6500	8450	9750	533	10346	11961	2166	2504	2285	2642
	300	10-40	850	425	252,5	700	460	600	Q 24000-S	F30	□75		19500		923	15316	17707	3141	3631	3312	3829
	350	10-40	980	490	252,5	700	495	600	Q 32000-S	F30	□75		25000		1409	21195	24504	4294	4964	4540	5249
	400	10-40	1100	550	*	700	535	600	Q 32000-S	F35	*		29000		*	28438	32878	5608	6484	5989	6923
	450	10-40	1200	600	*	700	620	600	Q 50000-S	F40	*		31000		*	37079	42867	7057	8158	7667	8864
	500	10-40	1250	625	*	700	640	740	Q 50000-S	F40	*		33000		*	47672	55113	8890	10278	9442	10916
	600	10-40	1450	725	*	*	*	*	*	F48	*		*		2596	71299	82429	12646	14620	13439	15537

	NPS	Class	L*** [mm]	L/2 [mm]	E [mm]	R [mm]	H [mm]	I [mm]	gear (Pro-Gear)	AZ-flange	SW [mm]	torque** [Nm] M_{BT}	$M_{1,3}$	$M_{1,5}$	weight [kg]	F-2 K_{VS}	F-2 C_V	F-3-S (L) K_{VS}	F-3-S (L) C_V	F-3-W (L4) K_{VS}	F-3-W (L4) C_V
ASME B16.10 / ISO 5211	2	150	230/222	115	*	300	195	240	Q 400-S	F10	22	270	351	405	34	323	374	85	98	90	105
		300	300/241	150											37	282	327	83	96	89	102
	2½	150	290/298	145	*	400	243	265	Q 800-S	F12	22	385	501	578	40	569	658	143	166	154	179
		300	290/330												43						
	3	150	310/343	155	*	400	243	265	Q 800-S	F14	27	460	598	690	56	947	1095	222	257	233	269
		300	310/397												60						
	4“	150	350/432	175	137,5	600	270	365	Q 6500-S	F16	55	1500	1950	2250	*	1446	1672	338	391	360	416
		300	430/457	215											*	1317	1522	335	384	358	414
	6	150	480/546	240	137,5	600	315	365	Q 6500-S	F25	□55	3080	4004	4620	191	3338	3859	781	903	820	948
		300	550/559	275											210	3155	3647	768	888	815	943
	8	150	600/622	300	180	700	355	520	Q 12000-S	F25	□55	5000	6500	7500	314	6362	7356	1385	1601	1470	1699
		300	650/686												*	6108	7062	1388	1605	1466	1695
	10	150	730/660	365	180	700	385	520	Q 12000-S	F30	□75	6500	8450	9750	*	10344	11959	1934	2235	2299	2658
		300	775/826												544	9933	11483	1941	2244	2327	2690
	12	150	850/762	425	252,5	700	460	600	Q 24000-S	F30	□75		19500		924	15317	17708	3064	3543	3308	3825
		300	850/965												963						
	14	150 & 300	980/*	490	252,5	700	495	600	Q 32000-S	F30	□75		25000		*	21194	24503	4285	4954	4545	5255
															*						
	16		838	550	*	700	535	600	Q 32000-S	F35	*		29000		1438	32823	37947	5638	6518	5991	6927
	18		1200	600	*	700	620	600	Q 50000-S	F40	*		31000		2242	37078	42866	7067	8170	7667	8864
	20		991	625	*	700	640	740	Q 50000-S	F40	*		33000		2382	54544	63058	8996	10400	9495	10977
	24		1450	725	*	*	*	*	*	F48	*		*		*	71301	82431	12489	14439	13439	15537

*) on request

**) M_{BT} breakaway torque for actuator sizing, without safety.

$M_{1.3}$ values include a manufacturer recommended safety factor of 1.3 applied to the breakaway torque for actuator sizing.

$M_{1,5}$ values include a manufacturer recommended safety factor of 1,5 applied to the breakaway torque for actuator sizing, for example, for safety-related applications (SIS/SIL).

Valid for PTFE sleeves and the sealing systems STANDARD, FS2 and CA2. For other configurations see **catalogue part ENGINEERING, page 37**

***) available lengths acc. to EN / ASME for 2-way valves (all other data apply to EN versions)

K_{VS} [m³/h] / C_V [US.gal/min] values determined by flow simulation (VDO/VDE 2173, (medium = water 20°C, pressure loss Δp = 1 bar)

In accordance with the standard, we reserve the right to provide threaded holes in flanges in case of space constraints.

Higher pressure rating on request.

Specifications for AZ flange (console type), SW, torque and weight apply to F-2.

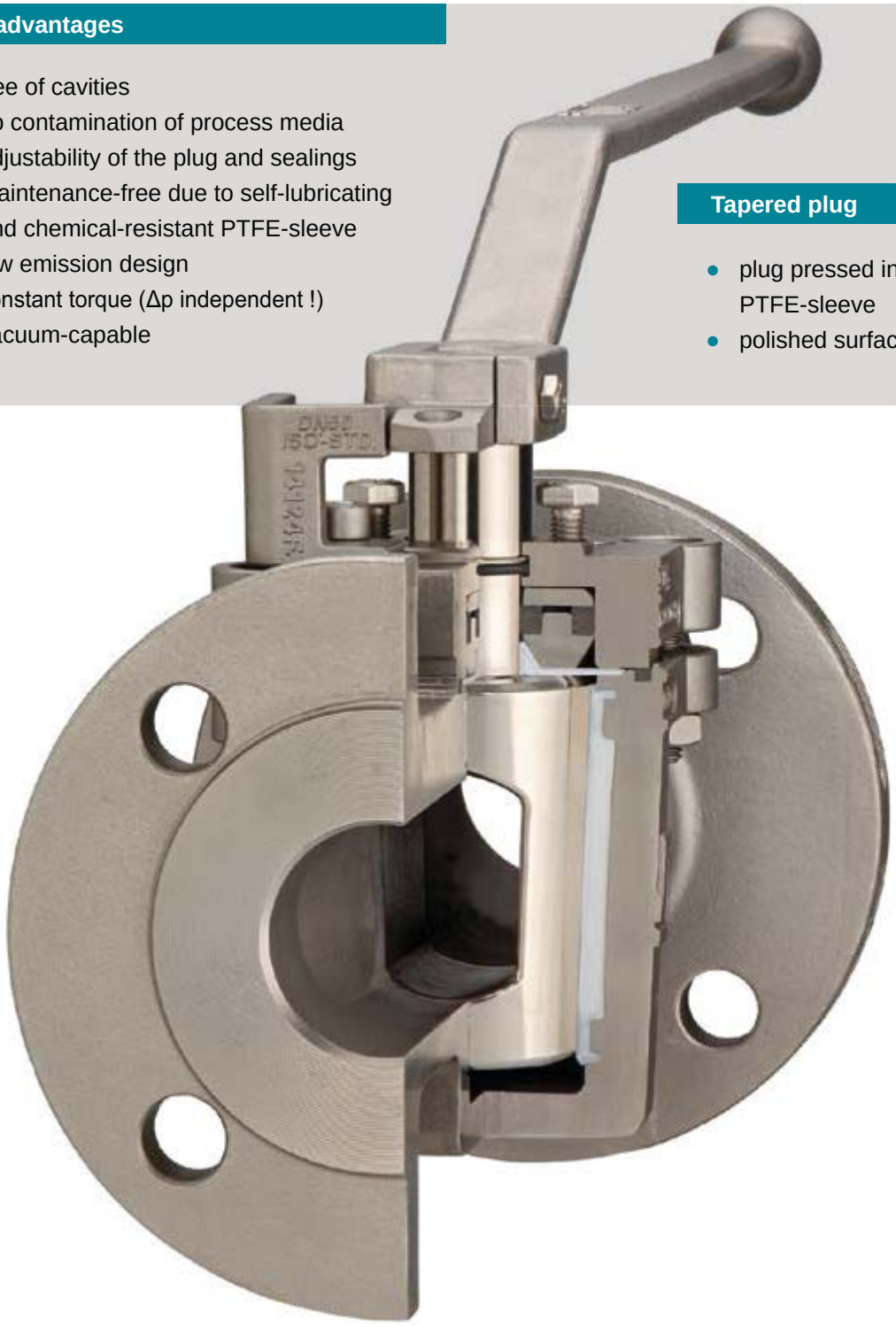
AZ-plug valve: the design principle

Key advantages

- free of cavities
- no contamination of process media
- adjustability of the plug and sealings
- maintenance-free due to self-lubricating and chemical-resistant PTFE-sleeve
- low emission design
- constant torque (Δp independent !)
- vacuum-capable

Tapered plug

- plug pressed into the PTFE-sleeve
- polished surface



Body

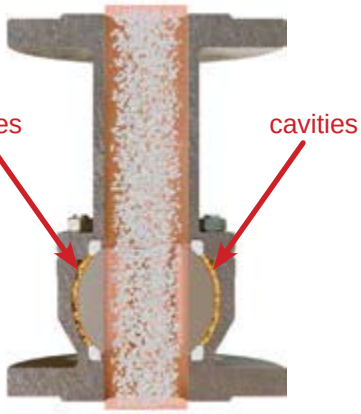
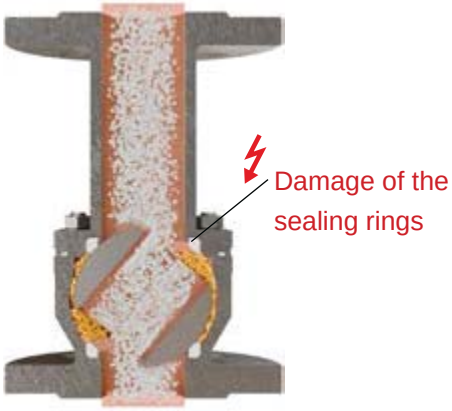
- tapered body interior
- integrated supporting ribs avoid rotation and coldflow of the sleeve
- large sealing surface

PTFE-sleeve

- mechanically locked into the valve body
- complete PTFE chambering
- robust, one-piece sleeve covers and protects the entire plug



Cavity-free: suitable for all media
Technical comparison

AZ-plug valve	Ball valve
Soft seated plug valve with PTFE-sleeve **Main sealing components** • metallic plug • sleeve 	**Soft seated ball valve with PTFE sealing rings, floating ball** **Main sealing components** • metallic ball • sealing rings 
OPEN position	
• suitable for all media due to cavity-free design • sealing surfaces are completely protected free of cavities 	• critical for the following media due to design with cavities ○ corrosives: crevice corrosion ○ polymerizing: clogging ○ crystallizing: abrasion / clogging  cavities cavities 
During operation	
• free of cavities, media cannot settle or be trapped • solids are pushed away • no contamination with old media 	• with cavities, media can settle or be trapped • solids cause abrasion of the sealing rings • contamination of process media  Damage of the sealing rings

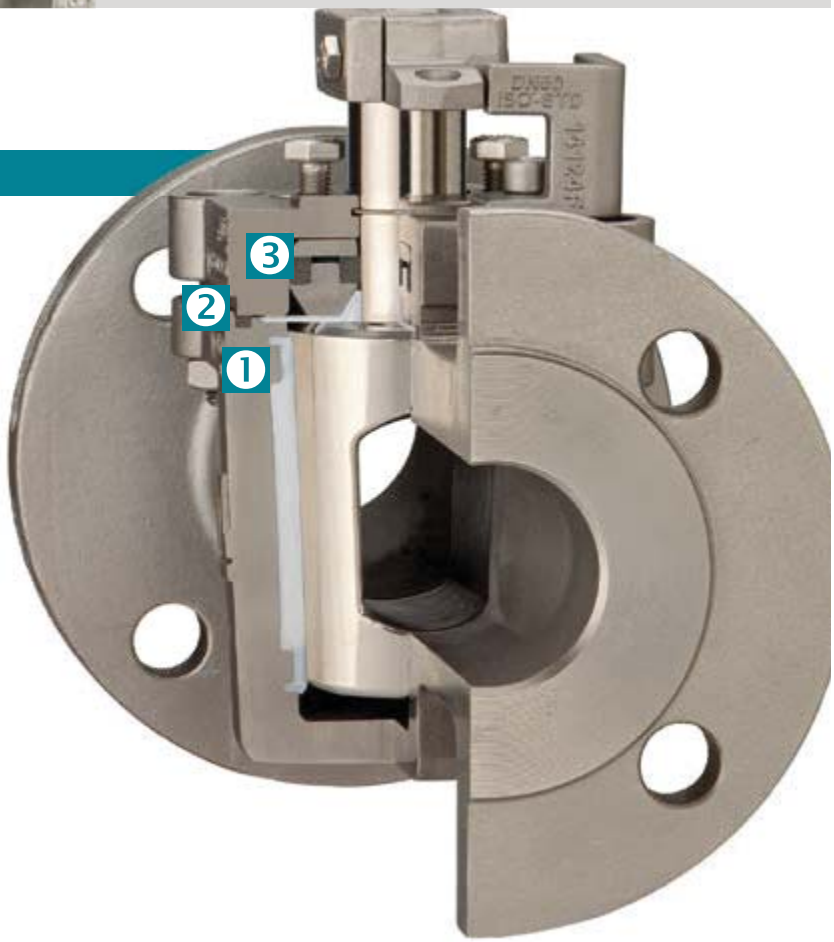
Safe and reliable tightness for years

Adjustable



- tapered plug design allows retightening of the sealing on site - if needed
- adjusting bolt even accesible with mounted actuator / gearbox

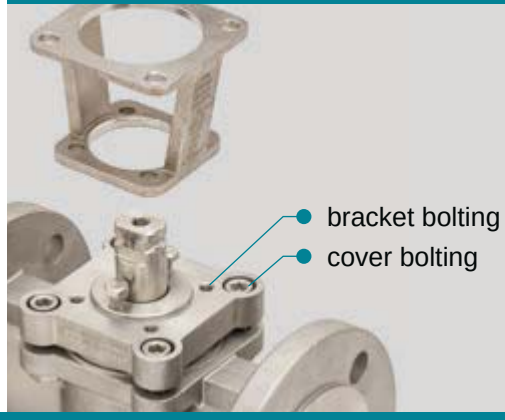
Several sealings to atmosphere



① Primary: sleeve
② Secondary: V-diaphragm / cover seal
③ Tertiary: stem packing (optional)

Detailed information about all certified AZ cover & stem sealing systems see chapter SEALING SYSTEMS

ISO cover



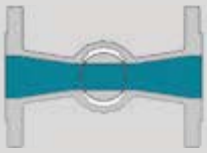
- pressure containing cover bolts separated from bracket boltings
- cover and bracket acc. to ISO 5211 for efficient actuator / gearbox assembly

Reduced and full bore design

Execution

Reduced bore
Type STANDARD

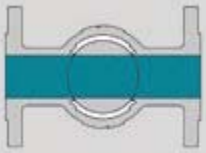
- compact valve (FF / weight)
- optimal torques for economic automation





Full round bore
Type EXTRA

- maximum flow rate
- minimal pressure drop
- piggable (optional)



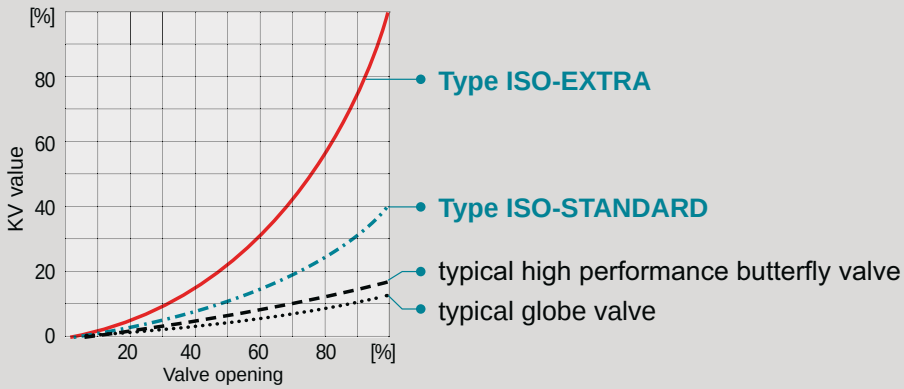


Type ISO-EXTRA

- excellent for abrasive, slurry and solid-containing applications
- maximum flow rate compared to other valve types with the same nominal size



Maximum flow rate



Options



Multi-port

- whole range of multi-port plugs for all configurations (up to 7-way)
- horizontal and vertical installation



Vented options

- plug bottom
- plug upstream / downstream

automatic pressure balance in case of thermal media expansion



System requirements

- **FDA** = Food and Drug Administration certifications and compliant materials
- **GMP** = Good-Manufacturing-Practice
- **CIP** = Clean-in-Place
- Polished internal surfaces, surface finish <0.8 Ra µm (<32 Ra µin)
- oil and grease free
- water-free



All connections possible

- flanges acc. to DIN, ASME, JIS etc.
- welded ends
- screwed and threaded ends
- combinations of connections
- oversize flanges
- compression fittings and ferrule ring couplings
- special connections



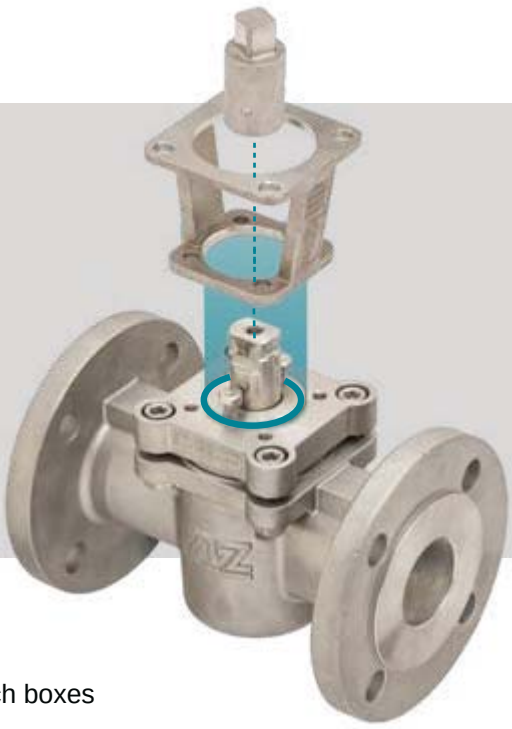
High and low temperature

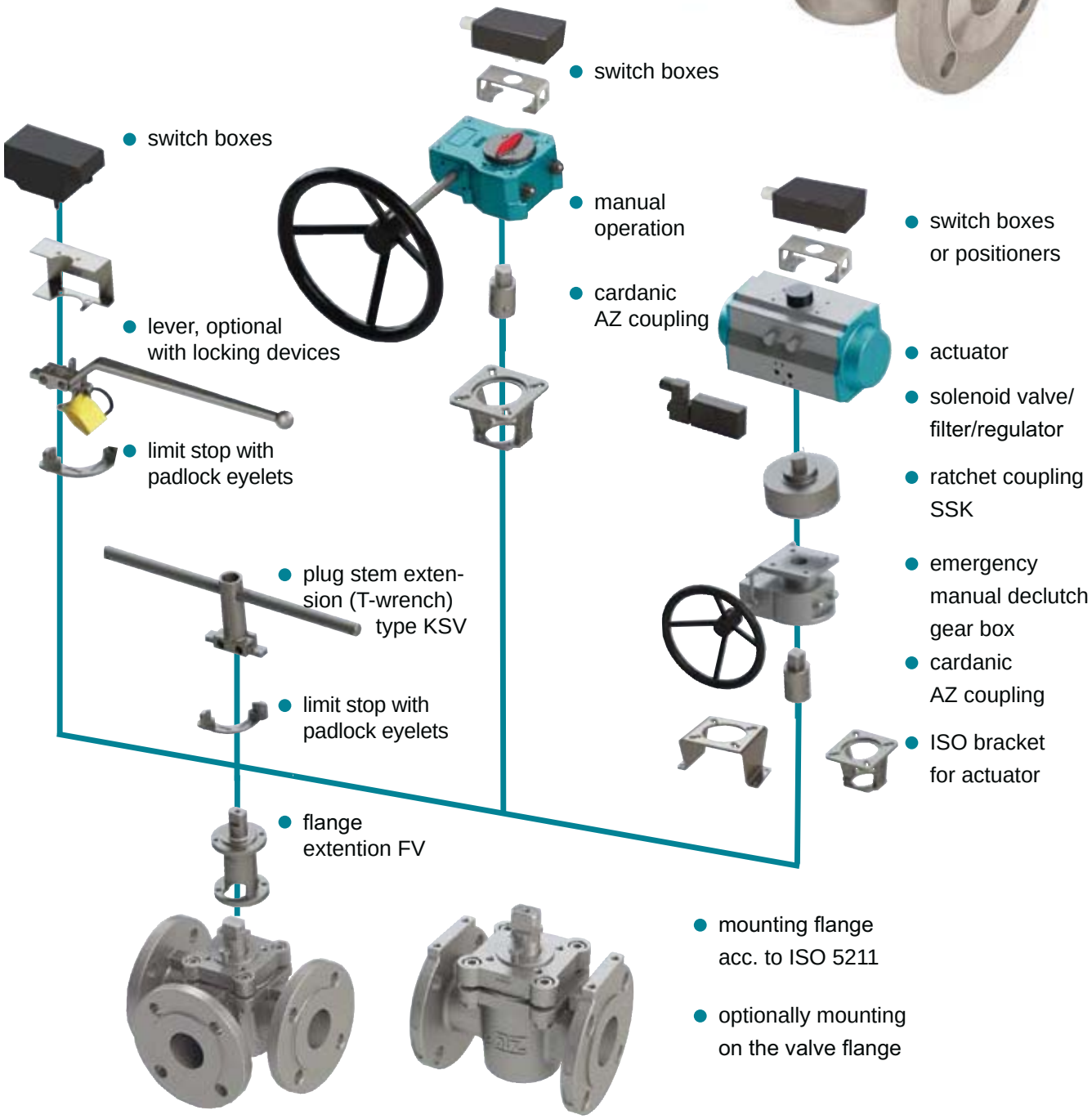
- extended bonnet with sealing at the top
- stem extension for insulated valves

Modular operation concept

Bracket according to ISO 5211

- standard installation of gearbox and actuator
- safe due to independent mounting of cover and bracket
- covering bonnet bolts to prevent opening of valve in service
- precise centering of the bracket to the plug stem due to adjusting ring
- easy inline plug adjustment during the process, screws are always accessible





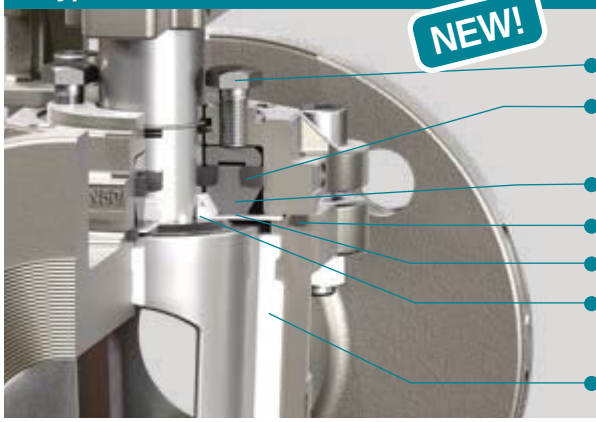
Cover and stem sealing systems suitable for general applications

Type STANDARD



- plug adjustment
- thrust collar
- cover sealing (PTFE)
- stainless steel diaphragm
- **Secondary sealing**: V-diaphragm (PTFE), delta thrust collar (PTFE)
- **Primary sealing**: sleeve*

Type FS2 — Fire-Safe-sealing (API 607)



- plug & packing adjustment
- **Tertiary sealing**: Packing to atmosphere (graphite)
- thrust collar
- cover sealing (graphite)
- stainless steel diaphragm
- **Secondary sealing**: V-diaphragm (PTFE) and delta thrust collar (PTFE)
- **Primary sealing**: sleeve*

Type CA2 — Chemistry sealing



- plug & packing adjustment
- **Tertiary sealing**: Packing to atmosphere (PTFE)
- thrust collar
- cover sealing (PTFE)
- stainless steel diaphragm
- **Secondary sealing**: V-diaphragm, delta thrust collar (PTFE)
- **Primary sealing**: sleeve*

*) The sleeve material has a decisive influence on the maximum operating temperature
Material selection acc. to PT-diagram

More safety
for severe applications

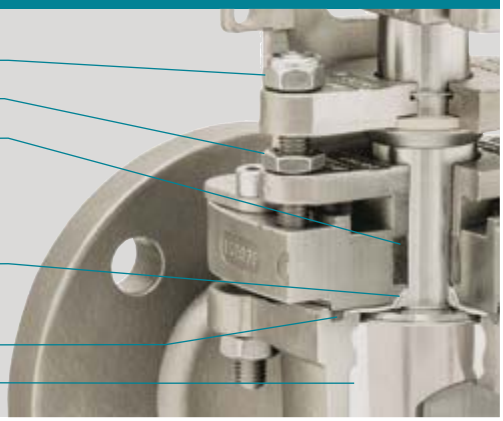
engineered.
fast.
dynamic.

Type FSN — Fire-Safe-sealing (API 607)

plug adjustment
triple safety stem packing adjustment
Tertiary sealing: triple safety stem packing (graphite)

Secondary sealing:
V-diaphragm (PTFE) and delta thrust collar (PTFE)

cover sealing (graphite)
Primary sealing: sleeve*



Type FSN-EF — Fire-Safe-sealing (API 607)

NEW!

Emission Free

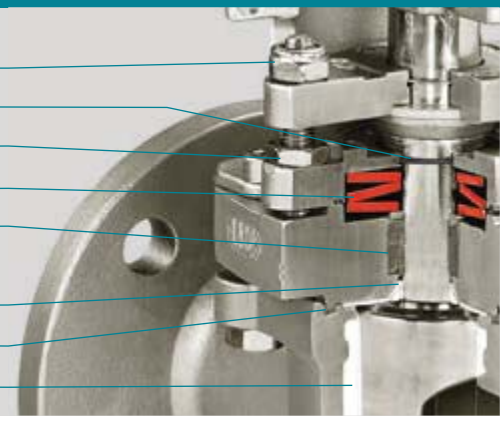
plug adjustment
triple safety stem packing adjustment
Quaternary sealing: three o-rings at the stem
Tertiary sealing:
triple safety stem packing
Secondary sealing:
V-diaphragm (PTFE) and delta thrust collar (PTFE)
cover sealing (graphite)
Primary sealing: sleeve*



Type FSN-SL — Fire-Safe-sealing (API 607)

live-loaded

plug adjustment
o-rings protect the springs against corrosion
triple safety stem packing adjustment
disk springs (optionally made of Inconel)
Tertiary sealing: triple safety stem packing (graphite)
Secondary sealing:
V-diaphragm (PTFE) and delta thrust collar (PTFE)
cover sealing (graphite)
Primary sealing: sleeve*



*) The sleeve material has a decisive influence on the maximum operating temperature
Material selection acc. to PT-diagram

Material for **type CASN** and **CASN-SL** chemistry safety sealing: packing and cover sealing in PTFE

Special sealing systems

Chevron packing

- increases the contact pressure (when pressure builds up on the safety stem packing towards plug stem)
- for toxic and fugitive media
- high wear resistance



Type CL Chlorine / gas applications

- approved for chlorine applications and other toxic gases
- ideal for media with changing state of aggregate (e.g. liquid to gas, vice versa)
- vacuum capable



Detection ports for monitoring purpose of lethal gases (phosgene, etc.)

- detection ports for early recognition of potential leakages
- sniffing at sealing surfaces to atmosphere



WORLD'S FIRST EMISSION FREE
plug valve certified acc. to **ISO 15848-1 /** AH
Type FSN-EF

NEW!



Low-Emission
according ISO 15848, TA-Luft & API 641



For all important information about ISO 15848, TA-Luft & API 641, as well as the current certificates, please refer to the "AZ Fugitive Emission" brochure

Latest information about ISO 15848 / API 641 / TA Luft see AZ Fugitive Emissions leaflet



Casting materials



		Casting Material					
Material Group	**Common Name**	**EN / DIN**	**Short name**	**Material-No.**	**ASTM**	**Grade**	**UNS**
Carbon Steel / Ductile Iron							
Ductile Iron	SG Iron	EN 1563	EN-GJS-400-18-LT	5.3103	A395	-	F32800
Carbon Steel	CS	EN 10213	GP240GH	1.0619	A216	WCB	J03002
Low Temp. Carbon Steel	LTCS	EN 10213	G17Mn5	1.1131	A352	LCB	J03003
Low Temp. Carbon Steel	LTCS	EN 10213	G21Mn5	1.1138	A352	LCC	J02505
Stainless Steel							
Stainless Steel	Duplex 2205	EN 10213	GX2CrNiMoN22-5-3(4A)	1.4470	A995	4A-CD3MN	J92205
Stainless Steel	Duplex 1B	EN 10213	GX3NiCrMoCuN26-6-3-3	1.4517	A995	1B-CD4MCuN	J93372
Austenitic	SS	EN 10213	GX5CrNi19-10	1.4308	A351	CF8	J92600
Austenitic	SS	EN 10213	GX2CrNi19-11	1.4309	A351L	CF3	J92700
Austenitic	SS	EN 10213	GX5CrNiMo19-11-2	1.4408	A351	CF8M	J92900
Austenitic	SS	EN 10213	GX2CrNiMo19-11-2	1.4409	A351	CF3M	J92800
Super Austenitic	Alloy 20	EN 10213	NiC420CuMo	1.4500	A351	CN7M	N08007
Super Austenitic	Alloy 20 mod.	EN 10213	GX2NiCrMoCuN25-20	1.4536	A743	CN7MS	J94650
Super Austenitic	AL6XN	-	-	-	A351	CN3MN	J94651
Superduplex	Superduplex 5A	EN 10213	25Cr-7Ni-Mo-N	1.4469	A995	CE3MN	J93404
Nickel Alloy							
	Monel/Alloy400	DIN 17730	G-NiCu30 Nb	2.4365	A494	M35-1	N24135
	Hastelloy C mod.	-	-	-	A494	CW6M	N30107
	Hastelloy C	-	-	2.4537	A494	CW12MW	N30002
	Hastelloy C-276	-	-	2.4883	-	-	-
	Hastelloy B-3	-	-	-	-	-	-
	Inconel 600	-	-	-	A494	CY40	N06040
	Inconel 625	-	-	-	A494	CW6MC	N26625
	Inconel 825	-	-	-	A494	CU5MCuC	N08826
	Nickel	DIN 17730	G-Ni 95	2.4170	A494	CZ100	N02100
Other Material Groups							
Tantalum	Tantalum	-	-	-	-	-	-
Titanium	Ti 2	DIN 17865	G-Ti 2	3.7031	B367	C-2	R52550
Zirconium	Zirconium 702	-	-	-	B752	702C	-
Zirconium	Zirconium 705	-	-	-		705C	-

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The use of these equivalents has to be evaluated on a case-by-case basis.

Other materials on request.

Equivalent forged and bar-stock materials





			Similar Forged Material						Bar Material	
Common Name	**Mat.Nr.**	**Grade**	**EN / DIN**	**Short Name**	**Mat.Nr.**	**ASTM**	**Grade**	**UNS**	**ASTM**	**Short**
Carbon Steel / Ductile Iron										
SG Iron	5.3103	-	EN 1563	EN-GJS-400-18-LT	5.3103	A395-99	60-40-18	-	-	-
CS	1.0619	WCB	EN 10213	GP240GH	1.0619	A105	A105	-	-	-
LTCS	1.1131	LCB	-	-	-	A350	LF2-Class1	G10300	-	-
LTCS	1.1138	LCC	-	-	1.0566	A350	LF2-Class1	G10250	-	-
Stainless Steel										
Duplex 2205	1.4470	4A-CD3MN	EN 10028-7	X2CrNiMoN22-5-3	1.4462	A182	F51	S32205	A479	S31803
Duplex 1B	1.4517	1B-CD4MCuN	EN 10028-7	X2CrNiMoCuN25-5-3	1.4507	A182	F59	S32520	A479	S32550
SS	1.4308	CF8	EN 10028-7	X5CrNi18-10	1.4301	A182	F304	S30400	A276	304
SS	1.4309	CF3	EN 10028-7	X2CrNi19-11	1.4306	A182	F304L	S30403	A276	304L
SS	1.4408	CF8M	EN 10028-7	X5C4NiMo17-12-2	1.4401	A182	F316	S31600	A276	316
SS	1.4409	CF3M	EN 10028-7	X2CrNiMo 17-12	1.4404	A182	316L	S31603	A276	316L
Alloy 20	1.4500	CN7M	-	-	2.4660	B462	N08020	N08020	B473	N08020
Alloy 20 mod.	1.4536	CN7MS	-	-	-	-	-	-	-	-
AL6XN	-	CN3MN	EN 10028-7	X1NiCrMoCuN25-20-7	1.4529	A182	F62	N08367	B462	N08367
Superduplex 5A	1.4469	CE3MN	EN 10028-7	X2CrNiMoN25-7-4	1.4410	A182	F63	S32615	-	-
Nickel Alloy										
Monel/Alloy400	2.4365	M35-1	DN 17744	NiCu30Fe	2.4360	B165	Alloy 400	N04400	B164	N04400
Hastelloy C mod.	-	CW6M	-	-	-	A494	-	-	-	-
Hastelloy C		CW12MW	-	NiMo16CrW	-	A494	-	-	-	-
Hastelloy C-276		-	DIN 17744	NiMo16Cr15W	2.4819	B565	N10675	N10276	B574	N10276
Hastelloy B-3	-	-	DIN 17744	NiMo29Cr	2.4600	B565	N10675	N10675	B335	N10675
Inconel 600	-	CY40	DIN 17742	NiCr15Fe	2.4816	B565	N06600	N06600	B166	N06600
Inconel 625	-	CW6MC	DIN 17744	NiCr22Mo9Nb	2.4856	B565	N06625	N06625	B446	N06625
Inconel 825	-	CU5MCuC	DIN 17744	NiCr21Mo	2.4858	B564	N08825	N08825	B425	N08825
Nickel	2.4170	CZ100	-	-	-	-	-	-	B160	N02200
Other Material Groups										
Tantalum	-	-				B365	TaW2,5	R05252	-	-
Ti 2	3.7031	C-2	DIN 17864	Grade 2	3.7035	B381	F2	R50400	B348	Grade 2
Zirconium 702	-	702C	-	-	6.0702	B493	R60702	R60702	B550	R60702
Zirconium 705	-	705C	-	-	-	B493	R60705	R60705	B550	R60705

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The use of these equivalents has to be evaluated on a case-by-case basis.

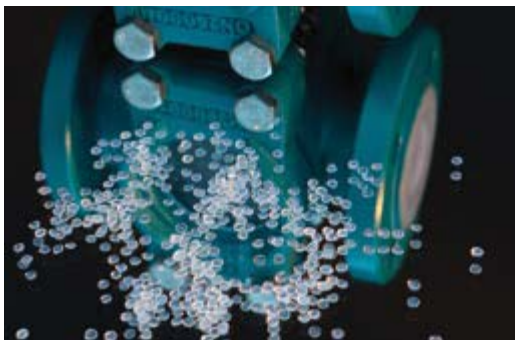
Other materials on request.

Sleeve materials / Lining materials



Type	UHMW-PE	PFA	PTFE, virgin	PTFE, glass	PTFE, graphite	TFM	PTFE-P
T_{max}	80°C / 176°F	200°C / 392°F	230°C / 446°F	230°C / 446°F	250°C / 482°F	250°C / 482°F	320°C / 608°F

Category	Sleeve Material	Characteristics	Typical applications	T_{MAX}
PTFE	PTFE, virgin	low friction, very good sealing characteristic	standard sleeve material for most applications	230°C / 446°F
RPTFE	PTFE-Glass	reinforced PTFE	additional stability for multiway valves with horizontal ports	230°C / 446°F
	PTFE-Graphite	reinforced PTFE	high temperature applications	250°C / 482°F
modified PTFE	TFM 1600* NXT 75* M 111*	chemically modified PTFE, reduced permeation, low friction	chemical applications where reduced permeability compared to PTFE is required	250°C / 482°F
Special Sleeves	PTFE-P* NFCE* NCS*	high performance sleeve materials	severe service highest temperatures, high pressure, abrasive applications	320°C / 608°F
PFA	PFA	reduced permeation	chemical applications where reduced permeability compared to PTFE is required	200°C / 392°F
UHMW-PE	UHMW-PE	Ultra High Molecular Weight Polyethylene	radiation resistent, abrasive application	80°C / 176°F



Combination of linings		
body lining	plug lining	T_{max}
PFA	PTFE [1]) or special materials	210°C / 410°F
PFA	PFA	200°C / 392°F
PFA conductive	PFA conductive	125°C / 256°F

1) Plugs with PTFE lining only for two-way valves up to DN 100.
Plugs for multi-way valves not with PTFE lining available.

IMPORTANT NOTE

For demanding conditions, such as process temperatures exceeding 200°C / 392°F (sleeved valve) respectively 150°C / 302°F (lined valve), valve size, media phase, plug position & temperature (constant or fluctuating) may have an impact on the lifetime. Consult factory for proper selection of material and sealing system.

Torques: Factors for different material combinations and sealing systems

Torque for actuator sizing

- Torque values for actuator sizing can be found in the tables of each valve model. These values apply for the sealing systems STANDARD, CA2 as well as FS2 and are based on virgin PTFE sleeve material.
- For other sealing systems, sleeve materials and material combinations, different factors apply as per charts below.
- The given torque values are based on long term records and experimental results. Please consult manufacturer for process media with degreasing effect.

	Sealing system			
sleeve materials for plug valves	STANDARD, FS2, CA2	STANDARD, FS2, CA2 oil and grease-free	CASN, FSN, -SL, -EF	CASN, FSN, -SL, -EF oil and grease-free
PTFE, virgin	1,0	1,3	1,3	1,6
TFM / NXT / M111	1,1	1,4	1,4	1,7
PTFE-"P" / NFCE / NCS	1,5	1,8	1,8	2,1
PTFE-Glass	1,7	2,0	2,0	2,3
PTFE-Graphite	1,7	2,0	2,0	2,3
PFA	2,0	2,3	2,3	2,6
UHMW-PE	2,5	2,8	2,8	3,1

material combinations for linded plug valves		Sealing system	
Body	plug	CA2A / SAFE-LINED / -SL	CA2A / SAFE-LINED / -SL oil and grease-free
PFA	PTFE	according product table (M_{BT} / $M_{1,3}$ / $M_{1,5}$)	1,3
PFA	PFA		1,3
PFA-conductive	PFA-conductive	on request	on request
PFA	special material	on request	on request

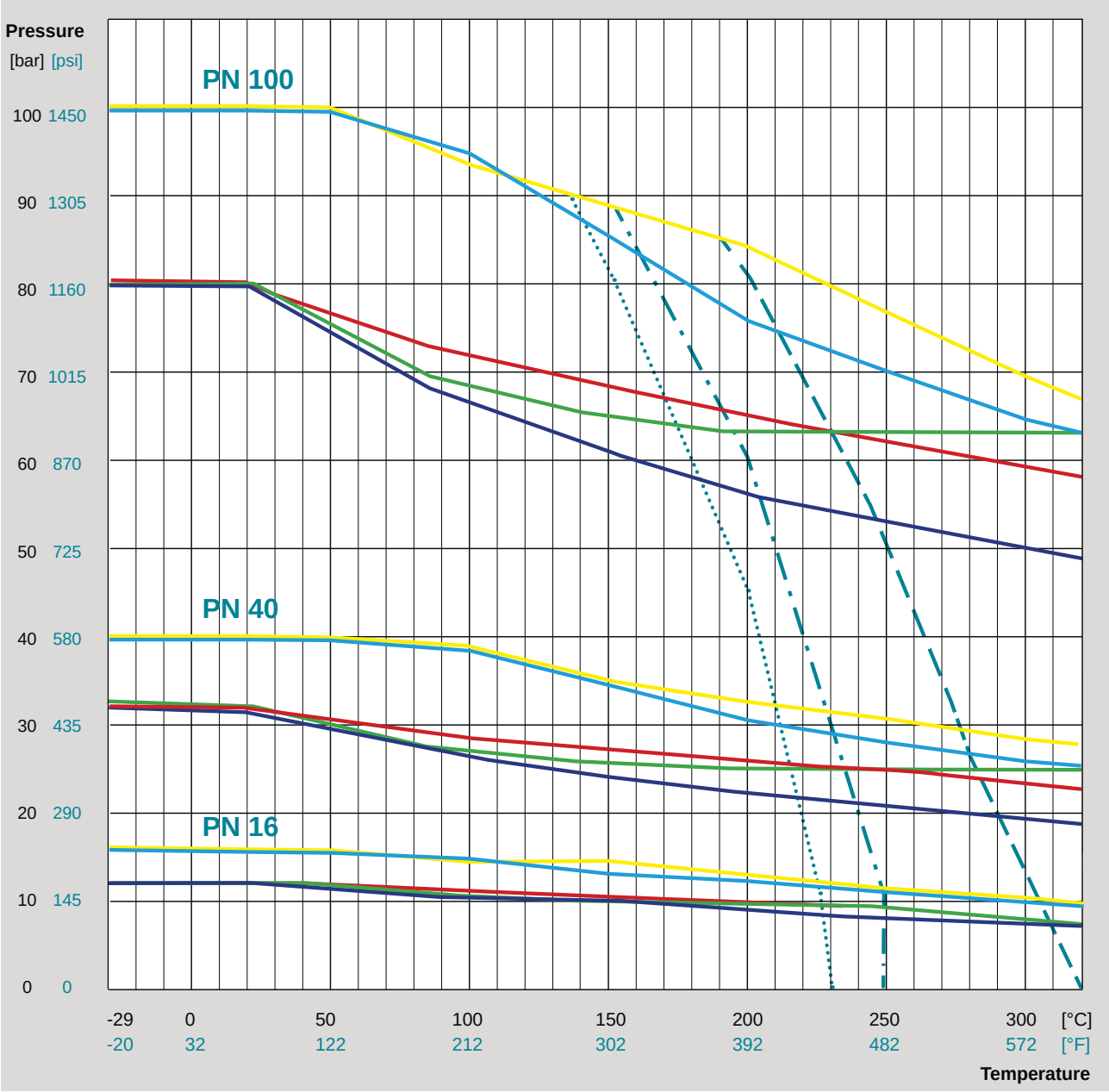
Sample calculation

Model F-2 ISO-FS2 - DN50

- breakaway torque (table column $M_{1,3}$ with 30 % safety on breakaway torque)
- cover and stem sealing system FS2
- sleeve material PTFE-Glass

Torque table column $M_{1,3}$	137 Nm
Factor as per table above	1,7
Torque for actuator sizing	137 * 1,7 = **233 Nm**

PT Diagram, PN 16 - PN 100
PTFE sleeved plug valves



Body material

- EN 10213 - 1.0619 / Carbon Steel
- EN 10213 - 1.4408 / Stainless Steel
- EN 17744 - 2.4819 / Hastelloy
- EN 17730 - 2.4365 / Monel 400
- UNS N08007 - 1.4500 / Alloy 20

other body materials on request

Sleeve material

PTFE (virgin) / PTFE (glass)	T_{max} 230°C / 446°F
TFM / NXT / M111 / PTFE graphite	T_{max} 250°C / 482°F
PTFE-P / NFCE / NCS	T_{max} 320°C / 608°F

other sleeve materials on request

Subject to technical change without notice.

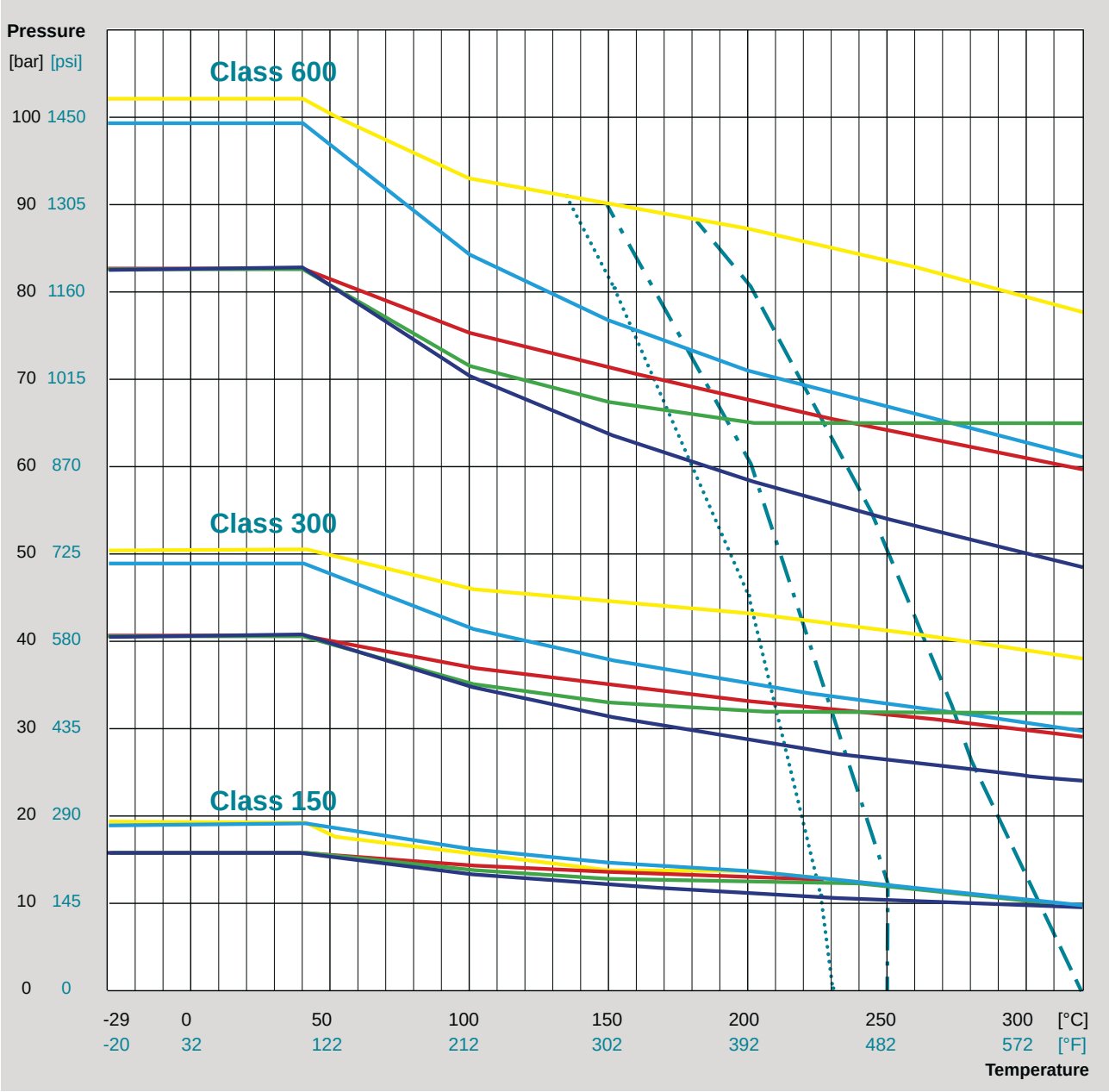
The data given are max. values according to EN 12516-1 and EN 1092-1.

IMPORTANT NOTE

for demanding conditions, such as process temperatures exceeding 200°C / 392°F: Valve size, media phase, plug position & temperature (constant or fluctuating) may have an impact on the lifetime. Consult factory for proper selection of sleeve material, cover sealing type and special features.

For temperatures < -29°C / -20°F, (T_{limit} = -60°C / -76°F) operating temperature, low-temperature carbon steel or austenitic stainless steels are required.

PT Diagram, Class 150 - Class 600
PTFE sleeved plug valves



Body material

- ASTM A216 - WCB
- ASTM A351 - CF8M
- ASTM A494 - CW12MW / Hastelloy
- ASTM A494 - M35.1 / Monel 400
- ASTM A351 - CN7M Alloy 20

other body materials on request

Sleeve material

PTFE (virgin) / PTFE (glass)	T_{max} 230°C / 446°F
TFM / NXT / M111 / PTFE graphite	T_{max} 250°C / 482°F
PTFE-P / NFCE / NCS	T_{max} 320°C / 608°F

other sleeve materials on request

Subject to technical change without notice.

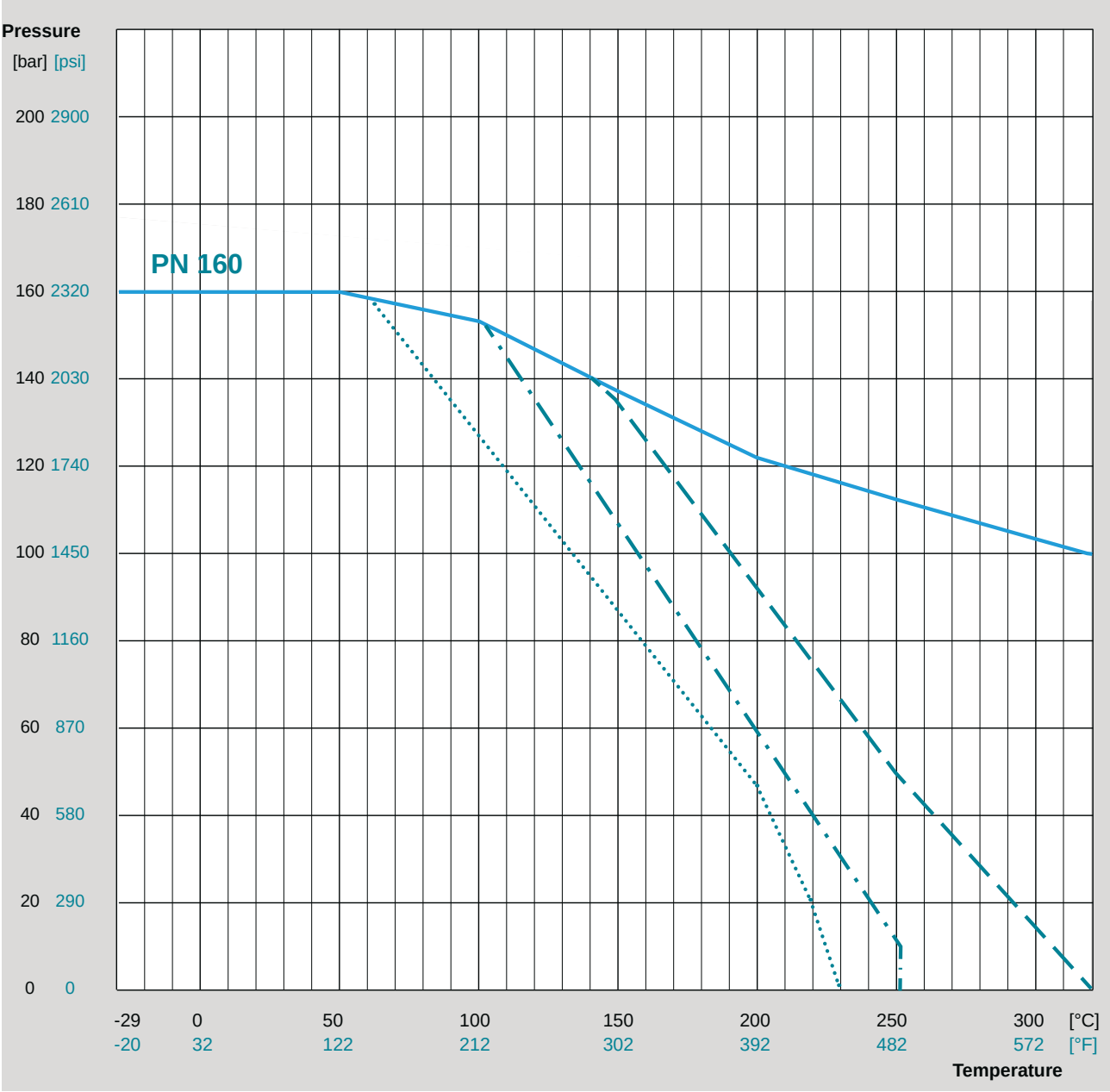
The data given are max. values according to ASME B16.34.

IMPORTANT NOTE

for demanding conditions, such as process temperatures exceeding 200°C / 392°F: Valve size, media phase, plug position & temperature (constant or fluctuating) may have an impact on the lifetime. Consult factory for proper selection of sleeve material, cover sealing type and special features.

For temperatures < -29°C / -20°F, (T_{limit} = -60°C / -76°F) operating temperature, low-temperature carbon steel or austenitic stainless steels are required.

PT Diagram High Pressure, PN 160
PTFE sleeved plug valves with trunnion mounted design



Body material (in line with EN 12516-1 and EN 1092-1)

EN 10213 - 1.4408 / Stainless Steel
other body materials on request

Sleeve material

.....	PTFE (virgin) / PTFE (glass)	T_{max} 230°C / 446°F
-.-.-	TFM / NXT / M111 / PTFE graphite	T_{max} 250°C / 482°F
— —	PTFE-P / NFCE / NCS	T_{max} 320°C / 608°F

other sleeve materials on request

Subject to technical change without notice.

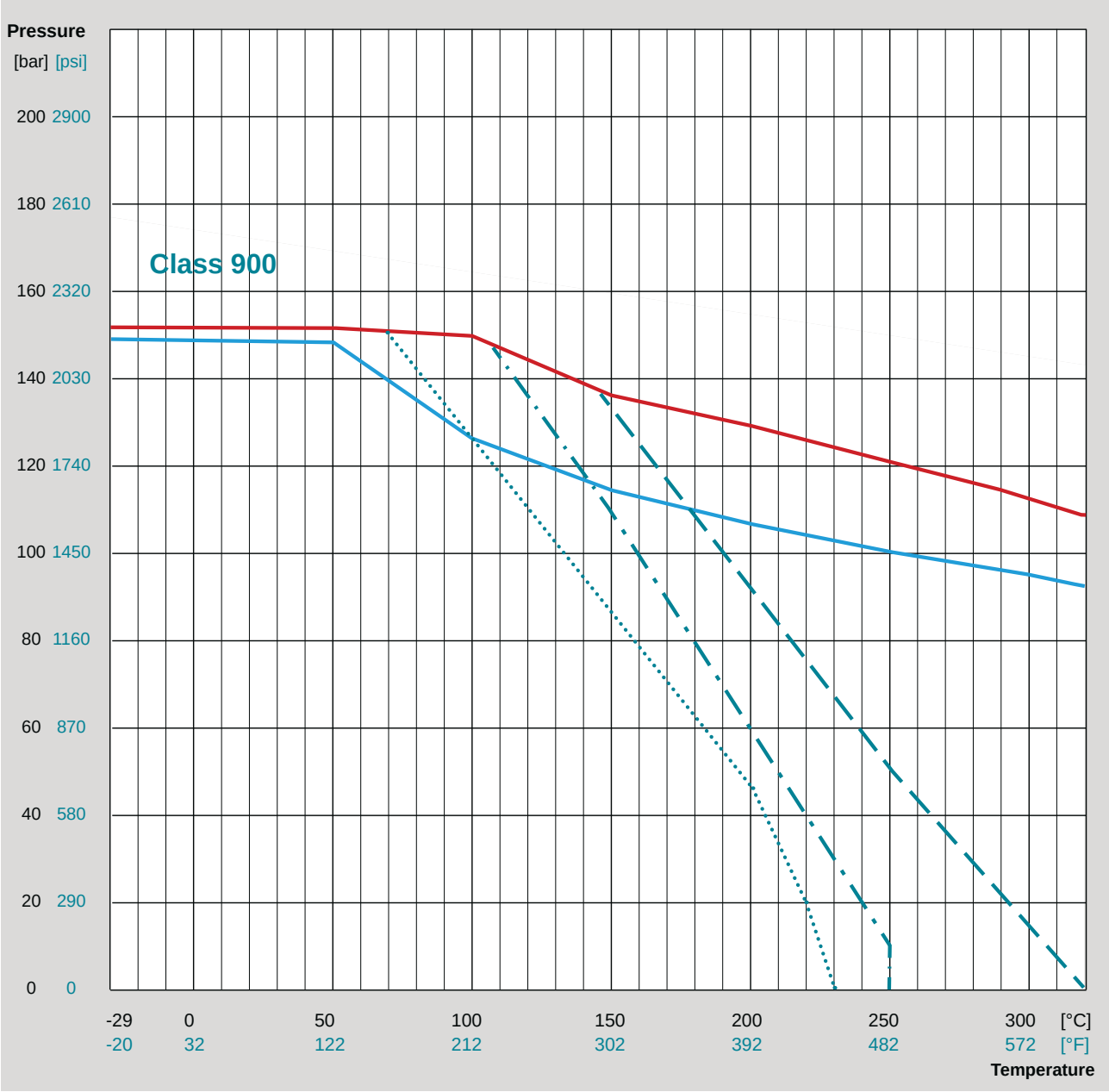
The data given are max. values according to EN 12516-1 and EN 1092-1.

IMPORTANT NOTE

for demanding conditions, such as process temperatures exceeding 200°C / 392°F: Valve size, media phase, plug position & temperature (constant or fluctuating) may have an impact on the lifetime. Consult factory for proper selection of sleeve material, cover sealing type and special features.

For temperatures < -29°C / -20°F, (T_{limit} = -60°C / -76°F) operating temperature, low-temperature carbon steel or austenitic stainless steels are required.

PT Diagram High Pressure, Class 900
PTFE sleeved plug valves with trunnion mounted design



Body material (in line with ASME B16.34)

- ASTM A351 - CF8M / Stainless Steel
- ASTM A995 - CD3MN / Superduplex

other body materials on request

Sleeve material

PTFE (virgin) / PTFE (glass)	T_{max} 230°C / 446°F
TFM / NXT / M111 / PTFE graphite	T_{max} 250°C / 482°F
PTFE-P / NFCE / NCS	T_{max} 320°C / 608°F

other sleeve materials on request

Subject to technical change without notice.

The data given are max. values according to ASME B16.34.

IMPORTANT NOTE

for demanding conditions, such as process temperatures exceeding 200°C / 392°F: Valve size, media phase, plug position & temperature (constant or fluctuating) may have an impact on the lifetime. Consult factory for proper selection of sleeve material, cover sealing type and special features.

For temperatures < -29°C / -20°F, (T_{limit} = -60°C / -76°F) operating temperature, low-temperature carbon steel or austenitic stainless steels are required.

Plug types: two-way and multi-port for standard reduced and full bore design



Design	STANDARD	EXTRA (full bore)	multiway
Plug type	two-way	two-way	e.g. T4

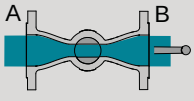
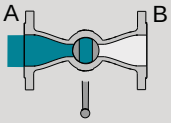
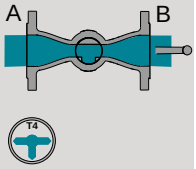
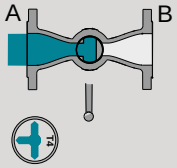
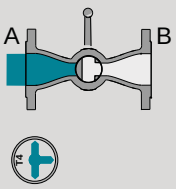


- position indicator for all multi-way valves welded on lever or stem extension
- Lined plug valves: multi-way plugs only with PFA plug lining or made of special materials. Two-way plugs with PTFE lining up to DN 100 / NPS 4 available

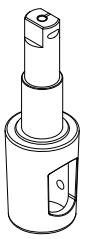
Recommendation for three-way valves type F-3-S with vertical outlet (longer life-time compared to type F-3-W with horizontal outlet)

Options

Plugs made of special materials or special designs, e.g. with flushing devices, vent holes in plug bottom or plug upstream / downstream side

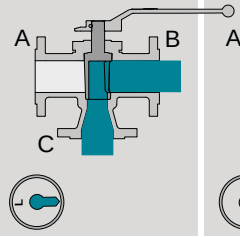
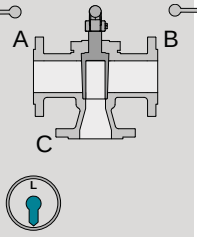
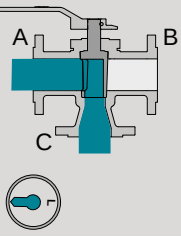
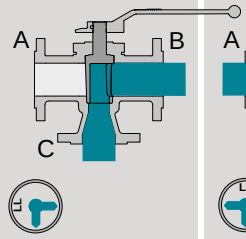
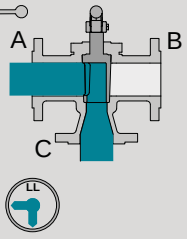
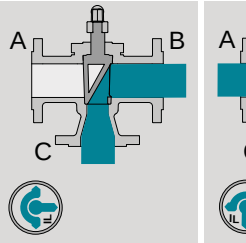
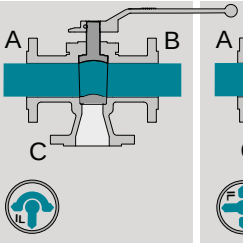
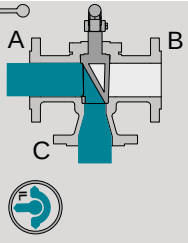
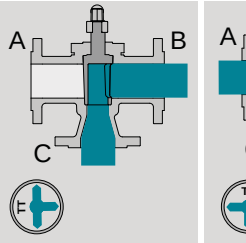
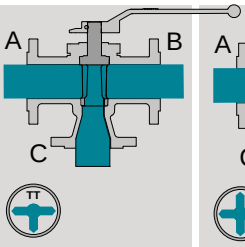
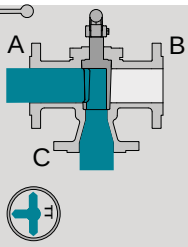
2-way	Plug type	Pos. I = 0°	Pos. II = 90°	Pos. III = 180°	Pos. IV = 270°
 Type F-2-ISO-STANDARD	D 				
 Type F-2-ISO-STANDARD-A	T4 * 				

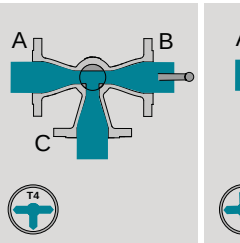
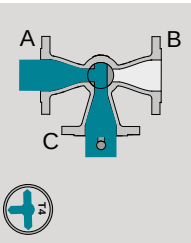
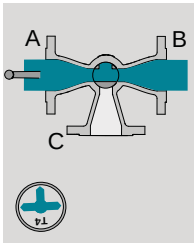
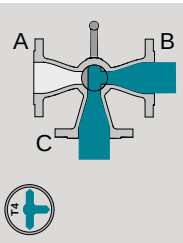
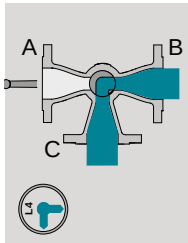
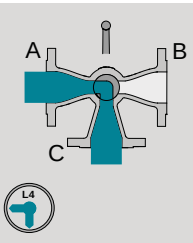
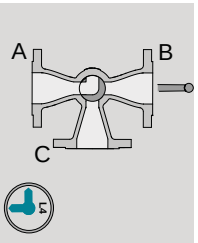
*) For highly expanding media AZ recommends the "i-plug" (relief hole and open plug buttom)



"i-plug"

Plug types: 3-way valve
for STANDARD and EXTRA design

Plug type	Pos. I = 0°	Pos. II = 90°	Pos. III = 180°	Pos. IV = 270°	3-way (vertical)
L					 Type F-3-S-ISO-STANDARD
LL					
IL*					 Type F-3-S-ISO-STANDARD-A
TT					

Plug type	Pos. I = 0°	Pos. II = 90°	Pos. III = 180°	Pos. IV = 270°	3-way (horizontal)
T4					 Type **F-3-W-ISO-STANDARD**
L4					 Type **F-3-W-ISO-STANDARD-A**

*) for EXTRA valves with IL-plug, F-3-W-EXTRA with T4-plug is recommended (higher flowrate)
Lined valves: the IL-plug is only available in special materials

Plug types 3-way (120°) valves and 4-way valves for STANDARD and EXTRA design

3-way (120°) type 3-W-120:

- min. cross section guaranteed (switching phase)
- piggable execution on request
- minimum flow guaranteed

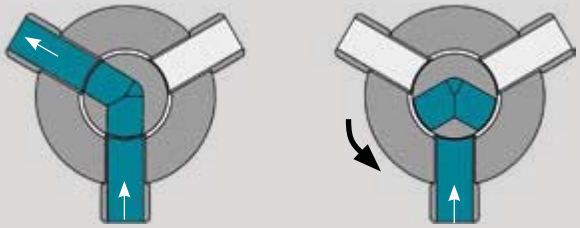
transflow design

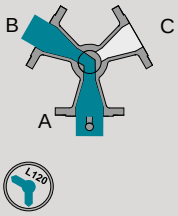
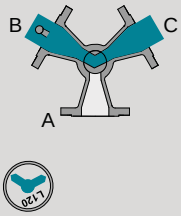
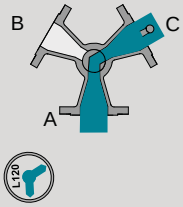


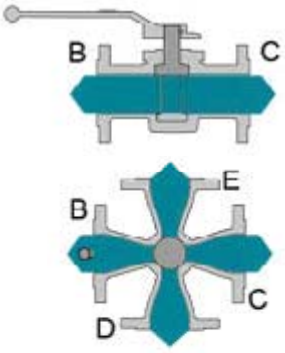
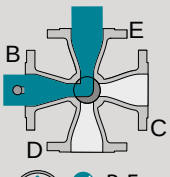
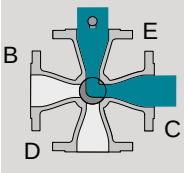
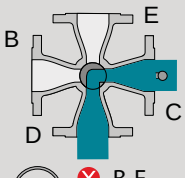
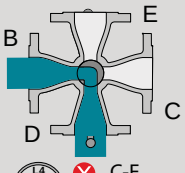
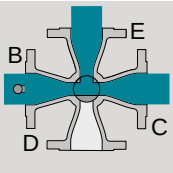
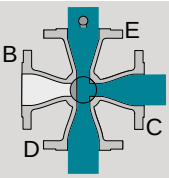
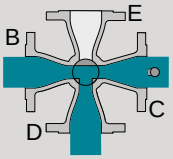
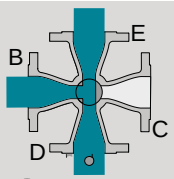
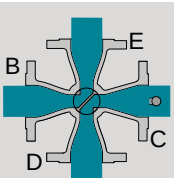
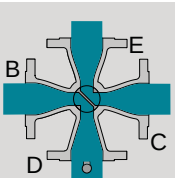
3-way (120°) type 3-WP-120

- with positive overlap
- flow interruption / isolation

positive overlap



3-way (120°)	Plug type	Pos. I = 0°	Pos. II = 120°	Pos. III = 240°	
	L120 				

4-way	Plug type	Pos. I = 0°	Pos. II = 90°	Pos. III = 180°	Pos. IV = 270°
 Type F-4-ISO-STANDARD 	L4 	 B-E C-D	 B-D C-E	 B-E C-D	 C-E B-D
	T4 	 D B-C-E	 B C-D-E	 E B-C-D	 C B-D-E
	LL4 	 B-E + C-D	 B-D + C-E		

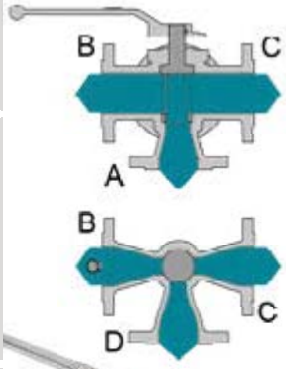
open
closed

Plug types 4-way (special) and 5-way valves for STANDARD and EXTRA design

Plug type	Pos. I = 0°	Pos. II = 90°	Pos. III = 180°	Pos. IV = 270°	4-way (special) / 5-way
L	✗ C-D-E ✓ A-B	✗ B-C-D ✓ A-E	✗ B-D-E ✓ A-C	✗ B-C-E ✓ A-D	
LL	✗ C-D ✓ A-B-E	✗ B-D ✓ A-C-E	✗ B-E ✓ A-C-D	✗ C-E ✓ A-B-D	
IL	✗ D ✓ A-E + B-C	✗ B ✓ A-C + D-E	✗ E ✓ A-D + B-C	✗ C ✓ A-B + D-E	
T	✗ D-E ✓ A-B-C	✗ B-C ✓ A-D-E	✗ D-E ✓ A-B-C	✗ B-C ✓ A-D-E	
TT	✗ E ✓ A-B-C-D	✗ C ✓ A-B-D-E	✗ D ✓ A-B-C-E	✗ B ✓ A-C-D-E	

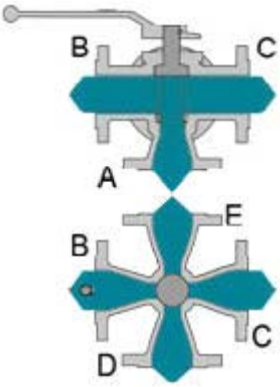


Type F-4-Special-ISO-STANDARD





Type F-5-ISO-STANDARD



✓ open
✗ closed

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