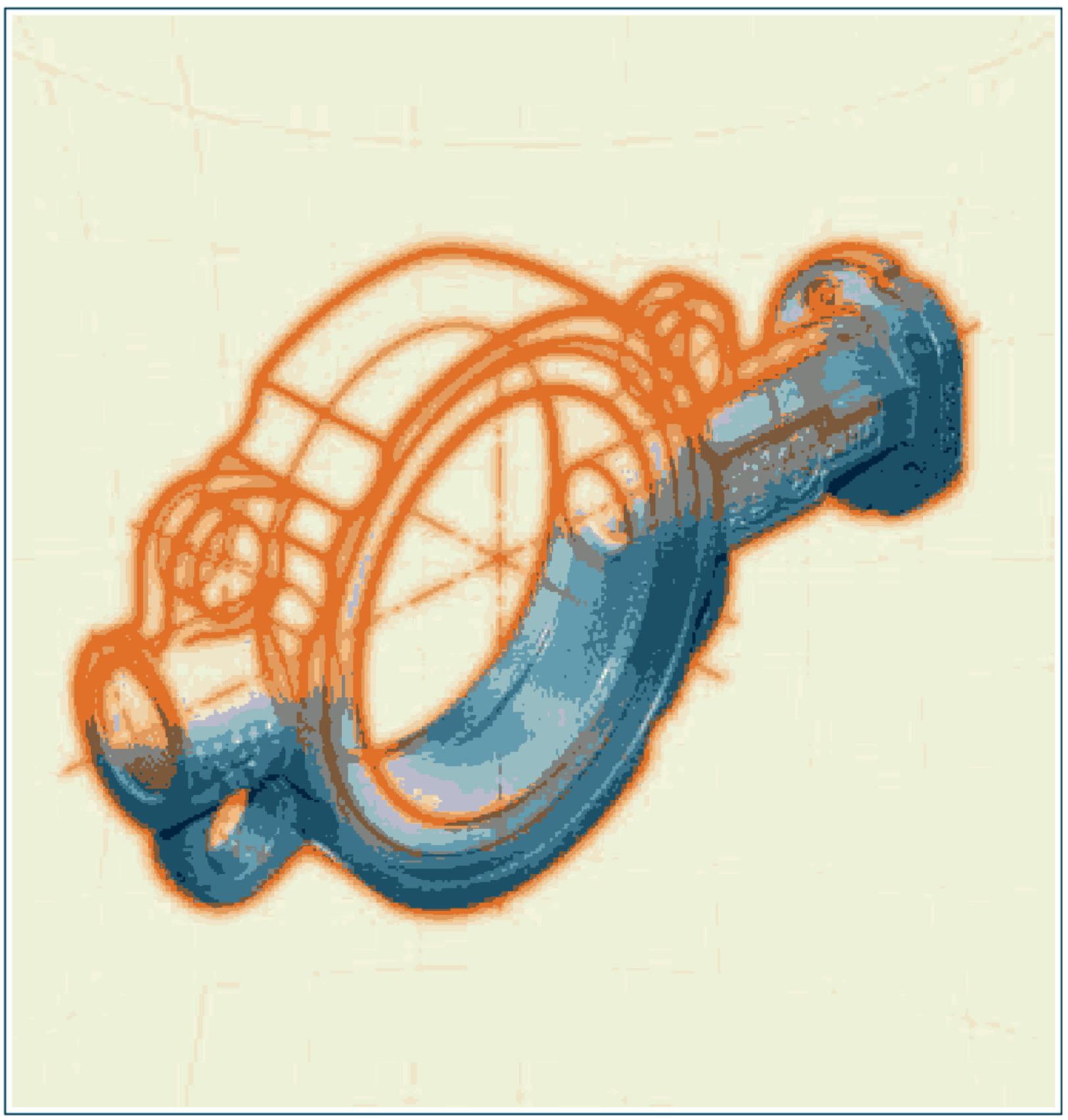
EBRO ARMATUREN®

TECHNICAL GUIDE



TG 10

TECHNICAL GUIDE

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1. CONVERSION TABLES

Length /

	mm	cm	m	in	ft	yd
mm	1	0.1	0.001	0.0394	0.003	0.0011
cm	10	1	0.01	0.3937	0.033	0.0109
m	1000	100	1	39.3701	3.281	1.0936
in	25.4	2.54	0.0254	1	0.083	0.0278
ft	305	30.48	0.3048	12	1	0.3333
yd	914	91.44	0.9144	36	3	1

1 km = 1 thousand metres = 0.62137 miles
1 mile = 1,609.34 metres = 1.60934 kilometres

Area A

	mm^2	cm^2	m^2	in^2	ft^2	yd^2
mm^2	1	0.01	10^{-6}	1.55×10^{-3}	1.076×10^{-5}	1.196×10^{-6}
cm^2	100	1	10^{-4}	0.155	1.076×10^{-3}	1.196×10^{-4}
m^2	10^{6}	10 000	1	1550	10.764	1.196
in^2	645.16	6.4516	6.452×10^{-4}	1	6.944×10^{-3}	7.716×10^{-4}
ft^2	92 903	929.03	0.093	144	1	0.1111
yd^2	836 127	8361.27	0.836	1296	9	1

Volume V

	mm^3	cm^3	m^3	in^3	ft^3	yd^3
mm^3	1	0.001	10^{-9}	6.1×10^{-5}	3.531×10^{-8}	1.308×10^{-9}
cm^3	1000	1	10^{-6}	0.061	3.531×10^{-5}	1.308×10^{-8}
m^3	10^{9}	10^{6}	1	61 024	35.31	1.308
in^3	16 387	16.39	1.639×10^{-5}	1	5.787×10^{-4}	2.143×10^{-5}
ft^3	2.832×10^{7}	2.832×10^{4}	0.0283	1728	1	0.0370
yd^3	7.646×10^{8}	7.646×10^{5}	0.7646	46 656	27	1

Velocity v

	m/s	ft/s	m/min	ft/min	km/h	mile/h
m/s	1	3.281	60	196.85	3.6	2.2369
ft/s	0.305	1	18.288	60	196.85	0.6818
m/min	0.017	0.055	1	3.281	0.06	0.0373
ft/min	0.005	0.017	0.305	1	0.0183	0.0114
km/h	0.278	0.911	16.667	54.68	1	0.6214
mile/h	0.447	1.467	26.822	88	1.6093	1

Force F, G

	N	kN	kgf	lbf
N	1	0.001	0.102	0.225
kN	1000	1	101.97	224.81
kgf	9.807	0.0098	1	2.205
lbf	4.448	0.0044	0.454	1

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1. CONVERSION TABLES

Mass m

	kg	lb	cwt	t	sh ton
kg	1	2-205	0.0197	0.001	0.0011
lb	0.454	1	0.0089	4.54×10^{-4}	5.0×10^{-4}
cwt	50.802	112	1	0.0508	0.056
t	1000	2204.6	19.684	1	1.1023
sh ton	907.2	2000	17.857	0.9072	1

Mass flow m/Q

	kg/s	lb/s	kg/h	lb/h	t/h
kg/s	1	2.205	3600	7936.64	3.6
lb/s	0.454	1	0.0089	3600	1.633
kg/h	2.78×10^{-4}	6.12×10^{-4}	1	2.205	0.001
lb/h	$1.26x\ 10^{-4}$	2.78×10^{-4}	0.454	1	4.54×10^{-4}
t/h	0.278	0.612	1000	2204.6	1

Volumetric flow V

	l/s	l/min	m^3/h	ft^3/h	ft^3/min	US barrel/d
l/s	1	60	3.6	127.133	2.1189	543.439
l/min	0.017	1	0.06	2.1189	0.0353	9.057
m^3/h	0.278	16.667	1	35.3147	0.5886	150.955
ft^3/h	0.008	0.472	0.0283	1	0.0167	4.275
ft^3/min	0.472	28.317	1.6990	60	1	256.475
US barrel/d	0.002	0.11	0.0066	0.2339	0.0039	1

Energy W, E

	J	kJ	MJ	ft lbf	kW h
J	1	0.001	10^{-6}	0.7376	2.78×10^{-7}
kJ	1000	1	0.001	737.56	2.78×10^{-4}
MJ	10^6	1000	1	737 562	0.2778
ft lbf	1.356	1.36×10^{-3}	1.36×10^{-6}	1	3.77×10^{-7}
kW h	3.6×10^6	3600	3.6	2.65×10^6	1

1 Joule = 1 Newton metre

Power P

	W	kgf m/s	PS	ft lbf/s	hp
W	1	0.102	0.00136	0.7376	0.00134
kgf m/s	9.806	1	0.0133	7.233	0.0131
PS	735.5	75	1	542.476	0.9863
ft lbf/s	1.356	0.138	0.00184	1	0.00182
hp	745.7	76.04	1.0139	550	1

1 Watt = 1 Joule per sec. = 1 Nm per sec.

1. CONVERSION TABLES

Pressure p

	N/m²=Pa	mbar	bar	kgf/cm²	lbf/in²	ft H_2O	m H_2O	mm Hg	in Hg
N/m²=Pa	1	0.01	10^{-5}	1.02×10^{-5}	1.45×10^{-4}	3.3×10^{-4}	1.02×10^{-4}	0.0075	2.95×10^{-4}
mbar	100	1	0.001	0.00102	0.0145	0.033	0.0102	0.75	0.029
bar	10^5	1000	1	1.02	14.5	33.455	10.2	750.1	29.53
kgf/cm²	98066	980.7	0.981	1	14.22	32.808	10.0	735.6	28.96
lbf/in²	6895	68.95	0.069	0.0703	1	2.307	0.703	51.71	2.036
ft H_2O	2989	29.89	0.03	0.0305	0.433	1	0.305	22.42	0.883
m H_2O	9807	98.07	0.098	0.1	1.42	3.28	1	73.55	2.896
mm Hg	133.3	1.333	0.0013	0.0014	0.019	0.045	0.014	1	0.039
in Hg	3386	33.86	0.0338	0.0345	0.491	1.133	0.345	25.4	1

Temperature t

°C	°F	°C	°F
– 40	– 40	115	239
– 35	– 31	120	248
– 30	– 22	125	257
– 25	– 13	130	266
– 20	– 4	135	275
– 15	+ 5	140	284
– 10	+ 14	145	293
– 5	+ 23	150	302
0	32	155	311
5	41	160	320
10	50	165	329
15	59	170	338
20	68	175	347
25	77	180	356
30	86	185	365
35	95	190	374
40	104	195	383
45	113	200	392
50	122	205	401
55	131	210	410
60	140	215	419
65	149	220	428
70	158	225	437
75	167	230	446
80	176	235	455
85	185	240	464
90	194	245	473
95	203	250	482
100	212	255	491
105	221	260	500
110	230		

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1. TABLE FOR CONVERTING INCHES TO MILLIMETRES (1 INCH = 25.4 MILLIMETRES)

Inch	0	1/16	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	25.4	27.0	28.6	30.2	31.8	33.3	34.9	36.5	38.1	39.7	41.3	42.9	44.5	46.0	47.6	49.2
2	50.8	52.4	54.0	55.6	57.2	58.7	60.3	61.9	63.5	65.1	66.7	68.3	69.9	71.4	73.0	74.6
3	76.2	77.8	79.4	81.0	82.6	84.1	85.7	87.3	88.9	90.5	92.1	93.7	95.3	96.8	98.4	100.0
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2
7	177.8	179.4	181.0	182.6	184.2	185.7	187.3	188.9	190.5	192.1	193.7	195.3	196.9	198.4	200.0	201.6
8	203.2	204.8	206.4	208.0	209.6	211.1	212.7	214.3	215.9	217.5	219.1	220.7	222.3	223.8	225.4	227.0
9	228.6	230.2	231.8	233.4	235.0	236.5	238.1	239.7	241.3	242.9	244.5	246.1	247.7	249.2	250.8	252.4
10	254.0	255.6	257.2	258.8	260.4	261.9	263.5	265.1	266.7	268.3	269.9	271.5	273.1	274.6	276.2	277.8
11	279.4	281.0	282.6	284.2	285.8	287.3	288.9	290.5	292.1	293.7	295.3	296.9	298.5	300.0	301.6	303.2
12	304.8	306.4	308.0	309.6	311.2	312.7	314.3	315.9	317.5	319.1	320.7	322.3	323.9	325.4	327.0	328.6
13	330.2	331.8	333.4	335.0	336.6	338.1	339.7	341.3	342.9	344.5	346.1	347.7	349.3	350.8	352.4	354.0
14	355.6	357.2	358.8	360.4	362.0	363.5	365.1	366.7	368.3	369.9	371.5	373.1	374.7	376.2	377.8	379.4
15	381.0	382.6	384.2	385.8	387.4	388.9	390.5	392.1	393.7	395.3	396.9	398.5	400.1	401.6	403.2	404.8
16	406.4	408.0	409.6	411.2	412.8	414.3	415.9	417.5	419.1	420.7	422.3	423.9	425.5	427.0	428.6	430.2
17	431.8	433.4	435.0	436.6	438.2	439.7	441.3	442.9	444.5	446.1	447.7	449.3	450.9	452.4	454.0	455.6
18	457.2	458.8	460.4	462.0	463.6	465.1	466.7	468.3	469.9	471.5	473.1	474.7	476.3	477.8	479.4	481.0
19	482.6	484.2	485.85	487.4	489.0	490.5	492.1	493.7	495.3	496.9	498.5	500.1	501.7	503.2	504.8	506.4
20	508.0	509.6	11.2	512.8	514.4	515.9	517.5	519.1	520.7	522.3	523.9	525.5	527.1	528.6	530.2	531.8
21	533.4	535.0	536.6	538.2	539.8	541.3	542.9	544.5	546.1	547.7	549.3	550.9	552.5	554.0	555.6	557.2
22	558.8	560.4	562.0	563.6	565.2	566.7	568.3	569.9	571.5	573.1	574.7	576.3	577.9	579.4	581.0	582.6
23	584.2	585.8	587.4	589.0	590.6	592.1	593.7	595.3	596.9	598.5	600.1	601.7	603.3	604.8	606.4	608.0
24	609.6	611.2	612.8	614.4	616.0	617.5	619.1	620.7	622.3	623.9	625.5	627.1	628.7	630.2	631.8	633.4
25	635.0	636.6	638.2	639.8	641.4	642.9	644.5	646.1	647.7	649.3	650.9	652.5	654.1	655.6	657.2	658.8
26	660.4	662.0	663.6	665.2	666.8	668.3	669.9	671.5	673.1	674.7	676.3	677.9	679.5	681.0	682.6	684.2
27	685.8	687.4	689.0	690.6	692.2	693.7	695.3	696.9	698.5	700.1	701.7	703.3	704.9	706.4	708.0	709.6
28	711.2	712.8	714.4	716.0	717.6	719.1	720.7	722.3	723.9	725.5	727.1	728.7	730.3	731.8	733.4	735.0
29	736.6	738.2	739.8	714.4	743.0	744.5	746.1	747.7	749.3	750.9	752.5	754.1	755.7	757.2	758.8	760.4
30	762.0	763.6	765.2	766.8	768.4	769.9	771.5	773.1	774.7	776.3	777.9	779.5	781.1	782.6	784.2	785.8
31	787.4	789.0	790.6	792.2	783.8	795.3	796.9	798.5	800.1	801.7	803.3	804.9	806.5	808.0	809.6	811.2
32	812.8	814.4	816.0	817.6	819.2	820.7	822.3	823.9	825.5	827.1	828.7	830.3	831.9	833.4	835.0	836.6
33	838.2	839.8	841.4	843.0	844.6	846.1	847.7	849.3	850.9	852.5	854.1	855.7	857.3	858.8	860.4	862.0
34	863.6	865.2	866.8	868.4	870.0	871.5	873.1	874.7	876.3	877.9	879.5	881.1	882.7	884.2	885.8	887.4
35	889.0	890.6	892.2	893.8	895.4	896.9	898.5	900.1	901.7	903.3	904.9	906.5	908.1	909.6	911.2	912.8
36	914.4	916.0	917.6	919.2	920.8	922.3	923.9	925.5	927.1	928.7	930.3	931.9	933.5	935.0	936.6	938.2
37	939.8	941.4	943.0	944.6	946.2	947.7	949.3	950.9	952.5	954.1	955.7	957.3	958.9	960.4	962.0	963.6
38	965.2	966.8	968.4	970.0	971.6	973.1	974.7	976.3	977.9	979.5	981.1	982.7	984.3	985.8	987.4	989.0
39	990.6	992.2	993.8	995.4	997.0	998.5	1000.1	1001.7	1003.3	1004.9	1006.5	1008.1	1009.7	1011.2	1012.8	1014.4
40	1016.0	1017.6	1019.2	1020.8	1022.4	1023.9	1025.5	1027.1	1028.7	1030.3	1037.9	1033.5	1035.1	1036.6	1038.2	1039.8
41	1041.4	1043.0	1044.6	1046.2	1047.8	1049.3	1050.9	1052.5	1054.1	1055.7	1057.3	1058.9	1060.5	1062.0	1063.6	1065.2
42	1066.8	1068.4	1070.0	1071.6	1073.2	1074.7	1076.3	1077.9	1079.5	1081.1	1082.7	1084.3	1085.9	1087.4	1089.0	1090.6
43	1092.2	1093.8	1095.4	1097.0	1098.6	1100.1	1101.7	1103.3	1104.9	1106.5	1108.1	1109.7	1111.3	1112.8	1114.4	1116.0
44	1117.6	1119.2	1120.8	1122.4	1124.0	1125.5	1127.1	1128.7	1130.3	1131.9	1133.5	1135.1	1136.7	1138.2	1139.8	1141.4
45	1143.0	1144.6	1146.2	1147.8	1149.4	1150.9	1152.5	1154.1	1155.7	1157.3	1158.9	1160.5	1162.1	1163.6	1165.2	1166.8
46	1168.4	1170.0	1171.6	1173.2	1174.8	1176.3	1177.9	1179.5	1181.1	1182.7	1184.3	1185.9	1187.5	1189.0	1190.6	1192.2
47	1193.8	1195.2	1197.0	1198.6	1200.2	1201.7	1203.3	1204.9	1206.5	1208.1	1209.7	1211.3	1212.9	1214.4	1216.0	1217.6
48	1219.2	1220.8	1222.4	1224.0	1225.6	1227.1	1228.7	1230.3	1231.9	1233.5	1235.1	1236.7	1238.3	1239.8	1241.4	1243.0
49	1244.6	1246.2	1247.8	1249.4	1251.0	1252.5	1254.1	1255.7	1257.3	1258.9	1260.5	1262.1	1263.7	1265.2	1266.8	1268.4

2.1 FACE-TO-FACE TO EN 558

Shut-off valves – Wafer type

DN	Face-to-face FTF				
	PN 2.5 – PN 6 – PN 10 – PN 16 – PN 25				PN 40
40	38	33	–	33	33
50	40	43	–	43	43
65	42	46	–	46	46
80	44	46	49	64	64
100	46	52	56	64	64
125	48	56	64	70	70
150	50	56	70	76	76
200	60	60	71	89	89
250	65	68	76	114	114
300	75	78	83	114	114
350	80	92[2])	92	127	127
400	95	102	102	140	140
450	107	114	114	152	152
500	120	127	127	152	152
600	144	154	154	178	178
700	160	165	–	229	–
800	180	190	–	241	–
900	195	203	–	241	–
1000	210	216	–	300	–
1200	–	254	–	350	–
1400	–	279	–	390	–
1600	–	318	–	440	–
1800	–	356	–	490	–
2000	–	406	–	540	–
Basic series	53[1])	20	25[3])	16	16

Shut-off valves – Flanged type

DN	Face-to-face FTF		
	PN 2.5 – PN 6 – PN 10 – PN 16 – PN 25		PN 40
40	106	140	140
50	108	150	150
65	112	170	170
80	114	180	180
100	127	190	190
125	140	200	200
150	140	210	210
200	152	230	230
250	165	250	250
300	178	270	270
350	190	290	290
400	216	310	310
450	222	330	330
500	229	350	350
600	267	390	390
700	292	430	430
800	318	470	470
900	330	510	510
1000	410	550	550
1200	470	630	630
1400	530	710	710
1600	600	790	790
1800	670	870	870
2000	760	950	950
Basic series	13	14	14

[1]) Only for PN 2.5, PN 6 and PN 10.
[2]) Or 78 mm, until basic series 2.5 is phased out (see [3])).
[3]) Basic series 25 will be phased out five years after this standard is published for the first time.

Gate valves

DN	Face-to-face FTF																	
	PN 6 – PN 10 – PN 16								PN 25 – PN 40								PN 63 – PN 100	
10	–	80	–	102	108	–	108	–	–	80	108	–	–	–	–	–	–	–
15	–	80	–	108	108	–	108	150	–	80	108	140	140	–	–	140	–	165
20	75	90	–	117	117	–	117	160	75	90	117	152	152	–	–	152	–	250
25	80	100	125	127	127	120	127	160	80	100	127	165	165	120	–	210	–	255
32	90	110	130	140	146	140	127	180	90	110	146	178	178	140	–	230	–	256
40	100	120	140	165	159	240	136	190	100	120	159	190	190	240	240	240	240	280
50	110	135	150	178	190	250	142	200	110	135	190	216	216	250	250	250	250	300
65	130	165	170	190	216	270	154	215	130	165	216	241	241	270	290	270	290	340
80	150	185	180	203	254	280	160	230	150	185	254	283	283	280	310	280	310	360
100	160	229	190	229	305	300	172	250	160	229	305	305	305	300	350	300	350	400
125	200	–	200	254	–	325	186	275	200	–	–	381	381	325	400	350	400	450
150	210	–	210	267	–	350	200	300	210	–	–	403	403	350	450	375	450	500
200	–	–	230	292	–	400	228	350	–	–	–	419	419	400	550	425	550	600
250	–	–	250	330	–	450	255	400	–	–	–	457	457	450	650	450	650	700
300	–	–	270	356	–	500	285	425	–	–	–	502	502	500	750	500	750	800
350	–	–	290	381	–	550	315	475	–	–	–	572	762	550	850	550	850	–
400	–	–	310	406	–	600	340	525	–	–	–	610	838	600	950	600	950	–
450	–	–	330	432	–	650	360	575	–	–	–	660	914	650	1050	–	1050	–
500	–	–	350	457	–	700	380	625	–	–	–	711	991	700	1150	–	1150	–
600	–	–	390	508	–	800	425	725	–	–	–	787	1143	800	1350	–	1350	–
700	–	–	430	610	–	900	470	825	–	–	–	–	–	–	–	–	–	–
800	–	–	470	660	–	1000	510	925	–	–	–	–	–	–	–	–	–	–
900	–	–	510	711	–	1100	555	1025	–	–	–	–	–	–	–	–	–	–
1000	–	–	550	813	–	1200	600	1125	–	–	–	–	–	–	–	–	–	–
Basic series	47[3])	18[3])	14[1])	3	7[3])	15	29	30	47[3])	18[3])	7[3])	19	4	15	26	45	26	46[2])

[1]) This series is also used for gate valves made of cast iron with laminated graphite (for details see relevant product standards).
[2]) This series is only designed for PN 63.
[3]) This series is only designed for valves made of copper alloys; it must not be used for valves made of cast iron or steel.

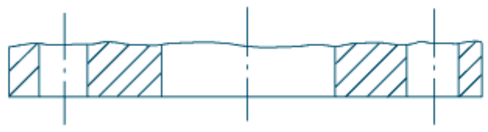
2.1 FACE-TO-FACE TO ISO 5752

	ISO 5752									
	Table 3		Table 4		Table 5			Table 6		
	short (ANSI B16 B16.10)	long (DIN 3202 F4)	short series (BS 3952)	long series (DIN 3202 F4)	short (API 609 BS 3953)	medium (MSS SP 67)	long (API 609 BS 3952)	short (ANSI B16 B 16.10	medium (ANSI B16.10 BS 1570	long (DIN 3202 F1)
ID	Gate valves		Double flanged butterfly valves		Wafer type butterfly valves			Ball valves		
DN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
20	117	–	–	–	–	–	–	117	117	150
25	127	–	–	–	–	–	–	127	127	160
32	140	–	–	–	–	–	–	140	140	180
40	165	240	106	140	33	–	33	165	165	200
50	178	250	108	150	43	–	43	178	203	230
65	190	270	112	170	46	–	46	190	222	290
80	203	280	114	180	46	49	64	203	241	310
100	229	300	127	190	52	56	64	229	305	350
125	254	325	140	200	56	64	70	254	356	400
150	267	350	140	210	56	70	76	267	394	480
200	292	400	152	230	60	71	89	292	457	600
250	330	450	165	250	68	76	114	330	533	730
300	356	500	178	270	78	83	114	356	610	850
350	381	550	190	290	78	92	127	381	686	980
400	406	600	216	310	102	102	140	406	762	1100
450	432	650	222	330	114	114	152	432	864	1200
500	457	700	229	350	127	127	152	457	914	1250
600	508	800	267	390	154	154	178	508	1067	1450
700	610	900	292	430	165	–	229	–	–	–
800	660	1000	318	470	190	–	241	–	–	–
900	711	1100	330	510	203	–	241	–	–	–
1000	811	1200	410	550	216	–	300	–	–	–

2.2 FLANGE DESIGNS TO DIN 2526

The possible types of sealing depend on the dimensional standards of the flanges.

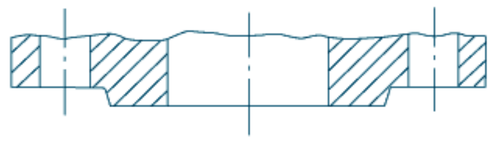
Flanges without sealing strip



Type A
Sealing surface without requirement

Type B
Sealing surface R_z = 160, turned (not finer than 40 µm)

Flanges with sealing strip



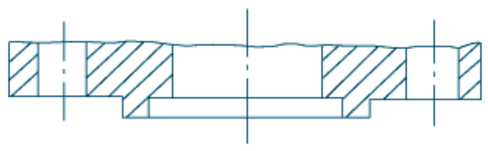
Type C
Sealing surface R_z = 160 (not finer than 40 µm), turned

Type D
Sealing surface R_z = 40, turned

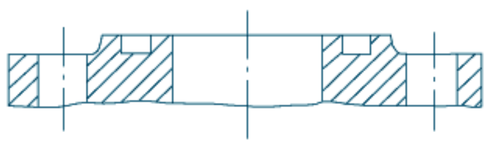
Form E
Sealing surface R_z = 16, turned

Flanges with positive locking seal

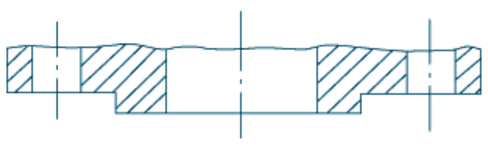
Type F
Spring to DIN 2512



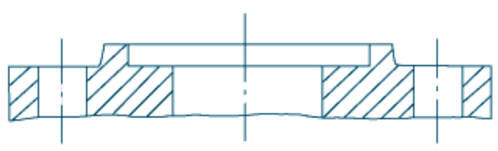
Type N
Groove to DIN 2512



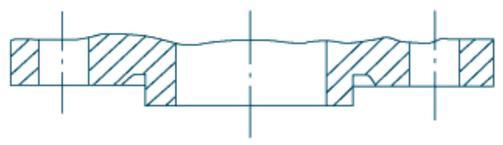
Type V 13
Projection to DIN 2513



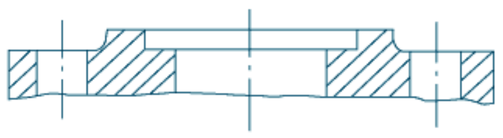
Type R 13
Recess to DIN 2513



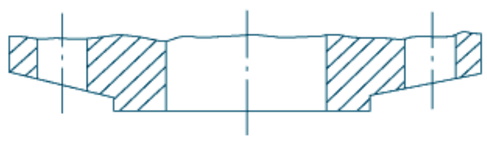
Type V 14
Projection to DIN 2514



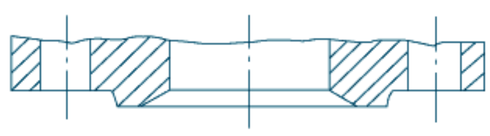
Type R 14
Recess to DIN 2514



Type M
Bevel for diaphragm only weld seal to DIN 2695



Type L
Groove for lenticular seal to DIN 2696



2.3 FLANGE ACCOMODATION (TO DIN 2501 SHEET 1 IN EXTRACTS FOR PN 1 TO PN 100)

Pressure rating	PN 1 and 2,5				PN 6				PN 10				PN 16			
Nominal diameter*) DN	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter
10	75	50	4	11	75	50	4	11	90	60	4	14	90	60	4	14
15	80	55	4	11	80	55	4	11	95	65	4	14	95	65	4	14
20	90	65	4	11	90	65	4	11	105	75	4	14	105	75	4	14
25	100	75	4	11	100	75	4	11	115	85	4	14	115	85	4	14
32	120	90	4	14	120	90	4	14	140	100	4	18	140	100	4	18
40	130	100	4	14	130	100	4	14	150	110	4	18	150	110	4	18
50	140	110	4	14	140	110	4	14	165	125	4	18	165	125	4	18
65	160	130	4	14	160	130	4	14	185	145	4	18	185	145	4	18
80	190	150	4	18	190	150	4	18	200	160	8	18	200	160	8	18
100	210	170	4	18	210	170	4	18	220	180	8	18	220	180	8	18
125	240	200	8	18	240	200	8	18	250	210	8	18	250	210	8	18
150	265	225	8	18	265	225	8	18	285	240	8	22	285	240	8	22
(175)	–	–	–	–	–	–	–	–	315	270	8	22	315	270	8	22
200	320	280	8	18	320	280	8	18	340	295	8	22	340	295	12	22
250	375	335	12	18	375	335	12	18	395	350	12	22	405	355	12	22
300	440	395	12	22	440	395	12	22	445	400	12	22	460	410	12	22
350	490	445	12	22	490	445	12	22	505	460	16	22	520	470	12	26
400	540	495	16	22	540	495	16	22	565	515	16	26	580	525	20	30
450	595	550	16	22	595	550	16	22	615	565	20	26	640	585	20	26
500	645	600	20	22	645	600	20	22	670	620	20	26	715	650	20	26
600	755	705	20	26	755	705	20	26	780	725	20	30	840	770	20	30
700	860	810	24	26	860	810	24	26	895	840	24	30	910	840	24	30
800	975	920	24	30	975	920	24	30	1015	950	24	33	1025	950	24	33
900	1075	1020	24	30	1075	1020	24	30	1115	1050	28	33	1125	1050	28	33
1000	1175	1120	28	30	1175	1120	28	30	1230	1160	28	36	1255	1170	28	36
1200	1375	1320	32	30	1405	1340	32	33	1455	1380	32	39	1485	1390	32	39
1400	1575	1520	36	30	1630	1560	36	36	1675	1590	36	42	1685	1590	36	42
1600	1790	1730	40	30	1830	1760	40	36	1915	1820	40	48	1930	1820	40	48
1800	1990	1930	44	30	2045	1970	44	39	2115	2020	44	48	2130	2020	44	48
2000	2190	2130	48	30	2265	2180	48	42	2325	2230	48	48	2345	2230	48	48

*) DN 175 for shipbuilding only

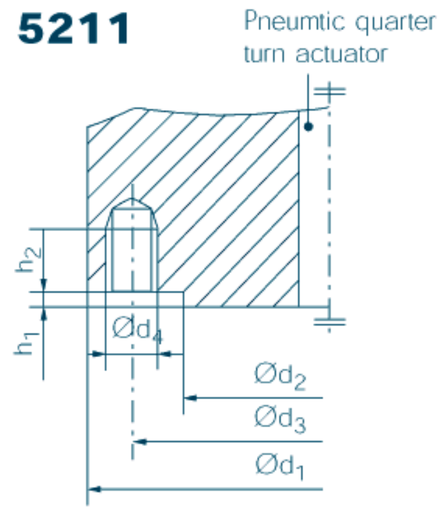
2.3 FLANGE ACCOMODATION (TO DIN 2501 SHEET 1 IN EXTRACTS FOR PN 1 TO PN 100)

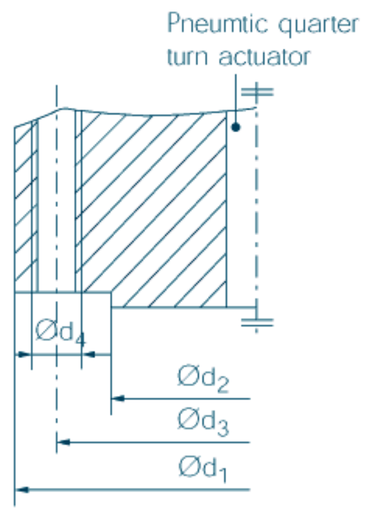
Pressure rating	PN 25				PN 40				PN 64				PN 100			
Nominal diameter*) DN	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter	Flange diameter	Pitch circle diameter	Bolt holes Number	Bolt holes Diameter
10	90	60	4	14	90	60	4	14	100	70	4	14	100	70	4	14
15	95	65	4	14	95	65	4	14	105	75	4	14	105	75	4	14
20	105	75	4	14	105	75	4	14	130	90	4	18	130	90	4	18
25	115	85	4	14	115	85	4	14	140	100	4	18	140	100	4	18
32	140	100	4	18	140	100	4	18	155	110	4	22	155	110	4	22
40	150	110	4	18	150	110	4	18	170	125	4	22	170	125	4	22
50	165	125	4	18	165	125	4	18	180	135	4	22	195	145	4	26
65	185	145	8	18	185	145	8	18	205	160	8	22	220	170	8	26
80	200	160	8	18	200	160	8	18	215	170	8	22	230	180	8	26
100	235	190	8	22	235	190	8	22	250	200	8	26	265	210	8	30
125	270	220	8	26	270	220	8	26	295	240	8	30	315	250	8	33
150	300	250	8	26	300	250	8	26	345	280	8	33	355	290	12	33
(175)	330	280	12	26	350	295	12	30	375	310	12	33	385	320	12	33
200	360	310	12	26	375	320	12	30	415	345	12	36	430	360	12	36
250	425	370	12	30	450	385	12	33	470	400	12	36	505	430	12	39
300	485	430	16	30	515	450	16	33	530	460	16	36	585	500	16	42
350	555	490	16	33	580	510	16	36	600	525	16	39	655	560	16	48
400	620	550	16	36	660	585	16	39	670	585	16	42	715	620	16	48
450	–	–	–	–	685	610	20	39	–	–	–	–	–	–	–	–
500	730	660	20	36	755	670	20	42	800	705	20	48	870	760	20	56
600	845	770	20	39	890	795	20	48	930	820	20	56	990	875	20	62
700	960	875	24	42	995	900	24	48	1045	935	24	56	1145	1020	24	70
800	1085	990	24	48	1140	1030	24	56	1165	1050	24	62				
900	1185	1090	28	48	1250	1140	28	56	1285	1170	28	62				
1000	1320	1210	28	56	1360	1250	28	56	1415	1290	28	70				
1200	1530	1420	32	56	1575	1460	32	62	1665	1530	32	78				
1400	1755	1640	36	62	1795	1680	36	62								
1600	1975	1860	40	62	2025	1900	40	70								
1800	2195	2070	44	70												
2000	2425	2300	48	70												

*) DN 175 for shipbuilding only

2.4 CONNECTIONS OF PNEUMATIC QUARTER TURN ACTUATORS TO EN ISO 5211

Flange type	Maximum torque of flange Nm	Flange dimensions d_1	d_2	d_3	d_4	h_1 max.	h_2 min.	Number of stud or through bolts
F 03	**32**	46	25	36	M 5	3	8	4
F 04	**63**	54	30	42	M 5	3	8	4
F 05	**125**	65	35	50	M 6	3	9	4
F 07	**250**	90	55	70	M 8	3	12	4
F 10	**500**	125	70	102	M 10	3	15	4
F 12	**1000**	150	85	125	M 12	3	18	4
F 14	**2000**	175	100	140	M 16	4	24	4
F 16	**4000**	210	130	165	M 20	5	30	4
F 25	**8000**	300	200	254	M 16	5	24	8
F 30	**16000**	350	230	298	M 20	5	30	8



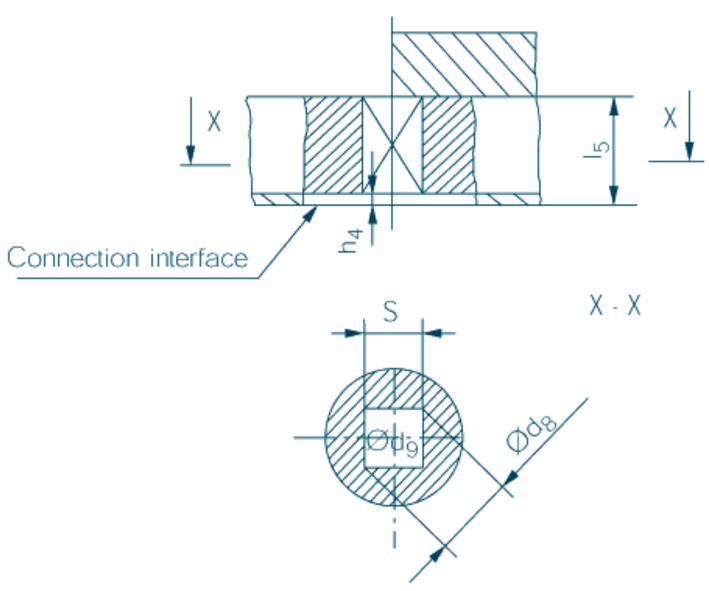


Flange type	Maximum torque of flange Nm	h_4 max.[1]	Actuator with parallel or diagonal square end SH11										
F 03	**32**	1.5	9	-	-	-	-	-	-	-	-	-	-
F 04	**63**	1.5	9	11[2]	-	-	-	-	-	-	-	-	-
F 05	**125**	3.0	9	11	14[2]	-	-	-	-	-	-	-	-
F 07	**250**	3.0	-	11	14	17[2]	-	-	-	-	-	-	-
F 10	**500**	3.0	-	-	14	17	19	22[2]	-	-	-	-	-
F 12	**1000**	3.0	-	-	-	17	19	22	27[2]	-	-	-	-
F 14	**2000**	5.0	-	-	-	-	-	22	27	36[2]	-	-	-
F 16	**4000**	5.0	-	-	-	-	-	-	27	36	46[2]	-	-
F 25	**8000**	5.0	-	-	-	-	-	-	-	36	46	55[2]	-
F 30	**16000**	5.0	-	-	-	-	-	-	-	-	46	55	75[2]
		Ø d_8 min.	12.1	14.1	18.1	22.2	25.2	28.2	36.2	48.2	60.2	72.2	98.2
		Ø d_9 max.	9.5	11.6	14.7	17.9	20	23.1	28.4	38	48.5	57.9	79.1
		l_5 min.	10	12	16	19	21	24	29	38	48	57	77

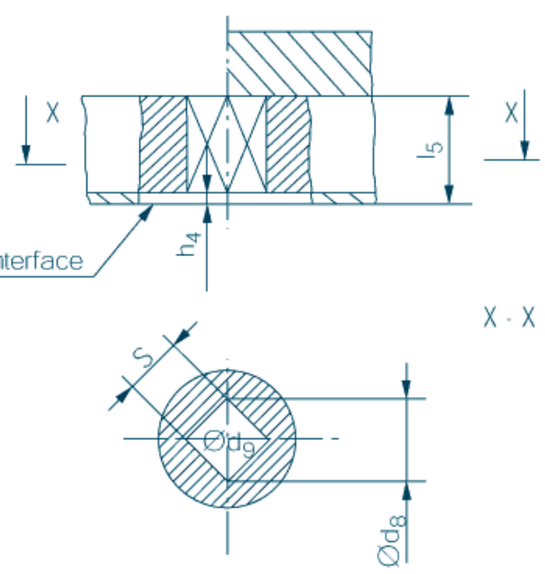
[1] h_4 = 0.5 mm

[2] Indicates the preferred dimension

[3] The maximum permissible torques for the coupling relate to a maximum permissible torsional tension of 280 MPa in the actuated section.

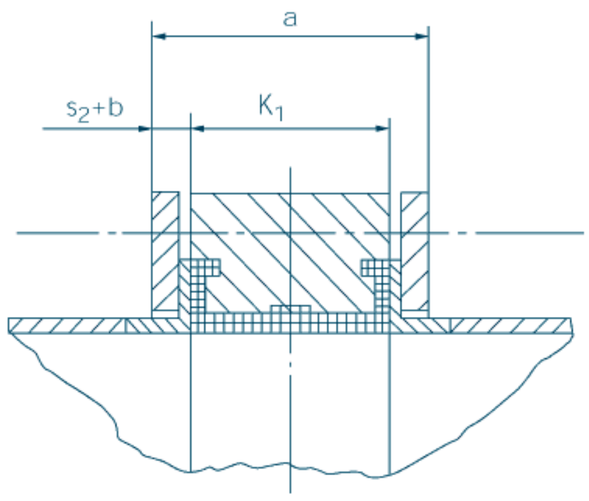


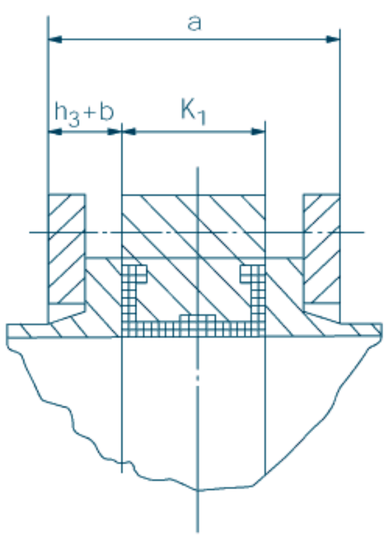
Actuator with parallel square end

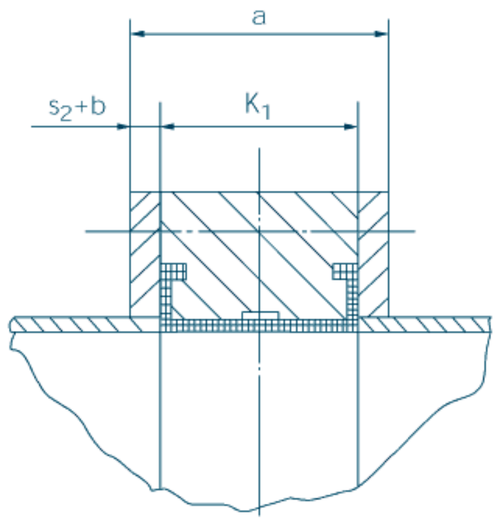


Actuator with diagonal square end

3 SCREW LENGTHS

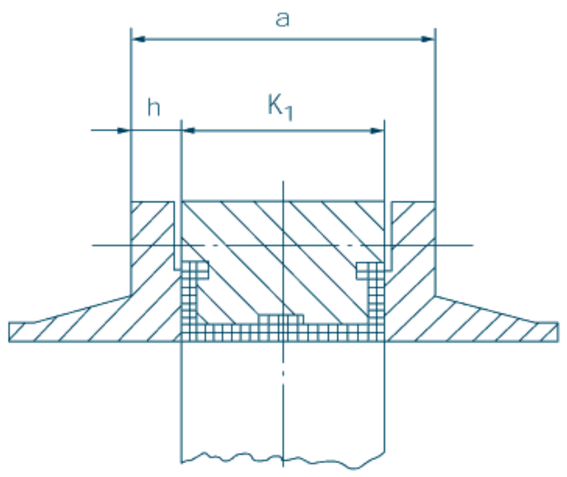






	Flared flanges						Loose flange			Brazed flanges, flush					
	DIN 2641		PN 6	DIN 2642		PN 10	DIN 2673		PN 10	DIN 2573		PN 6	DIN 2576		PN 10
DN	S_2+b	a	Bolt	S_2+b	a	Bolt	h_3+b	a	Bolt	b	a	Bolt	b	a	Bolt
25	15	63	M10x80	19	71	M12x90	28	89	M12x110	14	61	M10x80	16	65	M12x80
32	15.5	64	M12x80	19.5	72	M16x90	28	89	M16x110	16	65	M12x80	16	65	M16x90
40	15.5	64	M12x80	19.5	72	M16x90	28	89	M16x110	16	65	M12x80	16	65	M16x90
50	15.5	74	M12x90	19.5	82	M16x100	30	103	M16x130	16	75	M12x90	18	79	M16x100
65	15.5	77	M12x100	19.5	85	M16x110	30	106	M16x130	16	78	M12x100	18	82	M16x100
80	18	82	M16x100	22	90	M16x110	34	114	M16x130	18	82	M16x110	20	86	M16x110
100	18	88	M16x120	22	96	M16x120	34	120	M16x140	18	88	M16x110	20	92	M16x120
125	18	92	M16x120	22	100	M16x120	36	128	M16x150	20	96	M16x120	22	100	M16x120
150	18	92	M16x120	22	100	M20x130	36	128	M20x160	20	96	M16x120	22	100	M20x130
200	20	100	M16x120	24	108	M20x140	40	140	M20x170	22	104	M16x130	24	108	M20x140
250	25	118	M16x140	27	122	M20x150	44	156	M20x180	24	116	M16x140	26	120	M20x150
300	29	136	M20x160	31	140	M20x180	48	174	M20x200	24	126	M20x150	26	130	M20x160
350	30	152	M20x180	34	160	M20x200	50	192	M20x220	26	144	M20x170	28	148	M20x180
400	32	166	M20x200	38	178	M20x240	56	214	M24x280	28	158	M20x180	32	166	M24x200
450	–	–	–	–	–	–	–	–	–	30	174	M20x200	38	190	M24x220
500	36	199	M20x250	44	215	M24x280	64	255	M24x320	30	187	M20x220	38	203	M24x270
550	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
600	40	236	M24x300	51	256	M27x330	70	294	M27x370	–	–	–	–	–	–
700	44	253	M24x320	57	279	M27x350	78	321	M27x400	–	–	–	–	–	–
800	48	286	M27x360	63	316	M30x390	86	362	M30x430	–	–	–	–	–	–
900	52	307	M27x380	–	307	–	94	391	M30x490	–	–	–	–	–	–
1000	56	328	M27x400	–	328	–	102	420	M33x500	–	–	–	–	–	–

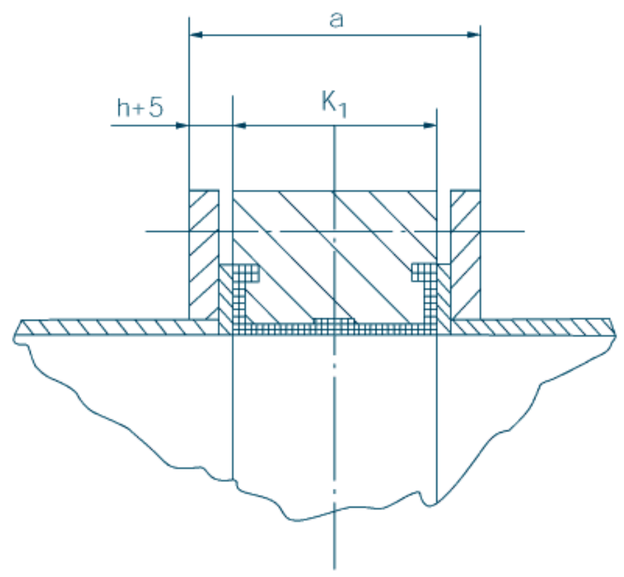
3 SCREW LENGTHS



		Welding flanges											
	Face-to-face	DIN 2631		PN 6	DIN 2632		PN 10	DIN 2633		PN 16	ANSI 150		
DN	**K1**	**h**	**a**	**Bolt**	**h**	**a**	**Bolt**	**h**	**a**	**Bolt**	**h**	**a**	**Bolt**
25	33	14	61	M10x80	16	65	M12x80	16	65	M12x80	14	61	1/2"x80
32	33	14	61	M12x80	16	65	M16x90	16	65	M16x90	16	65	1/2"x80
40	33	14	61	M12x80	16	65	M16x90	16	65	M16x90	18	69	1/2"x90
50	43	14	71	M12x90	18	79	M16x100	18	79	M16x100	19	81	5/8"x100
65	46	14	74	M12x90	18	82	M16x100	18	82	M16x100	22	90	5/8"x110
80	46	16	78	M16x100	20	86	M16x110	20	86	M16x110	24	94	5/8"x120
100	52	16	84	M16x100	20	92	M16x120	20	92	M16x120	24	100	5/8"x120
125	56	18	92	M16x120	22	100	M16x120	22	100	M16x120	24	104	3/4"x130
150	56	18	92	M16x120	22	100	M20x130	22	100	M20x130	25	106	3/4"x130
200	60	20	100	M16x120	24	108	M20x140	24	108	M20x140	28	116	3/4"x140
250	68	22	112	M16x140	26	120	M20x150	26	120	M24x150	30	128	7/8"x160
300	78	22	122	M20x150	26	130	M20x160	28	134	M24x160	32	142	7/8"x170
350	92	22	136	M20x160	26	144	M20x180	30	152	M24x180	35	162	1"x190
400	102	22	146	M20x180	26	154	M24x180	32	166	M27x200	37	176	1"x210
450	114	–	–	–	–	–	–	–	–	–	40	194	1 1/8"x260*)
500	127	24	175	M20x200	28	183	M24x240*)	34	195	M30x240	43	213	1 1/8"x280*)
550	154	–	–	–	–	–	–	–	–	–	–	–	–
600	154	24	202	M24x260*)	28	210	M27x280*)	36	228	M33x280	48	250	1 1/8"x320*)
700	165	24	213	M24x280*)	30	225	M27x300*)	36	237	M33x280	52	269	1 1/4x350*)
800	190	24	238	M27x310*)	32	254	M30x330*)	38	266	M36x360*)	57	304	1 1/2x390*)
900	203	26	255	M27x330*)	34	271	M30x340*)	40	283	M36x370*)	60	323	1 1/2x410*)
1000	216	26	268	M27x340*)	34	282	M33x360*)	42	300	M39x390*)	64	344	1 1/2x430*)

*) Threaded rod with two nuts and a washer

3 SCREW LENGTHS



	Welding flanges for tank construction											
	DIN 28031			DIN 28032		PN 10	DIN 28034		PN 10	DIN 28036		PN 10
DN	h	a	Bolt	h	a	Bolt	h	a	Bolt	h 2/5	a	Bolt
25	–	–	–	–	–	–	–	–	–	–	–	–
32	–	–	–	–	–	–	–	–	–	–	–	–
40	–	–	–	–	–	–	–	–	–	–	–	–
50	–	–	–	–	–	–	–	–	–	–	–	–
65	–	–	–	–	–	–	–	–	–	–	–	–
80	–	–	–	–	–	–	–	–	–	–	–	–
100	–	–	–	–	–	–	–	–	–	–	–	–
125	–	–	–	–	–	–	–	–	–	–	–	–
150	–	–	–	–	–	–	–	–	–	–	–	–
200	–	–	–	–	–	–	–	–	–	–	–	–
250	–	–	–	–	–	–	–	–	–	–	–	–
300	20	118	M16x140	30	138	M20x190	25	128	M20x160	35	148	M20x180
350	20	132	M16x160	35	162	M20x220*)	25	142	M20x170	40	172	M20x200
400	20	142	M16x140	35	172	M20x230*)	25	152	M20x180	40	182	M20x240*)
450	–	–	–	–	–	–	–	–	–	–	–	–
500	20	167	M16x210	35	1697	M20x250*)	30	187	M20x240*)	40	207	M20x260*)
550	–	–	–	–	–	–	–	–	–	–	–	–
600	20	194	M16x240*)	35	224	M20x280*)	30	214	M20x270*)	45	244	M20x300*)
700	20	205	M16x250*)	50	265	M24x330*)	40	245	M24x310*)	50	265	M24x320*)
800	20	230	M16x270*)	55	300	M24x360*)	45	280	M24x340*)	55	300	M24x360*)
900	20	243	M16x290*)	60	323	M24x390*)	45	293	M24x360*)	65	333	M24x400*)
1000	20	256	M16x300*)	60	336	M24x400*)	45	306	M24x370*)	65	346	M24x410*)

4.1 K_V-VALUE CALCULATION

a) Formula for liquid media

p_1	Absolute pressure at valve input
p_2	Absolute pressure at valve output
p_V	Liquid boiling pressure
K_V	Flow characteristic
Q	Flow (m^3/h)
Δp_0	1 bar = 10^5 N/m^2
Δp	Differential pressure (p_1-p_2)
∂_0	10^3 kg/m^3
∂	Density of medium
X_F	Pressure ratio
Z_y	(Cavitation value) Z-value at capacity y
V	Velocity m/s
ξ	Zeta-value
L_A	Sound pressure level at 1 m distance
F_L	Max. flow Qmax (m^3/h)

$$K_V = Q \cdot \sqrt{\frac{\Delta p_0}{\Delta p} \cdot \frac{\partial_0}{\partial}}$$

$$Q = K_V \cdot \sqrt{\frac{\Delta p}{\Delta p_0} \cdot \frac{\partial}{\partial_0}}$$

$$\Delta p = \left(\frac{Q}{K_V}\right)^2 \cdot \Delta p_0 \cdot \frac{\partial}{\partial_0}$$

b) Formula for steam

Compressible media

IF $\Delta p < 0.5\ p_1$

$\Delta p_2 > 0.5\ p_1$

= sub-critical pressure drop

$$K_V = \frac{G}{31.6} \sqrt{\frac{V_2}{\Delta p}} \left[\frac{m^3}{h}\right]$$

If $\Delta p > 0{,}5\ p_1$ Noise-

$\Delta p_2 < 0{,}5\ p_1$ problems!

= super-critical pressure drop

$$K_V = \frac{G}{31.6} \sqrt{\frac{V}{\Delta p}} \left[\frac{m^3}{h}\right]$$

Where the medium is water the simplified formula is often used:

$$K_V = \frac{Q}{\sqrt{\Delta p}}$$

$$Q = K_V \cdot \sqrt{\Delta p}$$

$$V = \sqrt{\frac{200 \cdot \Delta p}{\xi}}$$

Cavitation-free operation means that X_F must be $\leq Z_y$ (pressure ratio)

$$X_F = \frac{\Delta p}{p_1 \text{-} p_V}$$

Sound pressure level for cavitation-free operation

$$L_A = 10 \cdot \lg K_V + 18 \lg (p_1\text{-}p_V) - 5 \lg \partial + 18 \lg (X_F/Z_y) + 40 + \Delta L_F$$

The value ΔL_F is always stated by the value manufacturer.

P (bar abs.)	t °C 150	200 ↓	250	300 ↓	350	400 ↓	450	500 ↓	550
1	1.900	2.200	2.400	2.600	2.900	3.100	3.300	3.600	3.800
2	0.960	1.100	1.200	1.300	1.400	1.500	1.600	1.800	1.900
4	0.470	0.500	0.600	0.650	0.700	0.077	0.800	0.890	0.950
10		0.200	0.230	0.260	0.280	0.310	0.330	0.350	0.380
16			0.140	0.160	0.175	0.119	0.205	0.220	0.235
25			0.087	0.099	0.110	0.120	0.130	0.140	0.150
40				0.059	0.066	0.073	0.080	0.086	0.093
64	Steam			0.033	0.039	0.044	0.049	0.053	0.057
100	V (m^3/kg)				0.022	0.026	0.030	0.033	0.035

Medium	Temperature (°C)	Speed of sound M (m/s)
Steam	150	504
	200	532
Super-	250	560
heated	275	573
	300	586
	400	635
	500	680

4.2 SATURATED STEAM TABLE

Pressure *p* in bar of the saturated steam from 0 °C to 199 °C										
°C	0	1	2	3	4	5	6	7	8	9
0	0.0061	0.0066	0.0071	0.0076	0.0081	0.0087	0.0093	0.0100	0.0107	0.0115
10	0.0123	0.0131	0.0140	0.0150	0.0160	0.0170	0.0182	0.0194	0.0210	0.0220
20	0.0234	0.0249	0.0264	0.0281	0.0300	0.0317	0.0336	0.0356	0.0378	0.0400
30	0.0424	0.0449	0.0475	0.0503	0.0532	0.0562	0.0594	0.0627	0.0662	0.0699
40	0.0737	0.0778	0.0820	0.0864	0.0910	0.0958	0.1009	0.1061	0.1116	0.1174
50	0.1234	0.1296	0.1361	0.1429	0.1500	0.1574	0.1651	0.1731	0.1815	0.1901
60	0.1992	0.2086	0.2184	0.2285	0.2391	0.2501	0.2615	0.2733	0.2856	0.2984
70	0.3117	0.3254	0.3396	0.3543	0.3696	0.3855	0.4019	0.4189	0.4365	0.4547
80	0.4736	0.4931	0.5133	0.5342	0.5558	0.5781	0.6011	0.6249	0.6495	0.6749
90	0.7011	0.7281	0.7560	0.7848	0.8145	0.8451	0.8767	0.9093	0.9429	0.9775
100	1.01325	1.0499	1.0876	1.1256	1.1666	1.2079	1.2504	1.2941	1.3390	1.3852
110	1.4326	1.4814	1.5316	1.5831	1.6361	1.6905	1.7464	1.8038	1.8628	1.9233
120	1.9854	2.0491	2.1144	2.1814	2.2502	2.3208	2.3932	2.4674	2.5434	2.6213
130	2.7011	1.7829	2.8668	2.9528	3.041	3.130	3.222	3.317	3.414	3.513
140	3.614	3.717	3.823	3.931	4.042	4.155	4.271	4.389	4.510	4.634
150	4.760	4.889	5.020	5.155	5.293	5.433	5.576	5.723	5.872	6.024
160	6.180	6.339	5.502	6.667	6.836	7.008	7.183	7.362	7.545	7.731
170	7.929	7.114	8.311	8.511	8.716	8.925	9.137	9.354	9.574	9.799
180	10.027	10.497	10.497	10.738	10.984	11.234	11.488	11.747	12.011	12.280
190	12.553	12.830	13.112	13.400	13.692	13.989	14.291	14.598	14.910	15.228

4.3 DENSITY OF GASES AND LIQUIDS

Density of liquids

Description	kg-dm³
Water	1.0
Sea water	1.025
Kerosene	0.80
Sulphuric acid, 100 %	1.83
Hydrochloric acid, 45 %	1.48
Caustic soda, 25 %	1.27
Carbon tetrachloride	1.60
Petrol	0.65 – 0.80
Benzole	0.88
Turpentine	1.1 – 1.2
Air	1.29

Density of molecular weight of gases

Description	Chem. formula	Density	Mol. weight
Air	–	1.000	28.97
Ammonia	NH_3	0.5963	17.03
Carbon dioxide	CO_2	1.5290	44.00
Carbon monoxide	Co	0.9670	28.00
Chlorine	Cl_2	2.486	70.91
Ethylene	C_2H_4	0.9749	28.03
Helium	He	0.1380	4.00
Hydrogen	H_2	0.0695	2.016
Hydrogen sulphide	H_2S	1.1900	34.08
Methane	CH_4	0.5544	16.03
Chloromethane	CH_3Cl	1.7848	50.48
Nitrogen	N_2	0.9672	28.02
Nitrogen oxide	N_2O	1.530	44.02
Oxygen	O_2	1.105	32.00
Sulphur dioxide	SO_2	2.264	65.06
Natural gas		0.60	

4.4 STEEL KEY

Steel	ASTM	UNS No.	C	N	Cr	Ni	Mo	Other	EN	DN	SS	BS	Welded
201	201	S 20100	0.05	0.15	17.0	5.0	-	Mn	1.4372	-	-	284 S16	-
301	301	S 30100	0.10	0.04	17.0	7.0	-	-	1.4310	1.4310	2331	301 S21	-
303	303	S 30300	0.06	0.06	17.5	8.1	-	S	1.4305	1.4305	2346	303 S31	-
304	304	S 30400	0.04	0.06	18.5	8.7	-	-	1.4301	1.4301	2333	304 S31	308 L
304 L	304 L	S 30403	0.02	0.06	18.3	10.2	-	-	1.4306	1.4306	2352	304 S11	308 L
304 LN	304 LN	S 30453	0.02	0.15	18.5	9.5	-	-	1.4311	1.4311	2371	304 S61	308 L 2304
304 N	304 N	S 30451	0.04	0.15	18.5	8.5	-	-	1.6907	1.6907	-	304 S71	308 L 2304
321	321	S 32100	0.04	0.01	17.3	9.2	-	Ti	1.4541	1.4541	2337	321 S31	308 L
347	S 34700	S 34700	0.04	0.04	17.5	9.5	-	Cb	1.4550	-	2338	347 S31	347
316	316	S 31600	0.04	0.04	16.8	10.7	2.0	-	1.4401	1.4401	2347	316 S31	316 L
316	316	S 31600	0.04	0.06	17.0	11.0	2.7	-	1.4436	1.4436	2343	316 S33	316 L
316 L	316 L	S 31603	0.02	0.06	17.3	11.0	2.0	-	1.4404	1.4404	2348	316 S11	316 L
316 L	316 L	S 31603	0.02	0.06	17.0	11.7	2.7	-	1.4432	1.4432	2353	316 S13	316 L
316 LN	316 LN	S 31653	0.02	0.14	17.5	11.0	2.0	-	1.4406	1.4406	-	316 S61	316 L
317 L	317 L	S 31703	0.02	0.06	18.3	12.2	3.0	-	1.4438	1.4438	2367	317 S12	317 L
317 LMN	S 31726	S 31726	0.02	0.14	17.3	14.0	4.2	-	1.4439	1.4439	-	-	P12
904 L	904 L	N 08904	0.01	0.06	20.0	25.0	4.5	Cu	1.4539	1.4539	2562	904S13	P12
254 SMO	S 31254	S 31254	0.01	0.20	20.0	18.0	6.1	Cu	1.4547	-	2378	-	P12, P16
AL 6 XN	B 688	N 08367	0.02	0.20	20.5	24.0	6.2	-	-	50049	-	-	-
20 Cb-3	B 463	N 08020	-	-	-	-	-	-	-	50049	-	-	-
2205	S 31803	S 31803	0.02	0.17	22.0	5.5	3.0	-	1.4462	1.4462	2377	318 S13	2205
409	409	S 40900	0.02	-	11.0	-	-	Ti	1.4512	1.4512	-	409 S19	308 L, 309 L
410	410	S 41000	0.12	-	12.0	-	-	-	1.4006	1.4006	2302	410 S21	410
410 S	410 S	S 41008	0.06	-	12.0	-	-	-	1.4000	1.4000	2301	403 S17	410
430	430	S 43000	0.04	-	16.5	-	-	-	1.4016	1.4016	2320	430 S17	308 L, 309 L
304 H	304 H	S 30409	0.05	0.06	18.3	8.7	-	-	1.4948	1.4948	2333	304 S51	308
321 H	321 H	S 32109	0.05	0.01	17.3	9.2	-	Ti	1.4878	1.4878	2337	321 S51	347
309 S	309 S	S 30908	0.06	0.08	22.5	12.5	-	-	1.4833	1.4833	-	309 S16	309
310 S	310 S	S 31008	0.05	0.06	25.0	20.0	-	-	1.4845	1.4845	2361	310 S16	310
C-22	B 575	N 06022	0.01	-	22.0	56.0	13.0	V 0.35	-	17750	-	-	-
C-276	B 575	N 10276	0.01	-	16.0	57.0	16.0	V 0.35	-	17750	-	-	-
Monel	Monel												
400	B 127	N 04400	0.03	-	-	63.0	-	-	-	17743	-	3072	-
Inconel	Inconel												
200	B 162	N 02200	0.15	-	-	99.0	-	-	-	17741	-	3072	-
600	B 168	N 06600	0.15	-	17.0	72.0	-	-	-	17742	-	3072	-
625	B 443	N 06625	0.10	-	23.0	58.0	10.0	-	-	17744	-	3072	-
800 HT	B 409	N 08811	0.10	-	23.0	35.0	-	-	-	17460	-	3072	-
825	B 424	N 08825	0.05	-	23.5	46.0	3.5	-	-	17744	-	3072	-

5.1 ACCEPTANCE SPECIFICATIONS

No.	Specifications	Requirements, proofs
1	**Acceptance AD Code of Practice**	Permitted materials: AD codes of practice in series W Material acceptance: AD codes of practice
2	**Acceptance DIN 2470 Part 1**	Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B
3	**Acceptance DIN 2470 Part 2**	Permitted materials: group WG 4 DIN 3230 Part 5 Test group: PG 2 DIN 3230 Part 5 Final acceptance: Inside diameters > DN 200: acceptance test certificate 3.1 C Inside diameters ≤ DN 200: acceptance test certificate 3.1 B Component-tested stop valves: 3.1 B
4	**Factory sheet acceptance DIN 3545**	System-independent and system-based requirements and tests for steam traps according to certain test methods defined in DIN 3230 Part 3. Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B
5	**Technical rules for steam boilers (TRD)**	a) Material acceptance: officially recognised independent inspectors (TÜV) Proof: acceptance test certificate DIN 50049-3.1 A b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: officially recognised independent inspectors (TÜV) Proof: acceptance test certificate DIN 50049-3.1 A d) Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B
6	**Technical rules for combustible liquids (TRbF 301)**	Permitted materials: observe DIN 3230 Part 6 Final acceptance: Inside diameters > DN 200: acceptance test certificate 3.1 C Inside diameters ≤ DN 200: acceptance test certificate 3.1 B Component-tested valves (VdTÜV code of practice 1065): acceptance test certificate 3.1 B

5.1 ACCEPTANCE SPECIFICATIONS

No.	Specifications	Requirements, proofs
7	**Lloyd´s Register of Shipping**	a) Material acceptance: Lloyd's Register of Shipping Proof: acceptance test certificate from Lloyd's Register of Shipping b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Lloyd's Register of Shipping Proof: acceptance test certificate from Lloyd's Register of Shipping
8	**American Bureau of Shipping**	a) Material acceptance: American Bureau of Shipping Proof: acceptance test certificate from the American Bureau of Shipping b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: American Bureau of Shipping Proof: acceptance test certificate from the American Bureau of Shipping
9	**Det Norske Veritas**	a) Material acceptance: Det Norske Veritas Proof: acceptance test certificate from Det Norske Veritas b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Det Norske Veritas Proof: acceptance test certificate from Det Norske Veritas
10	**Germanic Lloyd**	a) Material acceptance: Germanic Lloyd Proof: acceptance test certificate from Germanic Lloyd b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Germanic Lloyd Proof: acceptance test certificate from Germanic Lloyd
11	**Bureau Veritas**	a) Material acceptance: Bureau Veritas Proof: acceptance test certificate from Bureau Veritas b) Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B c) Final acceptance: Bureau Veritas Proof: acceptance test certificate from Bureau Veritas

5.1 ACCEPTANCE SPECIFICATIONS

No.	Specifications	Requirements, proofs
12	**USSR Register of Shipping**	Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B Final acceptance: USSR Register of Shipping Proof: acceptance test certificate from USSR Register of Shipping
13	**Registro Italiano Navale**	Material acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1 B Final acceptance: RINA Proof: acceptance test certificate from RINA
14	**Register Boiler Regulations**	Material acceptance: independent inspectors commissioned by the manufacturer Proof: acceptance test certificate from the independent inspectors commissioned Final acceptance: independent inspectors commissioned by the manufacturer Proof: acceptance test certificate from the independent inspectors commissioned
15	**Final acceptance as per customer's instructions**	Material acceptance: independent inspectors commissioned by the manufacturer Proof: according to customer's instructions Final acceptance: manufacturer's plant Proof: acceptance test certificate DIN 50049-3.1-B

5.1 ACCEPTANCE TESTS ON ALL VALVES

Certificate to DIN 50049	Test responsibility and signature		Delivery conditions	Basis of certificate
- 2.1 Manufacturer's certificate of compliance with order			According to customer's instructions	Current operational inspections and knowledge of production Results from inspections of delivery or of the stated inspection units
- 2.2 Manufacturer's certificate	Manufacturing or processing plant			
- 2.3 Manufacturer's test certificate				
- 3.1 A Acceptance test certificate A		Independent inspector named in the official specification	According to official specifications or the associated Technical Rules	
- 3.1 B Acceptance test certificate B	From the production of independent inspectors	Manufacturer's inspector	According to the customer's instructions, possibly also according to official specifications and the associated technical rules	Results of inspections of delivery or the stated inspection units
- 3.1 C Acceptance test certificate C		Independent inspector commisioned by the customer	According to customer's instructions	
- 3.2 A Acceptance test report A	As for acceptance test certificate A	Aditional signature from the manufacturer's inspector	As for acceptance test certificate A	As for acceptance test certificate A
- 3.2 C Acceptance test report C	As for acceptance test certificate C		As for acceptance test certificate C	As for acceptance test certificate C

5.2 GENERAL RESISTANCE

Material	Abbreviation	Properties	Thermal range of application
Acrylonitrile-butadiene rubber	NBR	NBR has good mechanical properties, good low-temperature behaviour and a higher abrasion resistance than most other elastomers. It is highly resistant to mineral oils, HFA, HFB and HFC liquids. The ozone and weather resistance is limited.	-20°C to +90°C
Ethylene-propylene rubber	EPDM	EPDM is ideal for use in phosphate-ester-based hydraulic fluids, for glycol-based brake fluids, hot water and hot steam. It has good ozone and weather resistance but it is not resistant to mineral oil products.	-10°C to +120°C
Chlorosulphonated polyethylene	CSM	Good chlorine and weather resistance. Bad for oils and grease.	-10°C to +100°C
Fluorocarbon rubber	FPM	This material is excellent for high temperatures and has good chemical resistance. With applications in water and steam the upper temperature limit is approx. +60 °C. On account of its low permeability to gas FPM is suitable for high vacuums. However, it has good resistance to mineral oils, HFA, HFB and HFD fluids and is resistant to ozone and weather.	-25°C to +200°C
Silicone rubber	VSI	VSI behaves well at high and low temperatures, has good weather resistance and good physiological properties. It is the material of choice for hot air. Its mechanical properties are moderate and it is not resistant to mineral oils. VSI should not be used as a material for dynamic seals.	-50°C to +210°C
Polyurethane elastomer	AU	Polyurethane elastomers are split up into polyester urethanes (AU), which generally have the better mechanical properties, and polyether urethanes (EU), which have the better hydrolysis properties. Both have excellent resistance to wear, high crack resistance and elasticity, as well as low permeability to gas. AU has good resistance to mineral oils.	-20°C to +90°C
Polytetrafluoroethylene	PTFE	PTFE has virtually universal chemical resistance and very high thermal resistance. Its slip and electrical properties are very good, whilst resistance to weather and UV is excellent. The mechanical properties of PTFE are improved by adding various fillers. In areas with high exposure to radiation this plastic decomposes.	-50°C to +200°C

5.3 TRANSLATION TABLE OF TECHNICAL TERMS

English	German	French	Italian	Spanish
Air Relief Valves	Entlüfter	Soupapes de décharge pour air	Valvole sfiato aria	Válvulas de alvio de aire
Automatic Control Valves	automatische Regelarmaturen	Soupapes de décharge automatiques	Valvole di controllo automatiche	Válvulas automaticas de control
Ball (float) Valves	Schwimmerventile	Robinets à flotteur	Valvole a galleggiante	Válvulas de flotador
Ball Valves	Kugelhähne	Robinets à boisseau spherique	Valvole a sfera	Válvulas de bola
Butterfly Valves	Drosselklappen	Vannes à papillon	Valvole a fartalla	Válvulas de mariposa
CeramicValves	Armaturen aus Keramik	Robinetterie en Céramique	Valvole ceramische	Válvulas céramicas
Check Valves	Rückschlagventile	Clapets de non retour	Valvole di ritegno	Válvulas de retención
Cocks	Hähne	Robinets	Rubinetti	Grifos
Diaphragm Valves	Membranventile	Robinets à diaphragme	Valvole diaframma	Válvulas de diafragma
Fusible Link Valves	Schmelzsicherungen	Robinets à pastille fusible	Valvole a fusible	Válvulas de eclisa fundible
Flow Regulating Valves	Regulierventile	Soupapes régulatrices de débit	Valvole regolatrici del flusso	Válvulas reguladoras de caudal
Gate Valves	Schieber	Vannes à passages direct	Valvole a saracinesca	Válvulas de compuerta
Globe Valves	Durchgangsventile	Robinets à soupapes	Valvole a tappo	Válvulas de asiento
Lever & Weight Safety Valves	Sicherheitsventile mit Gewichts- oder Federbelastung	Soupapes de sûreté á contrepoids	Valvole di sicurezza acontrappeso	Válvulas de seguridad de contrapeso
Lubricated Plug	schmierbare Hähne	Robinets à boisseau lubrifiés	Rubinetti a maschio lubrificato	Válvulas de macho lubricado
Non-Lubricated Plug Valves	nicht schmierbare Hähne	Robinets à boisseau non-lubrifiés	Rubinetti a maschio non-lubrificato	Válvulas de macho no lubricado
Parallel Slide Valves	Parallel-Absperrschieber	Vannes à sièges parallèles	Valvole a sedi parallele	Válvulas de doble compuerta de caras paralelas
Pilot Operated Safety Valves	Sicherheitsventile mit Hilfssteuerung	Soupapes de sûreté à clapet pilote	Valvole di securezza servocommandate	Válvulas de seguridad accionadas por piloto
Pinch Valves	Quetscharmaturen	Robinets à membrane	Valvole a manicotto deformabile	Válvulas de pinza
Plastic Valves	Armaturen aus Kunststoff	Robinetterie en plastique	Rubinetti a maschio lubrificatoalvole di plastica	Válvulas de plastico
Plug Valves	Hähne	Robinets à boisseau	Rubinetti a maschio	Válvulas de macho
Pressure Control Valves	Druckregler	Soupapes régulartrices de pression	Rubinetti a maschio lubrificatoalvole regolatrici di pressione	Válvulas reguladoras de presion
Pressure Reducing Valves	Druckminderer	Détendeurs de pression	Valvole reduttrici di pressione	Válvulas reductoras de presion
Radiator Valves	Heizkörperarmaturen	Robinetterie pour radiateur	Valvole del termosfino	Válvulas para radiadores
Relief Valves	Überstromventile	Soupapes de décharge	Valvole di sfioro	Válvulas de alivio
Safety Valves	Sicherheitsventile	Soupapes de sûreté	Valvole di sicurezza	Válvulas de seguridad
Spring Loaded	federbelastet	Soupapes de sûreté a ressort	Valvole di sicurezza a molla	Válvulas de seguridad con resortes
Stop Valves	Absperrventile	Robinets d´arrêt	Valvole d´intercattazione	Válvulas de interupción
Temperature Regulating Valves	Temperaturregler	Soupapes régulatrices de température	Valvole regolatrici di temperatura	Válvulas reguladoras de temperatura
Thermostatic Mixing Vaves	thermostatische Mischhähne	Mitigeurs thermostatiques	Valvole miscelatrici termostatiche	Válvulas mezcladoras termostáticas

5.4 SYMBOLS FOR VALVES

Type Group	Type Sub-group	Description, remarks
		Valve, general
		Stop valve
		Slide valve
		Stop cock
		Butterfly valve
		Control valve
		Valve with continuous control
		Valve with safety function
Stop valves		
		Stop ball valve
		Stop cone valve, plug valve
		Stop valve, closed
		Stop valve, open
Valves with control/regulation function		
		Pressure reducing valve (after-pressure controller)
		Relief valve (pilot pressure controller)
Valves with safety function		
		Safety valve
		Safety valve, spring loaded, globe type
		Safety valve, weight-loaded, angle type
		Back flow preventer
		Check valve
		Swing type check valve
		Venting and air relief valve
		Fire damper
		Bursting disc, curved

Type Group	Type Sub-goup	Description, remarks
Direction, branch or union		
		Globe valve
		Angle valve
		Three-way valve
		Four-way valve
Actuators		
		Manual actuator
		Motorised actuator
		Electromagnetic actuator
		Fluid actuator (hydraulic or pneumatic)
		Diaphragm actuator
		Piston actuator
		Control against fixed weight
		Control against fixed spring force
		Float actuator
		Expansion actuator valve
Connections		
		Flanged
		Welded
		Bolted
		Inserted

5.5 ABBREVIATIONS FOR NAMES OF STANDARDS

AA	Aluminium Association
AAR	Association of American Railroads
AASHO	American Association of State Highway Officials
ABCQ	Associação Brasileira de Contròle de Qualidade
ABNT	Associação Brasileira de Normas Técnicas
ABS	American Bureau of Shipping
ACI	Alloy Casting Institute
AD	Arbeitsgemeinschaft Druckbehälter
AEC	Atomic Energy Commission
AECMA	Association Européenne des Constructeurs de Matériel Aèrospatial, Paris
AENOR	Asociación Española de Normalización y Certificación
AFNOR	Association Française de Normalisation
AFW	Akademie für Führungskräfte der Wirtschaft e.V.
AIEE	American Institute of Electrical Engineers
AISE	Association of Iron and Steel Engineers
AISI	American Iron and Steel Institute
AMS	Aerospace Materials Specification
ANP	Ausschuss Normenpraxis im DIN
ANSI	American National Standards Institute
API	American Petroleum Institute
ARSO	Atrican Regional Standards Organization
A.S.	Australian Standard Specification
ASA	American Standard Association
ASME	American Society of Mechanical Engineers
ASMO	Arab Organization for Standardization and Metrology
ASRE	American Society of Refrigerating Engineers
ASSAB	Associated Swedish Steel AB
ASTM	American Society for Testing and Materials
AWF	Ausschuss für Wirtschaftliche Fertigung e.V.
AWS	American Welding Society
AWV	Ausschuss für wirtschaftliche Verwaltung e.V.
BC	British Cooperation Register
BCIRA	British Cast Iron Research Association
BDS	Bulgarische Norm
BIBB	Bundesinstitut für Berufsbildung
BS (I)	British Standards (Institution)
BV	Bureau Veritas, Paris
BWB	Bundesamt für Wehrtechnik und Beschaffung
BWG	Birmingnam Wire Gauge
CARICOMCO	Caribbean Common Market Standards Council
CAS	Normenorganisation der Volksrepublik China
CCITB	China Commodity Inspection and Testing Bureau
CDA	Copper DevelopmenIt Association
CEN	Europäisches Komitee für Normung (Comité Européen de Normalisation)
CENIM	Centro Nacional de Investigadciones Metalurgicas
CERN	Conseil Européen pour la Recherche Nucléaire
CI	Cast Iron
CMEA	Council tor Mutual Economic Assistance
COLIME	Comité de Liaison des Industries Métalliques Européennes
COPANT	Pan American Standards Commission
CS	Commercial Standard
CSA	Canadian Standards Association
CSN	Tschechoslowakische Norm
DEK	Deutsche Echtheitskommission
DGOR	Deutsche Gesellschaft für Operations Research
DGQ	Deutsche Gesellschaft für Qualität
DIN	Deutsches Institut für Normung e.V.
DNA	Deutscher Normenausschuss
DNV	Det Norske Veritas
DS	Dansk Standardiseringsraad
DVM	Deutscher Verband für Materialprüfung
DVS	Deutscher Verband für Schweißtechnik e.V.
EGKS	Europäische Gemeinschaft für Kohle und Stahl
EIA	Electronic Industries Association
EN	Europäische Norm
EU	EURONORM
EOS	Ägyptische Normenorganisation
ESI	Äthiopisches Normeninstitut
ESU	Elektroschlacke-Umschmelzverfahren
GAEB	Gemeinsamer Ausschuss „Elektronik Im Bauwesen"
GIC	Gray Iron Casting
GL	Germanischer Lloyd
GOST	Sovietische Norm (Gosudarstvenny Standart)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IBN	Institut Beilge de Normalisation
ICI	Imperial Chemical Industries
IEC	Internationale Elektrotechnische Kommission
INMETRO	Institute de Metrologia Normalização e Qualidade Industrial (Brasilien)
INPM	Instituto de Pesos e Medidas (Brasilien)
IRE	Institute of Radio Engineers
IRS	Indian Railway Specification
ISA	International Federation of the National Standardizing Associations
ISI	Indian Standards Institution
ISO	International Standard Organisation
IVBH	Internationale Vereinigung für Brücken und Hochbau
IWG	Imperial Wire Gauge
JAN	Joint Army-Navy Specification
JIS	Japanese Industrial Standards
JSA	Japanese Standard Association
JUS	Jugoslawische Norm
KBS	Kenya Bureau of Standards
LR	Lloyd's Register of Shipping
LSG	Legal Standard Gauge (= IWG)
LW	Werkstoff-Handbuch der Deutschen Luftfahrt
LWG	Legal Wire Gauge (= IWG)
M	Siemens-Martin-Stahl, Siemens-Martin-Verfahren
Mat-A.	Materialamt der Bundeswehr
MIC	Ministério da Industria e do Comercio (Brasilien)
MIL	Military Specification, Washington
MSZ	Ungarische Norm
N	Newton
NASA	National Aeronautics and Space Administration
NACE	National Association of Corrosion Engineers
NB	Nominal Bore (= Nennweite)
NBN	Normes Belges normalisees
NBS	National Bureau of Standards
ND	Nenndruck
NEMA	National Electrical Manufacturer Association
NEN	Norm des Nederlands Normalisatie-Instituut
NF	Norme Française
NNI	Nederlands Normalisatie-Instituut
NOP	Schweizerische Normenpraxis
NSF	Norges Standardiseringsforbund
NSO	Nigerianische Normenorganisation
NW	Nennweite
ÖNORM	Norm des österreichischen Normungsinstituts
PASC	Pacific Area Standards Congress
PN	Polnische Norm
QO-S	Federal Specification, Washington
RAL	Ausschuss für Lieferbedingungen und Gütesicherung beim DNA
REFA	Verband für Arbeitsstudien e.V.
RKW	Rationalisierungskuratorium der Deutschen Wirtschaft
RTMA	Radio-Electronics-Television Manufacturers Association
SAA	Standards Association of Australia
SAE	Society of Automotive Engineers
SEW	Stahl-Eisen-Werkstoffblatt
SFS	Suomen Standardisoimisliitto r.y.
SI	Internationales Einheitssystem
SINMETRO	Slistema Nacional de Metrologia Normalização e Qualidade Industrial (Brasilien)
SIS	Svensk Industrie Standard
SME	Society of Manufacturing Engineers
SNCF	Societé Nationale das Chemins de Fer (France)
STAS	Rumänische Norm
SWG	Imperial Standard Wire Gauge (= IWG)
TBS	Tanzania Bureau of Standards
TGL	DDR-Norm *
TI	Tube Investment
TL	Technische Lieferbedingungen
TLDB	Technische Lieferbedingungen der Deutschen Bundesbahn
TMCA	Titanium Metals Corporation of America
TÜV	Technischer Überwachungsverein
UEAtc	Europäische Union für technische Zulassungen
UIC	Union Internationale des Chemins de Fer (Internationaler Eisanbahnverband)
UNE	Spanische Norm
UNI	Unificazione Italiana (Ente Nazionale Italiano di Unificazione)
UNS	Unified Numbering System
UNSIDER	Sezione DI UNIFICAZIONE SIDERURGICA (Italien)
VDA	Verband der Automobilindustrie
VDE	Verband Deutscher Elektrotechniker
VDEh	Verein Deutscher Eisenhüttenleute
VDI	Verein Deutscher Ingenieure
VDMA	Verein Deutscher Maschinenbau-Anstalten
VdTÜV	Vereinigung der Technischen Überwachungsvereine
Wbl	Werkstoffblatt
WW	Werkstoff-Handbuch der Wehrtechnik
ZDA	Zinc Development Association, London
ZMD	Zentralstelle für maschinelle Dokumentation

* only for reference purposes

5.6 EXPLOSION PROTECTION

Description	EEx...I for mining EEx...II for all other sectors		
Basic terms	**Symbol**	**EN...**	**Installer regulations for Germany**
General provisions		50014	DIN 57165 or. VDE 0165 and DIN/EN 50039
Oil enclosure	o	50015	
Excess pressure enclosure	p	50016	
Sand enclosure	q	50017	
Pressure-resistant enclosure	d	50018	
Increased safety	e	50019	
Intrinsic safety	ia, ib	50020	
Encapsulation	m	50028	
Intrinsically safe systems	i	50039	
Explosion categories	IIA, IIB, IIC after minimum ignition in the case of „i" or maximum permitted gap in the case of „d"		
Temperature class of equipment	T1 - 450 °C T3 - 200 °C T5 - 100 °C		T2 - 300°C T4 - 135°C T6 - 85°C

Explanation of the table on the following page:

1) Extract from the table „Safety parameters of combustible gases and vapours" in accordance with VDE 0165, September 1983.
2) The numbering (column 1) under which the substances are listed coincides with the consecutive numbers in the aforementioned table.
3) The terms flash point (column 3), ignition temperature (column 4), temperature compensation (column 5) and explosion category (column 6) are explained in section 2.
4) For the substances the explosion categories has not yet been determined.
5) The ignition temperature of these hydrocarbon compounds depends on composition; in special cases it may be above 300 °C. Compare the relevant footnotes in the aforementioned table.
6) The flash point chiefly depends on when the respective hydrocarbon compound begins to boil. Compare to the relevant preliminary remarks and footnotes in annex II and III of the aforementioned table, including supplement 5. The limit values of the flashpoints of diesel fuels and EL,L,M and S fuel oil are in accordance with DIN 51601 and DIN 51603, part 1 and 2 of the terms of delivery.
7) Also explosion group IIB + CS2.
8) Also explosion group IIB + H2.

5.6 EXPLOSION PROTECTION Safety parameters of combustible gases and vapours

1 No. [2]	2 Name of substance	3 Flash point [3] °C	4 Ignition temp. [3] °C	5 Temperature class	6 Explosion group [3]
2	Acetaldehyde	< -20	140	T4	IIA
6	Acetone	< -20	540	T1	IIA
14	Acetylene	(gas)	305	T2	IIC [9]
20	Ethane	(gas)	515	T1	IIA
24	Ethyl acetate	-4	460	T1	IIA
27	Ethyl ether	< -20	180 Peroxide formation	T4	IIB
28	Ethyl alcohol	12	425	T2	IIB/IIA
52	Ethyl chloride	(gas)	510	T1	IIA
58	Ethylene	(gas)	425	T2	IIB
64	Ethylene oxide	(gas)	440 Spontan. decomposit.	T2	IIB
67	Ethyl glycol	40	235	T3	- [4]
103	Ammonia	(gas)	630	T1	IIA
106	i-Amyl acetate	25	380	T2	IIA
	Benzenes, petrol Boiling point <135 °C	< 21 [6]	220 to 300 [5]	T3	IIA
II/III	Special benzenes Boiling point >135 °C	> 21 [6]	220 to 300 [5]	T3	IIA
135	Benzole (pure)	-11	555	T1	IIA
152	n-Butane	(gas)	365	T2	IIA
165	n-Butyl alcohol	35	340	T2	IIA
243	Cyclohexanone	43	430	T2	IIA
324	1,2- Dichlorethane	13	440	T2	IIA
II/17	Diesel fuels DIN 51 601/04.78	> 55 [6]	220 to 300 [5]	T3	IIA
II/16	Jets fuels	< -20 to 60 [6]	220 to 300 [5]	T3	IIA
421	Acetic acid	40	485	T1	IIA
422	Acetic acid anhydride	49	330	T2	IIA
II/21	EL fuel oil DIN 51 603 Part 1/12.81	> 55 [6]	220 to 300 [5]	T3	IIA
II/22	L fuel oil DIN 51 603 Part 2/10.76	> 55 [6]	220 to 300 [5]	T3	IIA
II/23	M and S fuel oils	> 65 [6]	220 to 300 [5]	T3	IIA
und 24	DIN 51 603 Part 2/10.76	> 65 [6]	220 to 300 [5]	T3	IIA
448	n-Hexane	< -20	240	T3	IIA
469	Carbon monoxide	(gas)	605	T1	IIA
485	Methane	(gas)	595 (650)	T1	IIA
503	Methanol	11	455	T1	IIA
519	Methyl chloride	(gas)	625	T1	IIA
564	Naphtalene	80	520	T1	IIA
600	Oleic acid	189	360 Spontan. decomposit.	T2	- [4]
616	Phenol	82	595	T1	IIA
637	Propane	(gas)	470	T1	IIA
650	n-Propyl alcohol	15	405	T2	- [4]
681	Carbon bisulphide	< -20	95 [1]	T6 [1]	IIC [7]
682	Hydrogen sulphide	(gas)	270	T3	IIB
I/6	Town gas (lightning gas)	(gas)	ca. 560	T1	IIB
699	Tetraline (tetrahydronaphtalene)	77	425	T2	- [4]
709	Toluene	6	535	T1	IIA
777	Hydrogen	(gas)	560	T1	IIC [8]

Materials in accordance with DIN / EN / ASTM

Stainless steels

Material no.	DIN		EN		ASTM
	Standard	Description	Standard	Description	
1.4000	17440	X6Cr13	10088-3	X6Cr13	A276 Gr. 403
1.4006	17440	X10Cr13	10088-3	X12Cr13	A276 Gr. 410
1.4021	17440	X20Cr13	10088-3	X20Cr13	A276 Gr. 420
1.4057	17440	X20CrNi17 2	10088-3	X17CrNi16-2	A276 Gr. 431
1.4104	17440	X12CrMoS17	10088-3	X14CrMoS17	AISI Gr. 430 F
1.4301	17440	X5CrNi18 10	10088-3	X5CrNi18-10	A276 Gr. 304
1.4305	17440	X5CrNi18 9	10088-3	X8CrNi18-9	AISI Gr. 303
1.4310	SEW400	X12CrNi17 7	10088-3	X10CrNi18-8	A313 Gr. 302
1.4401	17440	X5CrNiMo17 12 2	10088-3	X5CrNiMo17-12-2	A276 Gr. 316
1.4404	17440	X2CrNiMo17 13 2	10088-3	X2CrNiMo17-12-2	A276 Gr. 316L
1.4406	17440	X2CrNiMoN17 12 2	10088-3	X2CrNiMoN17-11-2	A276 Gr. 316LN
1.4418	SEW400	X4CrNiMo16 5	10088-3	X4CrNiMo16-5-1	–
1.4436	17440	X5CrNiMo17 13 3	10088-3	X3CrNiMo17-13-3	A276 Gr. 316
1.4439	17440	X2CrNiMoN17 13 5	10088-3	X2CrNiMoN17-13-5	A312
1.4462	17440	X2CrNiMoN22 5 3	10088-3	X2CrNiMoN22-5-3	A182 Gr. F51
1.4529*	SEW400	X1CrNiMoCuN25 20 6	10088-3	X1CrNiCrMoCuN25-20-7	UNS N08926
1.4539	17440	X1CrNiMoCuN25 20 5	10088-3	X1CrNiCrMoCu25-20-5	UNS N08904
1.4541	17440	X6CrNiTi18 10	10088-3	X6CrNiTi18-10	A240 Gr. 321
1.4571	17440	X6CrNiMoTi17 12 2	10088-3	X6CrNiMoTi17-12-2	A240 Gr. 316Ti

* Avesta 254 SMo

Steel, unalloyed and low-alloy

Material no.	DIN		EN		ASTM
	Standard	Description	Standard	Description	
1.0035	17100	St 33	10025	S185	A 283 Gr. A
1.0037	17100	St 37-2	10025	S235 JR	A 283 Gr. C
1.0038	17100	RSt 37-2	10025	S235 JR G2	A 283 Gr. B+C
1.0050	17100	St 50-2	10025	E295	A 570 Gr. 50
1.0116	17100	St 37-3N	10025	S235 JR G3	A 570 Gr. 36
1.0570	17100	St52-3	10025	S355 J2 G3	A 572 Gr. 50
1.0402	17200	C22	10083	C22	A 576 Gr. 1020
1.0425	17155	HII	10028	P265 GH	A 285 Gr. B
1.0460	17243	C22.8	10273	C22 G2	A 10 5
1.0501	17240	C35	10083	C35	A576 Gr. 1035
1.0718	1651	9 SMnPb28	10087	11 SMn Pb 30	SAE 12L14
1.0509	17240	C45	10083	C45	A 576 Gr. 1045
1.7225	17200	42CrMo4	10083	42CrMo4	A 322 Gr. 4170
1.7131	17210	16MnCr5	10084	16MnCr5	A 304 Gr. 4118H
1.7218	17200	25CrMo4	10083	25CrMo4	A 322 Gr 4130
1.7335	17155	13CrMo44	10028	13CrMo4-5	A182 Gr. F12
1.8159	17200	50CrV4	10083	51CrV4	A322 Gr 6150

Materials in accordance with DIN / EN / ASTM

Cast materials

Material no.	DIN		EN		ASTM
	Standard	Description	Standard	Description	
0.6025	1691	GG-25	1561	GJL-250	A48 Gr. 40B
0.7040	1693	GGG-40	1563	GJS-400-15	A536 Gr. 60-40-18
0.7043	1693	GGG-40.3	1563	GJS-400-18LT	–
1.0619	17245	GS-C25	10213-1	GP 240 GH	A216 Gr. WCB
1.4308	17445	G-X6CrNi18 9	10213-4	G X5CrNi19-10	A351 Gr. CF8
1.4408	17445	G-X6CrNiMo18 10	10213-4	G X5CrNiMo19-11-2	A351 Gr. CF8M
1.4469	17445	G-X2CrNiMoN25 7 4	10213-4	G X2CrNiMoN26-7-4	Alloy SX
1.4008	17445	G-X12Cr14	10283	GX8CrNi13	A217 Gr. CA15
2.0975	1714	G-CuAl10Ni	1982	CuAl10Fe5Ni5-C	C95 800
2.4617	–	Hastelloy B-2	–	–	UNS N10665
3.2163	1725 T2	G-AlSi9Cu3	–	–	AA B380.1

Fasteners

Material no.	DIN		EN		ASTM	
	Standard	Description	Standard	Description	A193	A194
1.0501	17240	C35	10083	C35	2H	4
1.7225[3)]	17200	42CrMo4	10083	42CrMo4	B7	–
1.7258	17240	24CrMo4	–	24CrMo4	–	4
1.7711	17240	40CrMoV47	10269	40CrMoV4-7	B16	–
1.4301[1)]	17440	X5CrNi18 10	10088-3	X5CrNi18-10	B8	8
1.4541[1)]	17440	X6CrNiTi18 10	10088-3	X6CrNiTi18-10	B8T	8T
1.4401[2)]	17440	X5CrNiMo17 12 2	10088-3	X5CrNiMo17-12-2	B8M	8M
1.4021	17440	X20Cr13	10088-3	X20Cr13	B6	6

1) A2-70 DIN 267 T18

2) A4-70 DIN 267 T18

3) Also ASTM A320 Gr. L7 for low temperature

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