



Tata Steel Technical Directive

R1 81 01 01 Flange assembly procedure and torque tables

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Information and changes

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INTRODUCTION

This technical directive supplements the standards intended for pipe systems based on DIN and EN. The relevant DIN and EN standards do not provide information about the force that can be used when making a flange connection between pipe flanges.

This Technical Directive therefore provides additional data and conditions that must be met to produce a good flange joint.

This includes:

- Assembly procedure;
- Tightening of the bolts;
- Example flange protocol;
- Torque tables.



This document is not made for selection of gasket material. For this see:

- R1850001 Gasket specifications;
- R1850101 Field of application and range of gaskets on the basis of: Media, Flanges, Nominal Diameter (DN), Pressure Rating (PN) and Temperatures.

1 APPLICABLE CODES AND STANDARDS

EN-standard

Technical Directive

EN 1092-1 Flanges and their joints; Circular flanges for pipes, valves, fittings and accessories, PN designed; Part 1: Steel flanges

EN 1591-1 Flanges and their joints; Design rules for gasketed circular flange connections; Part 1: Calculation

EN 1591-4 Flanges and their joints; Part 4: Qualification of personnel competency in the assembly of the bolted connections of critical service pressurized systems



Tatasteel-standards

connections

- Tata Steel QHSE
- Tata Steel Standard S1768101
- Tata Steel Directive R1850001
- Tata Steel Directive R1420102 part 2
- Flange management The marking of medium carriers Gaskets Design of hydraulic- & pneumatic flange
- VCA-certificate WF (Working on flange connections, Werken aan flensverbindingen)
- VCA-certificate WFpr (Working on flange connections according to protocol, Werken aan flensverbindingen volgens protocol)

2 STARTING POINTS FOR TORQUE CALCULATION

5.30

- The calculation has been performed based on EN 1591-1 (version 2014);
- Calculation has been performed with leak tightness L0,01; means a specific leakage rate should be equal or less than 0.01 mgs-1m-1;
- Coefficient of friction applied in the calculation is 0,15 or 0,14 and then used as input for the other grease types;
- As the basis for the calculation of the torque values, the flange-, gasket- and bolting materials are used;
- Special materials as nickel, titanium, etc. are not included in the torque calculation, this needs to be performed case to case;
- Gasket strength parameters based on http://www.gasketdata.org;
- Tolerance and corrosion allowance are not taken into account for the torque calculation;
- Additional loads according to EN 1092-1 have been taken into account for the calculation for EN flanges;
- The values of the torque tables are based on acceptable stress values;
- The torque values for FRP are based on manufacturers standard.





3 ASSEMBLY PROCEDURE

Depending on the flange category determined in QHSE 5.30 a "flange protocol" shall be filled in during the flange assembly. For an example see chapter 7.

3.1 Surface condition of flange gasket surface

In case flange gasket surface has been temporarily covered e.g. with an anti-corrosion coating, the coating has to be removed before the assembly.

When gaskets are replaced, attention must be paid to fully remove the old gasket from the flange facing without damaging the flange gasket surface.

3.2 Visual inspection before assembly

Attention should be paid to having the flange faces clean, intact and flat. In particular, no surface damage in the form of radial oriented grooves or impact scars may occur. In case of doubt the damage must be examined on the spot by an expert, and the flanges have to be replaced or modified as mentioned below:

- Bolts, nuts and washers must be clean and intact. Special attention should be given to screw threading and bearing surfaces;
- Bolts, nuts and washers disassembled during mounting operations should be replaced by new ones, or the bolts, washers and nuts have to be in very good condition to make reuse possible;
- Check bolt and nut materials before installing (bolt and nut identification symbols can be found on the bolt top and nu top);
- Before installation the mechanic shall verify the correctness and damages on the gasket;
- The gasket must be clean, intact, dry and free of dirt;
- In practice, it is permitted to apply spray adhesive very thinly to 4 quadrants with large gaskets. Spray adhesive is not allowed for oxygen systems. The application of glue, graphite tape or mounting pastes is not allowed;
- Used gaskets may not be reused with exception of undamaged rubber gaskets without insert;
- All gaskets which are to be installed must be free of faults and defects. Fiber and elastomer gaskets may not be exposed to UV radiation (sunlight) or heat for long periods during storage. The manufacturer's instruction must be followed.

3.3 Lubrication and lubricants

To minimize frictional forces, the contact surfaces of the bolts, nuts and washers must be pre-treated with suitable lubricants before tightening. Optimum lubrication is achieved when all contact surfaces, including the threading and landing area nut are lubricated. Only in this way the required pre-clamping force of the bolts can be achieved.

As a principle all lubricants should be applied in a thin but fully covering film. Over-greasing bring no advantage in respect of friction reduction or otherwise. Basically, molycote is prescribed as a lubricant.

For oxygen piping, only Berulub OX 40 EP or Berulub OX 100 EP shall be used as lubricant on the bolts and washers.

If the bolt connections are exposed to operating temperatures > 250°C, heat-resistant lubricant must be applied.

Ensure that the lubricant is chemically compatible with bolt, nut, washer and process medium. This will avoid lubricant that could contribute to stress corrosion cracking, galvanic corrosion, oxygen auto ignition etc.



3.4 Inserting an aligning the gasket

Gaskets to be used have to be mounted according to the gasket list of the pipe system specification, cross indexes, key lists, isometrical drawings, job description of the apparatus.

Synthetic fiber gaskets may not be greased. Greasing will have a negative effect on the compressive strength and the gas tightness of the gasket. The gasket is delivered with a non-sticking layer. The reinforced graphite gasket needs to be installed in dry condition for the above reason.



For correct mounting of the flange joints it is essential that the flanges are aligned in parallel, allowing positioned insertion of the gasket without damaging. In particular in case of reduced-shaft bolts an assembly aid should be applied in the form centring bolts.

The sealing faces should be pushed apart to the extent that the gasket can be inserted without applying force and without damaging.

Proper alignment of all joint members is essential to ensure maximum sealing surface contact, maximum opportunity for uniform and designed sealing pressure and reduced friction between the nut and the flange.

The gap between the sealing surfaces, after the bolts have been hand-tightened without tools, but before the bolts are tightened with the torque wrench, should be checked. The maximum allowable opening is shown in the table below.

The opening should be repaired first on the side where it is widest (a). If the distance is greater than described in the table, an attempt may be made to get the largest deviation within the tolerance with a maximum of 10% of the tightening torque.



DN	a – b (mm)
10-150	± 0,5
> 150	± 1,0

As per NEN EN 13480-4 Annex B

4 TIGHTENING OF THE BOLTS

4.1 General

The sequence in which the bolts and nuts are tightened has an essential effect on the distribution of forces acting on the gasket (plane pressure). Inappropriate tightening leads to a wide dispersion of sealing pressure and can result in a shortfall from the required minimum sealing pressure, causing leakage.



After the nuts are tightened, the nut height should fully bear on the bolt and pierce at least 1 pass. The recommended number of passes through the nut is 3.





Care is taken that the nut does not get stuck on the shoulder (borst) of the bolt, so that the tightening torque is achieved but the correct surface pressure is not.



Threaded rods should be mounted in such a way that the protrusion is about the same on both ends. Bolt heads, nut and washers must be in plane. The bolts should be pre-positioned by hand, observing the following:



- All bolts and nuts must be twisted over each other manually without hitches, if in doubt they must be replaced;
- All new bolts, nuts and washers shall be hot dip galvanised (according to NEN EN ISO 10684). This shall be reconsidered in case of "special" environmental conditions.
- Under the nuts washers according to ISO 7089 or ISO 7090 shall be used. The hardness of the washers shall be at least class 200HV by using bolts up to grade 8.8;
- Install the bolts in such a manner that all bolt heads are on one side of the flange;
- In case of screw joints where the screw head is rotated (blind tapped hole), place the washer under the screw head;
- With horizontally arranged flanges, stich the bolts through from above;
- Replace difficulty moving bolts by smooth-moving ones.



4.2 Tools

To avoid excessive forces on bolted connections when applying the required torque values, the use of calibrated adjustable torque wrenches is required. The torque wrenches may only be used on the nuts. The use of non-adjustable electric or pneumatic impact wrenches or bolts is prohibited. For critical connections, e.g. chlorine, etc., the use of electronic torque wrenches with torque indicator is recommended. Hydraulic tightening tools should only be used after consultation with the foreman or PTC-MCE-HPM.

4.3 Additional requirement for PTFE gaskets

PTFE gaskets need re-torque to compensate for their stress relaxation behaviour. Consult the gaskets supplier for detailed and specific information for the type of gasket used or the PTC MCE HPM department. The common practice is to torque again after 24 hours at process temperature, with 70% of the torque value.

4.4 Additional requirement for reinforced graphite gaskets

When using reinforced graphite gaskets, the bolted connection needs to be tightened in one tightening procedure in depressurized condition. When this isn't done correctly the gasket can suck up medium and the mechanical properties of the gasket are lost.

4.5 Additional requirements for rubber lined butterfly valves

When using a rubber-lined butterfly valve, you can choose to make the seal with the rubber from the lining of the valve. In that case, the supplier will prescribe the tightening torque to be applied in his manual, for example:



4.6 Tightening procedure

The bolts should be tightened in the following sequence:

- 1. All bolt/studs/washers and nuts shall be hand tight mounted,
- 2. Determine the biggest gap (a) (see image below)
- 3. Bolt closest to (a) is bolt 1 (see image below)
- 4. Crosswise as depicted in figures on next pages, to 30% of the nominal torque,
- 5. As 3, to 60% of the nominal torque,
- 6. As 3, to 100% of the nominal torque, and
- 7. Once more to the full nominal torque, going around clockwise.
- 8. Sequence 6. should be repeated until the nuts will turn no further under application of the full torque.



In individual cases the "setting" of the gasket (its adaptation to the flange face) requires re-tightening of bolts. In such cases the bolts, after a few hours or after the first heat exposure, must be re-tightened at room temperature under non pressurized condition of the flange joint. The individual risk assessment is required, if the re-tightening required while in operation at an elevated temperature.



Cross-tightening sequences, the larger the flange the more complex it becomes.

5 DISASSEMBLING

It must be ensured that the installation is non-pressurized and has been flushed.

- Built-in or built-on parts that are not held separate must be secured before the flange joint is dismantled;
- Loosening the bolts and/or nuts should start from the furthest point from the body and then the adjacent bolts, provided that the bolt closest to the fitter is loosened last;
- If the piping is under mechanical stress, the possibility of its sudden deflection must be taken into account;
- When gaskets are exchanged, it must be ensured that the old gasket is completely removed from the flange gasket surface without damaging the gasket contact facing of the flange.



6 REQUIREMENTS

In QHSE 5.30 Flange Management, piping is classified based on the PED and some exceptions in flange categories. Depending on the flange categories, the flange fitter can work with a certificate on a flange connection in pipework. The different certificates can be:

- VCA-WF (working on flange connections),
- VCA-WFpr (working on flange connections under protocol)
- NEN-EN1591 Design rules for flange connections



6.1 Assembling personnel

The mounting of the flange connections shall only be carried out by qualified (certified) personnel. The technician's certificate determines which pipes the technician may work on.



6.2 Quality assurance

From the flange category it follows which quality assurance measures, including the relevant documentation, are required. See QHSE 5.30. The signed protocol form is secured in the data book provided by the supplier. If there is no supplier, the signed protocol form is secured in SAP.

7 FLANGE PROTOCOL (example/ template)

Factory:					
Location:					
Tag number:					
Flange:	Size			DN	_ PN
Gasket:	Туре				
	Quantit	У			
Bolt connection	Bolt size	5		Bolt M_	_X
	Quantit	y of bolts			
	Quantit	y of nuts			
	Quantit	y of washe	rs		
	Grease	type:			
Mounting procedu	re:				9 8
Step 1:	85Nm		Crosswise 30%		•11 9 [•]
Step 2:	170Nm		Crosswise 60%		(•8 3•)
Step 3:	250Nm		Crosswise 100%		•4 7•
Step 4:	250Nm		Clockwise 100%		
Step 5:	250Nm		Clockwise 100%		
				1	
Mounting				Comme	ents:
Piping aligned?		Yes / No			
Bolts thread clean?		Yes / No			
Bolts greased?		Yes / No			
Washers used?		Yes / No			
Torque wrench use	d?	Yes / No		Calibra	ted (/)
Valve/instrument re	enewed	Yes / No			
Final inspection					
Name mechanic:					
Name company:					
Name inspector:					

8 TORQUE TABLES

8.1 Table 1: Pipe class: A010, A060, A061, A120, I010, I011 / PN10 - Graphite Gasket

Pipe clas	s			A060, A12	20, A061, A	010, 1011, 1	010					Table 1			
Pipe syst	em			PN10											
Flange M	aterial			P250GH											
Bolt Mate	rial			25CrMo4 /	8.8										
Gasket N	laterial			Novaphit S	STC TA-L	, novaphit S	STC TA-L	with XP-T	echnology :	2mm					
Gasket N	lanufactur	e		Frenzelit											
Basket ty	/ne	-		IBC											
eak tigh	ness			10.01											
riction				0.15											
)esian n	ressure			According	to the nine	class									
Jesign T	emneratur	e		200% con	sidered in t	he calculati	00								
rosigir r	emperatur			200 0 000	Sidered in t	no calculati									
vternal	force and	momente		DN15 - DN	350: accor	ding to EN1	002_1 (red	luced)							
Atomai	force and	momenta		DN400 D	N500: 1 35	times of int	ornal prace								
				DN600 8 o	houe: 1 tim	an of intern	ernarpress	Suic							-
				DNOUU & a	loove. i tim	es or intern	ai pressur	C							
lower	.														
Deneral	ð Ínn en lete	rianting -t		d autoro al f	erees the -	atual ració		may diffe-	from the b	alaus advia	ad aslaula	ted termine			
Afback	nig on iddi aliik waa da	ncation, st	ate of boit an	lu external f	orces the a	ebtee kee h	eu torque	may onter	nom the D	elow advis	eu caicula	het bierces	lar haralırı		
Athank	elijk van de	e smering,	staat van de	bouten en e	externe kra	Conten kan n	iet werkelij	k benoaigo	de aannaair	noment atv	vijken van	net nierono	Jer bereker	ide aanna	aimomen
Flange			External	B	olt Force K	N		010.45			Torque Nm	1			
size			axial force					010,15		M	08	NOL	ubrication	0,25	
(DN)	Bolt size	Number	(KN)	Min	Max	Used	MIN	мах	Used	MIN	мах	Used	MIN	мах	Used
												07			
15	M12	4	13,6		104	84	12	62	50	6	33	2/	20	103	83
20	M12	4	18,1	17	104	85	17	61	50	9	33	21	28	102	83
25	M12	4	22,6	38	103	85	22	60	50	12	32	27	37	100	83
32	M16	4	29	47	202	131	36	155	100	19	83	53	60	258	167
40	M16	4	36,2	62	201	131	47	154	100	25	82	53	78	257	167
50	M16	4	50	83	204	131	64	156	100	34	83	53	107	260	167
65	M16	8	58,8	123	336	261	47	129	100	25	69	53	78	215	167
80	M16	8	72,4	149	443	261	57	170	100	30	91	53	95	283	167
100	M16	8	100	180	468	261	69	179	100	37	95	53	115	298	167
125	M16	8	101,2	221	462	261	85	177	100	45	94	53	142	295	167
150	M20	8	122,5	247	609	515	120	296	250	64	158	133	200	493	417
200	M20	8	128	326	685	515	158	333	250	84	178	133	263	555	417
250	M20	12	158,1	387	999	772	125	324	250	67	173	133	208	540	417
300	M20	12	173,2	460	1051	772	149	340	250	79	181	133	248	567	417
350	M20	16	187,1	696	1236	1029	169	300	250	90	160	133	282	500	417
400	M24	16	143,5	747	1429	1042	215	412	300	115	220	160	358	687	500
450	M24	20	182.9	1020	1452	1302	235	335	300	125	179	160	392	558	500
500	M24	20	227.5	1329	1514	1389	306	349	320	163	186	171	510	582	533
600	M27	20	243.9	1590	1817	1652	414	473	430	221	252	229	690	788	717
700	M27	24	226.6	1632	2368	1983	354	514	430	189	274	229	590	857	717
800	M30	24	298.1	2133	2808	2454	521	686	600	278	366	320	868	1142	1000
900	M30	27	372 4	2535	3656	2863	531	766	600	283	400	320	885	1277	1000
1000	M30	20	J12,4	2000	4000	2003	704	024	000	203	407	427	1160	1211	4222
1000	: MOO	: 20	410,0	3074	: 4002	3000	701	901	: 000	3/4	497	421	1100	: 1002	1000

8.2 Table 2: Pipe class A210, A211, A241, I200 / PN16 – Graphite Gasket

Pipe class				A210, A21	1, A241, I2	00				Table 2					
Pipe syst	tem			PN16											
Flange M	laterial			P250GH											
Bolt Mate	erial			25CrMo4 /	8.8										
Gasket N	laterial			Novaphit S	STC TA-L /	novaphit S	STC TA-L	with XP-Te	echnology 2	2mm					
Gasket N	lanufactur	e		Frenzelit											
Gasket t	vpe			IBC											
Leak tigh	iness			L0.01											
Friction				0.15											
Desian p	ressure			According	to the pipe	class									
Design T	emperatur	e		200°C cons	idered in th	e calculatio	on								
External	force and	moments		DN15 - DN	1000: acco	rdina EN10	92 -1 (redu	(ced)							
								,							
Remark	s														
- Depend	tina on lubr	rication st	ate of bolt an	d external f	orces the a	ctual requi	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	eliik van de	smerina	staat van de	bouten en e	externe kra	chten kan h	et werkeli	k benodiad	le aanhaaln	noment af	wiiken van	het hierond	der bereker	nde aanha	almome
Flange		, on or not	External	B	olt Force K	N		it bonouige	o dannadan	ionioni an	Torque Nn	1			
size			axial force					Oil 0 15		N	lolycoat 0	08	Nol	ubrication	0.25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	lised	Min	Max	Used	Min	Max	Use
(011)	001 0120	Hambor	(tat)		111425	0000		max	0000						
15	M12	4	13.6	27	98	67	16	59	40	9	31	21	27	98	67
20	M12	4	18.1	43	93	67	26	56	40	14	30	21	43	93	67
25	M12	4	22.6	57	94	67	34	56	40	18	30	21	57	93	67
32	M16	4	29	70	188	128	54	146	100	29	78	53	90	243	167
40	M16	4	36.2	92	185	120	72	144	100	38	77	53	120	240	167
50	M16	4	45.3	115	190	154	90	148	120	48	79	64	150	247	200
65	M16	8	58.8	155	329	257	60	128	100	32	68	53	100	213	167
80	M16	× 8	72.4	101	431	257	74	168	100	30	00	53	123	280	467
100	M16	8	88.1	210	445	308	85	173	120	45	02	64	1/2	200	200
125	M16	8	101.2	272	432	308	106	168	120	57	90	64	177	280	200
150	M20	8	110.8	299	589	412	145	286	200	77	153	107	242	477	200
200	M20	12	128	394	774	618	128	251	200	68	134	107	213	418	322
250	M24	12	143.1	479	919	651	184	353	250	98	188	133	307	588	417
300	M24	12	173.2	615	1305	1042	236	536	400	126	286	213	307	893	667
350	M24	16	164.8	830	1736	1389	230	500	400	127	267	213	398	833	667
400	M27	16	176.1	954	1929	1537	310	628	500	165	207	267	517	1047	822
400	M27	20	126.9	1350	2020	1537	251	520	400	103	282	243	595	880	667
400	M20	20	100,0	1000	2023	1937	276	020 629	400	147	202	213	460	1062	00/
500	MOU	20	210.5	2200	21/0	2504	2/0	000	000	204	524	427	400	1003	422
700	MJJ	20	310,5	2309	3117	2504	/ 30	990	700	394	531	921	1230	1000	133
/00	MJJ	24	319,6	2300	3212	2029	035	0/1 4007	100	339	405	5/3	1058	1452	116
800	M36	24	415,3	3128	3562	3281	906	103/	950	463	553	507	1510	1/20	1583
900	M36	28	467,7	3692	4335	3828	916	10/6	950	489	5/4	507	1527	1/93	1583
1000	M39	28	520,6	4056	5670	4475	1088	1521	1200	580	811	640	1813	2535	2000

8.3 Table 3: Pipe class A270, I250 / PN25 – Graphite Gasket

Pipe cla	ss			A270, I250)							Table 3			
Pipe sys	stem			PN25											
Flange N	/laterial			P250GH											
Bolt Mat	erial			25CrMo4											
Gasket I	Material			Novaphit S	STC TA-L	/ novaphit	SSTC TA-	L with XP-T	echnology	2mm					
Gasket I	Manufactur	е		Frenzelit											
Gasket t	ype			IBC											
Leak tig	nness			L0.01											
Friction				0,15											
Design p	pressure			According	to the pipe	class									
Design 1	Temperatur	e		200°C con	sidered in t	he calcula	tion								
External	force and	moments		DN15 - DN	1600: accoi	rding EN10)92 -1 (red	uced)							
Deme															
Remark	S Jina an Ista	insting -			farmen the	natual es -	uine di terrere		a fan an tha -	halam ach it	ad an lawly	at a d ta a sure			
- Depend	aing on lub	ication, s	tate of bolt a	nd external	torces the	actual req	uirea torqu	le may diffe	r from the	below advis	sed calcula	ated torque			
- Athank	elijk van de	e smering,	staat van de	e bouten en	externe kr	achten kar	1 net werk	elijk benodi	gde aanna	almoment	atwijken va Teenve Nee	in net niero	nder berei	cende aanr	laalmomer
Flange			External		oit Force P			01.0.45		N	Forque INIT	1	No.1	whether	0.05
SIZE (DNI)	Delt size	Number		Min	Max	Lload	Min	011 0, 15	llaad	IV Min	Max	Uo	NO L	Max	U,25
(DN)	Doit size	Number	(KIN)	IVIIII	IVIAX	Used	IVIIII	IVIAX	Usea	IVIIII	IVIAX	Usea	IVIIII	Iviax	Usea
15	M12	1	13.6	27	98	67	16	50	40	Q	21	21	27	98	67
20	M12	4	18.1	11	92	67	26	55	40	1/	29	21	13	92	67
25	M12	4	25	59	93	67	35	56	40	19	30	21	58	93	67
32	M16	4	29	72	188	128	56	146	100	30	78	53	93	243	167
40	M16	4	36.2	92	185	120	72	140	100	38	77	53	120	245	167
50	M16	4	45.3	115	185	128	90	144	100	48	77	53	150	240	167
65	M16	8	58.8	156	415	257	61	162	100	33	86	53	102	270	167
80	M16	8	72.4	194	404	257	76	157	100	41	84	53	127	262	167
100	M20	8	88.1	251	601	412	122	292	200	65	156	107	203	487	333
125	M24	8	101,2	295	751	521	170	433	300	91	231	160	283	722	500
150	M24	8	110,8	382	997	694	220	574	400	117	306	213	367	957	667
200	M24	12	128	527	1282	1042	202	492	400	108	262	213	337	820	667
250	M27	12	143,1	645	1489	1153	280	646	500	149	345	267	467	1077	833
300	M27	16	152,5	838	1752	1230	273	570	400	146	304	213	455	950	667
350	M30	16	164,8	945	2325	1636	347	853	600	185	455	320	578	1422	1000
400	M33	16	176,1	1087	2810	2003	434	1122	800	231	598	427	723	1870	1333
450	M33	20	186,8	1056	3090	2504	337	987	800	180	526	427	562	1645	1333
500	M33	20	206,7	1224	4178	2504	391	1335	800	209	712	427	652	2225	1333
600	M36	20	273.5	1415	4367	2878	492	1517	1000	262	809	533	820	2528	1667

8.4 Table 4: Pipe Class A400, A401, A450 / PN40 – Graphite Gasket

Pipe clas	s			A400, A40	1, A450	A450 Table 4									
Pipe syst	tem			PN40											
Flange M	aterial			P250GH											
Bolt Mate	rial			25CrMo4 /	8.8										
Gasket N	laterial			Novaphit S	STC TA-L	/ novaphit S	STC TA-L	with XP-Te	echnology 2	2mm					
Gasket N	lanufactur	e		Frenzelit											
Gasket t	уре			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C cons	sidered in t	he calculation	on								
External	force and	moments		DN15 - DN	600: accor	ding EN109	2 -1 (reduc	ced)							
Remark	S														
- Depend	ling on lubr	rication, st	ate of bolt an	d external f	orces the a	ctual requi	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en e	externe kra	chten kan h	net werkelij	ik benodigo	le aanhaaln	noment afv	wijken van	het hierond	ler berekei	nde aanhaa	almoment
Flange			External	E	olt Force K	N					Torque Nn	n			
size			axial force				Oil 0,15			M	lolycoat 0,	08	No L	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	13,6	37	98	67	22	59	40	12	31	21	37	98	67
20	M12	4	18,1	59	91	67	35	54	40	19	29	21	58	90	67
25	M12	4	22,6	79	92	84	47	55	50	25	29	27	78	92	83
32	M16	4	29	98	188	128	76	146	100	41	78	53	127	243	167
40	M16	4	36,2	125	185	154	97	144	120	52	77	64	162	240	200
50	M16	4	45,3	160	184	167	125	143	130	67	76	69	208	238	217
65	M16	8	58,8	207	421	308	81	164	120	43	87	64	135	273	200
80	M16	8	72,4	256	411	308	100	160	120	53	85	64	167	267	200
100	M20	8	88,1	300	592	412	146	288	200	78	154	107	243	480	333
125	M24	8	101,2	361	740	521	208	426	300		227	160	347	710	500
150	M24	8	110,8	441	964	694	254	555	400	135	296	213	423	925	667
200	M27	12	128	629	1394	922	273	605	400	146	323	213	455	1008	667
250	M30	12	143,1	841	2052	1432	411	1003	700	219	535	373	685	1672	1167
300	M30	16	152,5	1026	2627	1909	376	963	700	201	514	373	627	1605	1167
350	M33	16	164,8	1011	2959	2003	404	1182	800	215	630	427	673	1970	1333
400	M36	16	180,5	1458	4294	2993	633	1865	1300	338	995	693	1055	3108	2167
450	M36	20	230,6	1519	4668	3741	528	1622	1300	282	865	693	880	2703	2167
500	M39	20	291	1763	5417	3995	662	2034	1500	353	1085	800	1103	3390	2500
600	M45	20	394,4	2253	7396	5466	989	3248	2400	527	1732	1280	1648	5413	4000

8.5 Table 5: Pipe Class A420 / PN40 – Graphite Gasket

Pipe class Pipe data <																
Pipe system Pit40	Pipe clas	s			A420								Table 5			
Flange Material Soft Material Soft Material ChOVeS-7 Novapht SSTC TA-L / novapht SSTC TA-L with XP-Technology 2mm Image: Construct of the procession of theprocession of the procession of the procession of th	Pipe syst	tem			PN40											
Bot Material Gasket Manufacture CirclitoVS-7 (asket Manufacture Novaphi SSTC TA-L vite XVP.Technology Zmm Image: CirclitoVS-7 (asket Manufacture) Image: CirclitoVS-7 (asket Manufacture) <thimage: circlitovs-7<br="">(aske</thimage:>	Flange M	aterial			16Mo3											
Gasket Material Novapht SSTC TA-L / novapht SSTC TA-L with XP-Technology Zmm Image: State Material Mat	Bolt Mate	erial			21CrMoV5	-7										
Gasket Manufacture Frenzelit BC Image: BC	Gasket N	laterial			Novaphit S	STC TA-L	/ novaphit S	STC TA-L	with XP-T	echnology (2mm					
Gasket type BC	Gasket N	lanufactur	е		Frenzelit											
Leak ighness L0.01 0.15 Image: Considered in the pipe class Image: Considered in the calculation Image	Gasket ty	уре			IBC											
Friction According to the pipe class Image: Constrained in the calculation Remarks Constrained in the calculation Constrained in the calculation Constrained in the calculation Constrained in the calculation Figure in the calculation Constrained in the calculation <td>Leak tigh</td> <td>ness</td> <td></td> <td></td> <td>L0.01</td> <td></td>	Leak tigh	ness			L0.01											
Design pressure According to the pipe class Considered in the calculation Considered in the calculation Considered in the calculation Considered in the calculation External force and moments DN25 - DN600: according EN1092 -1 (reduced) DN25 - DN600: according EN1092 -1 (reduced) Considered in the calculation Considered in the calculation - Depending on lubrication, state of boil and external forces the actual required torque may differ from the below advised calculated torque External force External force and moment af while may and the interoder berekende anhaamoment af while may an het hieronder berekende anhaamoment af while may and be berekende anhaamoment af while may anhaamoment af while may and be berek	Friction				0,15											
Design Temperature 200°C considered in the calculation Image: Considered in the calculation Image: Considered in the calculation Image: Considered in the calculation External force and moments DN25 - DN600: according EN1092 -1 (reduced) Image: Considered in the calculation - Depending on lubrication, state of bolt and external forces the accular equired torque may differ from the below advised calculated torque Image: Considered in the calculation Image: Considered in the calculation Image: Considered in the calculation - Afmankelik van de smering, staat van de bouten en externe krachten kan het werkelik benodigde aanhaalmoment af vujken van het hieronder berekende aanhaalmoment Image: Considered in the calculation Image: Considered in the calculation Flame External axial force Min Max Used Min	Design p	ressure			According	to the pipe	class									
External force and moments DN25 - DN600: according EN1092 - 1 (reduced) Image: Constraint of the second of the se	Design T	emperatur	e		200°C con	sidered in tl	he calculati	on								
Remarks Depending on lubrication, state of bolt and external forces the actual required torque may differ from the below advised calculated torque Torque mm Size External axial force Min Max Used for the externe krachter kan het werkelik bendigde aanhaalmoment at wijken van het hieronder berekende aanhaalmoment Size Number C(N) External axial force Bolt Force KN Image: C(DN) Bolt size Number Colspan="2">Colspan="2" Colspan="2" </td <td>External</td> <td>force and</td> <td>moments</td> <td></td> <td>DN25 - DN</td> <td>600: accor</td> <td>dina EN109</td> <td>2 -1 (redu</td> <td>ced)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	External	force and	moments		DN25 - DN	600: accor	dina EN109	2 -1 (redu	ced)							
Armanka Armanka <t< td=""><td></td><td></td><td></td><td></td><td>51120 511</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>					51120 511											
Nemarks - Depending on lubrication, state of bolt and external forces the actual required torque may differ from the below advised calculated torque - Afhankelijk van de smering, staat van de bouten en externe krachten kan het werkelijk benodigde aanhaalmoment afwijken van het hieronder berekende aanhaalmoment. Flange size (DN) External axial force (KN) Bolt Force KN Torque Nm - <																
- Uppending on lubrication, state of boil and external forces the actual required torque may differ from the below advised calculated torque - Afhankelijk van de smering, staat van de bouten en externe krachten kan het werkelijk benodigde aanhaalmoment af vijken van het hieronder berekende aanhaalmoment Flange size External axial force (DN) Bolt Size Number External axial force (KN) Bolt Force KN Torque Nm Used Min Max Used Min	Remark	S														
- Antanketijk van de smering, staat van de boute en externe krachten kan net werkelijk behodigde aannaalmoment atvijken van net nieronder berekende aannaalmoment Torque Nm Flange size (DN) Bolt size Number (KN) Bolt Force KN Torque Nm Torque Nm 15 M12 4 Min Max Used Min Max Used Min Max Used 20 M12 4 25 82 109 92 49 65 55 26 35 29 82 108 92 25 M12 4 25 82 101 220 154 79 171 120 42 91 64 132 285 200 40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 50 M16 8 58.8 209 419 306 102 191 140 54 93 75 168	- Depend	ling on lubr	rication, st	ate of bolt an	d external f	orces the a	actual requi	red torque	may differ	from the b	elow advis	ed calcula	ted torque			
Plange size (DN) External axial force (M) Boit Force KN Olit Porce KN Olit O(15 Molycoat 0,08 No Lubrication 0,25 (DN) Boit size Number (KN) Max Used Min Max	- Afnank	elijk van de	e smering,	staat van de	bouten en	externe kra	chten kan r	iet werkelij	jk benodigo	te aannaair	noment atv	wijken van	net nierono	Jer bereker	nde aanna	almoment
size number (KN) Min Max Used 15 M12 4 25 82 101 220 154 79 171 120 42 91 64 132 285 200 40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 250 816 165 155 150 150 150 151 150 152 215 215 283 233 <td>Flange</td> <td></td> <td></td> <td>External</td> <td></td> <td>ont Force K</td> <td>IN</td> <td></td> <td>010.45</td> <td></td> <td></td> <td>Torque Nn</td> <td>1</td> <td>No.1</td> <td></td> <td>0.05</td>	Flange			External		ont Force K	IN		010.45			Torque Nn	1	No.1		0.05
(N) Bolt Size Number (N) Nin Nax Used Nin Max Used Nin Nin <th< td=""><td>SIZE</td><td>Dellation</td><td>Mumber</td><td>axial force</td><td></td><td></td><td>Unad</td><td>Min</td><td>010,15</td><td>Used</td><td>Min</td><td>loiycoat u,i</td><td>Jo Heed</td><td>NO L</td><td>.uprication</td><td>0,25</td></th<>	SIZE	Dellation	Mumber	axial force			Unad	Min	010,15	Used	Min	loiycoat u,i	Jo Heed	NO L	.uprication	0,25
15 M12 4 4 6 7 7 1	(DN)	Bolt size	Number	(KN)	MIN	мах	Used	MIN	мах	Used	MIN	Max	Useu	MID	max	Usea
10 112 4 10 17 10 120 42 91 64 132 285 200 40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 50 M16 4 50 166 218 180 129 170 140 69 91 75 215 283 233 65 M16 8 58.8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 75	45	M42														
25 M12 4 25 82 109 92 49 65 55 26 35 29 82 108 92 32 M16 4 32 101 220 154 79 171 120 42 91 64 132 285 200 40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 50 M16 4 50 166 218 180 129 170 140 69 91 75 215 283 233 65 M16 8 58,8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 191 140 54 102 75 170 31	20	M12	4													
32 M16 4 32 103 32 49 03 90 20 50 105 52 106 32 32 M16 4 32 101 220 154 79 171 120 42 91 64 132 285 200 40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 50 M16 4 50 166 218 180 129 170 140 69 91 75 215 283 233 65 M16 8 58,8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 191 140 54 102 75 170 318	20	M12	4	25	<u>.</u> 22	100	02	10	65	55	26	25	29	82	108	02
40 M16 4 40 130 223 180 101 174 140 54 93 75 168 290 233 50 M16 4 50 166 218 180 129 170 140 69 91 75 168 290 233 65 M16 8 58,8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 191 140 54 102 75 170 318 233 100 M20 8 100 309 726 515 150 353 250 80 188 133 250 588 417 125 M24 8 111,8 367 885 694 211 510 400 113 272 213 352<	32	M16	4	32	101	220	154	70	171	120	42	Q1	64	132	285	200
40 M16 4 40 100 223 100 101 114 140 69 91 75 215 233 233 50 M16 4 50 166 218 180 129 170 140 69 91 75 215 233 233 65 M16 8 58.8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 191 140 54 102 75 170 318 233 100 M20 8 100 309 726 515 150 353 250 80 188 133 250 588 417 125 M24 8 1122,5 447 1069 781 257 616 450 137 329 240 42	40	M16		40	130	220	180	101	174	140	54	02	75	168	200	200
65 M16 8 58,8 209 419 308 81 163 120 43 87 64 135 272 200 80 M16 8 80 261 491 360 102 191 140 54 102 75 170 318 233 100 M20 8 100 309 726 515 150 353 250 80 188 133 250 588 417 125 M24 8 111,8 367 885 694 211 510 400 113 272 213 352 850 667 125 M24 8 122,5 447 1069 781 257 616 450 137 329 240 428 1027 750 200 M27 12 141,4 661 1535 1153 287 666 500 153 355 267 <td>50</td> <td>M16</td> <td></td> <td>50</td> <td>166</td> <td>223</td> <td>180</td> <td>120</td> <td>170</td> <td>140</td> <td>69</td> <td>01 01</td> <td>75</td> <td>215</td> <td>283</td> <td>233</td>	50	M16		50	166	223	180	120	170	140	69	01 01	75	215	283	233
80 M16 8 80 261 491 360 102 191 140 54 102 75 170 318 233 100 M20 8 100 309 726 515 150 353 250 80 188 133 250 588 417 125 M24 8 111,8 367 885 694 211 510 400 113 272 213 352 850 667 150 M24 8 122,5 447 1069 781 257 616 450 137 329 240 428 1027 750 200 M27 12 141,4 661 1535 1153 287 666 500 153 355 267 478 1110 833 250 M30 12 158,1 868 2254 1636 424 1102 800 265 588	65	M16	8	58.8	209	<u>410</u>	308	81	163	120	43	87	64	135	203	200
100 M20 8 100 309 726 515 150 353 250 80 188 133 250 516 417 125 M24 8 111,8 367 885 694 211 510 400 113 272 213 352 850 667 150 M24 8 122,5 447 1069 781 257 616 450 137 329 240 428 1027 750 200 M27 12 141,4 661 1535 1153 287 666 500 153 355 267 478 1110 833 250 M30 12 158,1 868 2254 1636 424 1102 800 226 588 427 707 1837 1333 300 M30 16 164,9 1282 2811 2182 470 1031 800 251 550	80	M16	8	80	261	491	360	102	103	140	54	102	75	170	318	200
125 M24 8 111.8 367 885 694 211 510 400 113 272 213 352 850 667 150 M24 8 122,5 447 1069 781 257 616 450 137 329 240 428 1027 750 200 M27 12 141,4 661 1535 1153 287 666 500 153 355 267 478 1110 833 250 M30 12 158,1 868 2254 1636 424 1102 800 226 588 427 707 1837 1333 300 M30 16 164,9 1282 2811 2182 470 1031 800 251 550 427 783 1718 1333 350 M33 16 178,1 1409 3133 2003 563 1251 800 300	100	M20	8	100	309	726	515	150	353	250	80	188	133	250	588	417
120 111,0 00 000 001 110 100 110 110 110 100 110 110 110 100 100 110 110 100 100 110 110 100 100 110 110 110 100 100 110 110 110 100 100 110 <td>125</td> <td>M24</td> <td>8</td> <td>111.8</td> <td>367</td> <td>885</td> <td>694</td> <td>211</td> <td>510</td> <td>400</td> <td>113</td> <td>272</td> <td>213</td> <td>352</td> <td>850</td> <td>667</td>	125	M24	8	111.8	367	885	694	211	510	400	113	272	213	352	850	667
200 M27 12 141,4 661 1535 1153 287 666 500 153 355 267 478 1110 833 250 M30 12 158,1 868 2254 1636 424 1102 800 226 588 427 707 1837 1333 300 M30 16 164,9 1282 2811 2182 470 1031 800 251 550 427 783 1718 1333 350 M33 16 178,1 1409 3133 2003 563 1251 800 300 667 427 938 2085 1333 400 M36 16 195,2 2534 4728 3454 1101 2053 1500 587 1095 800 1835 3422 2500 450 M36 20 249,3 2656 4902 923 1703 1400 492 <t< td=""><td>150</td><td>M24</td><td>8</td><td>122.5</td><td>447</td><td>1069</td><td>781</td><td>257</td><td>616</td><td>450</td><td>137</td><td>329</td><td>240</td><td>428</td><td>1027</td><td>750</td></t<>	150	M24	8	122.5	447	1069	781	257	616	450	137	329	240	428	1027	750
250 M30 12 158,1 868 2254 1636 424 1102 800 226 588 427 707 1837 1333 300 M30 16 164,9 1282 2811 2182 470 1031 800 251 550 427 783 1718 1333 350 M33 16 178,1 1409 3133 2003 563 1251 800 300 667 427 938 2085 1333 400 M36 16 195,2 2534 4728 3454 1101 2053 1500 587 1095 800 1835 3422 2500 450 M36 20 249,3 2656 4902 923 1703 1400 492 908 747 1538 2838 2333 500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595	200	M27	12	141.4	661	1535	1153	287	666	500	153	355	267	478	1110	833
300 M30 16 164,9 1282 2811 2182 470 1031 800 251 550 427 783 1718 1333 350 M33 16 178,1 1409 3133 2003 563 1251 800 300 667 427 938 2085 1333 400 M36 16 195,2 2534 4728 3454 1101 2053 1500 587 1095 800 1835 3422 2500 450 M36 20 249,3 2656 4902 923 1703 1400 492 908 747 1538 2838 2333 500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595 1154 853 1858 3605 2667 600 M45 20 426.4 4381 7718 5693 1192.4 3389 2500 1026 </td <td>250</td> <td>M30</td> <td>12</td> <td>158.1</td> <td>868</td> <td>2254</td> <td>1636</td> <td>424</td> <td>1102</td> <td>800</td> <td>226</td> <td>588</td> <td>427</td> <td>707</td> <td>1837</td> <td>1333</td>	250	M30	12	158.1	868	2254	1636	424	1102	800	226	588	427	707	1837	1333
350 M33 16 178,1 1409 3133 2003 563 1251 800 300 667 427 938 2085 1333 400 M36 16 195,2 2534 4728 3454 1101 2053 1500 587 1095 800 1835 3422 2500 450 M36 20 249,3 2656 4902 923 1703 1400 492 908 747 1538 2838 2333 500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595 1154 853 1858 3605 2667 600 M45 20 426.4 4381 7718 5693 1924 3389 2500 1026 1807 1333 3207 5648 4167	300	M30	16	164.9	1282	2811	2182	470	1031	800	251	550	427	783	1718	1333
400 M36 16 195,2 2534 4728 3454 1101 2053 1500 587 1095 800 1835 3422 2500 450 M36 20 249,3 2656 4902 4029 923 1703 1400 492 908 747 1538 2838 2333 500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595 1154 853 1858 3605 2667 600 M45 20 426,4 4381 7718 5693 1924 3389 2500 1026 1807 1333 3207 5648 4167	350	M33	16	178 1	1409	3133	2003	563	1251	800	300	667	427	938	2085	1333
450 M36 20 249,3 2656 4902 4029 923 1703 1400 492 908 747 1538 2838 2333 500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595 1154 853 1858 3605 2667 600 M45 20 426.4 4381 7718 5693 1924 3389 2500 1026 1807 1333 3207 5648 4167	400	M36	16	195.2	2534	4728	3454	1101	2053	1500	587	1095	800	1835	3422	2500
500 M39 20 314,6 2969 5760 4262 1115 2163 1600 595 1154 853 1858 3605 2667 600 M45 20 426.4 4381 7718 5693 1924 3389 2500 1026 1807 1333 3207 5648 4167	450	M36	20	249.3	2656	4902	4029	923	1703	1400	492	908	747	1538	2838	2333
600 M45 20 426 4 4381 7718 5693 1924 3389 2500 1026 1807 1333 3207 5648 4167	500	M39	20	314.6	2969	5760	4262	1115	2163	1600	595	1154	853	1858	3605	2667
	600	M45	20	426.4	4381	7718	5693	1924	3389	2500	1026	1807	1333	3207	5648	4167

8.6 Table 6: Pipe Class F020, F022, H130 / PN10 – Graphite Gasket

Pipe clas	s			F020, F022	2, H130							Table 6			
Pipe sys	tem			PN10											
Flange M	laterial			1.4404 / 1.	4539 / 1.45	71									
Bolt Mate	erial			A4-70											
Gasket N	/aterial			Novaphit S	STC TA-L	/ novaphit	SSTC TA-I	with XP-T	echnology 2	2mm					
Gasket N	/anufactur	е		Frenzelit											
Gasket t	уре			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperatur	e		200°C cons	sidered in t	he calculat	ion								
External	force and	moments		DN15 - DN	600: accor	dina EN109) 2 -1 (redu	(ced)							
								1							
Remark	(S			d automat 4		-			from the ba	- Income and the	a di a a la cila	4 - 4 4			
- Depend	on lubi eliik van de	ICation, st	ate of bolt an staat van de	bouten en e	orces the a externe kra	ictual requ	irea torque het werke	e may differ liik benodia	from the be	noment afv	ed calcula viiken van	het hierond	ler hereke	nde aanha	almoment
Flance	conjic Parrie	onioring,	External	F	off Force K	N		igk berrouigt	ac aannaan	iononi an	Torque Nn	n	for boroko	ac aanna	amomon
size			axial force					Oil 0.15		M	olycoat 0	08	Nol	ubrication	0.25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	11.8	22	115	67	13	69	40	7	37	21	22	115	67
20	M12	4	15,7	31	102	67	19	61	40	10	33	21	32	102	67
25	M12	4	19,6	40	102	67	24	61	40	13	33	21	40	102	67
32	M16	4	25,1	48	203	128	37	158	100	20	84	53	62	263	167
40	M16	4	31,4	63	193	128	49	150	100	26	80	53	82	250	167
50	M16	4	39,3	83	199	128	65	155	100	35	83	53	108	258	167
65	M16	8	51,1	123	271	180	48	105	70	26	56	37	80	175	117
80	M16	8	62,9	151	402	257	59	156	100	31	83	53	98	260	167
100	M16	8	78,6	181	437	257	70	170	100	37	91	53	117	283	167
125	M16	8	87,8	222	454	257	86	177	100	46	94	53	143	295	167
150	M20	8	96,2	250	548	412	121	266	200	65	142	107	202	443	333
200	M20	8	111,1	329	711	515	160	345	250	85	184	133	267	575	417
250	M20	12	124,2	390	894	618	126	290	200	67	155	107	210	483	333
300	M20	12	136,1	471	975	772	153	316	250	82	169	133	255	527	417
350	M20	16	147	706	1096	823	171	266	200	91	142	107	285	443	333
400	M24	16	157,1	838	1244	1042	241	358	300	129	191	160	402	597	500
450	M24	20	166,7	910	1295	1085	210	298	250	112	159	133	350	497	417
500	M24	20	175,7	1032	1389	1085	238	320	250	127	171	133	397	533	417
600	M27	20	192.5	1236	1612	1345	322	420	350	172	224	187	537	700	583

8.7 Table 7: Pipe Class F210, F212 / PN16 – Graphite Gasket

Pipe class F210, F212 Pipe system PN16				Table 7											
Pipe sys	tem			PN16											
Flange N	laterial			1.4307 / 1	4571										
Bolt Mate	erial			A4-70											
Gasket I	laterial			Novaphit S	STC TA-L	/ novaphit \$	SSTC TA-I	with XP-T	echnology :	2mm					
Gasket I	lanufactur	e		Frenzelit											
Gasket t	ype			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperatur	е		200°C con	sidered in t	he calculat	ion								
External	force and	moments		DN15 - DN	600: accor	ding EN109	2 -1 (redu	iced)							
Remark	s														
- Depend	ding on lubr	rication, st	ate of bolt an	d external f	orces the a	ictual requi	ired torque	e may differ	from the b	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	e smering,	staat van de	bouten en	externe kra	chten kan	het werke	lijk benodige	de aanhaalr	moment af	wijken van	het hierond	ler bereke	nde aanha	almoment
Flange			External	E	olt Force K	N					Torque Nn	1			
size			axial force					Oil 0,15			lolycoat 0,	08	No I	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
											ļ				
15	M12	4	11,8	27	115	67	16	69	40	9	37	21	27	115	67
20	M12	4	15,7	46	102	67	28	61	40	15	33	21	47	102	67
25	M12	4	19,6	60	102	84	36	61	50	19	33	27	60	102	83
32	M16	4	25,1	73	203	128	57	158	100	30	84	53	95	263	167
40	M16	4	31,4	92	193	128	72	150	100	38	80	53	120	250	167
50	M16	4	39,3	115	199	167	90	155	130	48	83	69	150	258	217
65	M16	8	51,1	154	265	206	60	103	80	32	55	43	100	172	133
80	M16	8	62,9	189	396	257	74	154	100	39	82	53	123	257	167
100	M16	8	78,6	226	424	257	88	165	100	47	88	53	147	275	167
125	M16	8	87,8	280	462	334	109	180	130	58	96	69	182	300	217
150	M20	8	96,2	311	538	412	151	261	200	81	139	107	252	435	333
200	M20	12	111,1	413	704	463	134	228	150	71	122	80	223	380	250
250	M24	12	124,2	483	839	651	185	322	250	99	172	133	308	537	417
300	M24	12	136,1	600	1179	781	230	453	300	123	242	160	383	755	500
350	M24	16	147	739	1662	1042	213	479	300	114	255	160	355	798	500
400	M27	16	157,1	831	1861	1230	270	605	400	144	323	213	450	1008	667
450	M27	20	166,7	934	1969	1537	243	512	400	130	273	213	405	853	667
500	M30	20	175,7	1090	2108	1534	320	618	450	171	330	240	533	1030	750
600	M33	20	244	1543	2701	1878	493	863	600	263	460	320	822	1438	1000

8.8 Table 8: Pipe Class F250 / PN25 – Graphite Gasket

Pipe clas	s			F250								Table 8			
Pipe sys	tem			PN25											
Flange M	aterial			1,4404											
Bolt Mate	erial			A4-70											
Gasket N	laterial			Novaphit S	STC TA-L	novaphit S	STC TA-L	with XP-Te	echnology 2	2mm (Rev.	2)				
Gasket N	lanufactur	e		Frenzelit							· ·				
Gasket t	уре			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculati	on								
External	force and	moments		DN15 - DN	600: accor	ding EN109	2 -1 (reduc	ced)							
Remark	S														
- Depend	ling on lubr	rication, st	ate of bolt an	d external f	orces the a	ctual requir	red torque	may differ	from the be	elow advis	ed calcula	ted torque		L	
- Athank	elijk van de	e smering,	staat van de	bouten en	externe kra	chten kan h	iet werkelij	k benodigd	le aanhaain	noment afv	vijken van	het hierond	ler bereke	nde aanhaa	almoment
Flange			External		olt Force K	N		010.45			Torque Nn	1		1.1.11	0.05
size	D		axial force					010,15		Min	olycoat 0,	08	NOL	ubrication	0,25
(DN)	Bolt size	Number	(KN)	MIN	мах	Used	MIN	мах	Usea	MID	Max	Useu	MIN	Max	Usea
15	M12	4	11.2	27	115	67	16	60	40	0	27	21	27	115	67
20	M12	4	11,0	21 AG	110	67	20	61	40	15	22	21	47	110	67
20	M12	4	19.6	07	102	8/	20	61	- 4 0 50	10	22	21	60 60	102	97 92
32	M12		25.1	73	203	128	57	158	100	30	94 84	53	00	263	467
40	M16	4	31.4	92	103	120	72	150	100	38	80	53	120	200	167
50	M16	4	39.3	115	197	167	90	153	130	48	82	69	150	255	217
65	M16	8	51.1	162	397	257	63	155	100	34	83	53	105	258	167
80	M16	8	62.9	195	440	257	76	171	100	41	91	53	127	285	167
100	M20	8	78.6	244	573	412	119	278	200	63	148	107	198	463	333
125	M24	8	87.8	289	696	521	166	401	300	89	214	160	277	668	500
150	M24	8	96.2	320	918	694	184	529	400	98	282	213	307	882	667
200	M24	12	111.1	414	1150	781	159	442	300	85	236	160	265	737	500
250	M27	12	124.2	497	1412	1037	216	612	450	115	326	240	360	1020	750
300	M27	16	136,1	607	1710	1230	197	556	400	105	297	213	328	927	667
350	M30	16	147	756	2247	1636	277	824	600	148	439	320	462	1373	1000
400	M33	16	157,1	868	2699	2003	347	1078	800	185	575	427	578	1797	1333
450	M33	20	166,7	961	2928	2191	307	935	700	164	499	373	512	1558	1167
500	M33	20	184,4	1135	3955	2817	363	1264	900	194	674	480	605	2107	1500
600	M36	20	244	1393	4101	2878	484	1426	1000	258	761	533	807	2377	1667

8.9 Table 9: Pipe class F400, F401 / PN40 – Graphite Gasket

Pipe clas	ss			F400, F40	1							Table 9			
Pipe sys	tem			PN40											
Flange N	laterial			1.4404 / 1.	4571										
Bolt Mate	erial			21CrMo5-7	7/A4-70										
Gasket I	Material			Novaphit S	STC TA-L	/ novaphit S	STC TA-L	with XP-Te	echnology 2	2mm					
Gasket I	Manufactur	e		Frenzelit											
Gasket t	уре			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	remperatur	e		200°C con	sidered in t	he calculati	on								
External	force and	momente		DN15 DN	400: accor	ding EN109	2 1 (reduc	(her							
LAternal	TOTCE and	nomenta		DN13-DN	400. accon	ung En 103.	2 -1 (16000	,cu)							
Demark	(8														
- Denen/	dina on lubr	rication st	ate of holt an	d external f	orces the s	actual requir	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	eliik van de	smerina	staat van de	houten en i	externe kra	chten kan h	et werkeli	k benodiad	le aanhaaln	noment af	wiiken van	het hierond	ler hereke	nde aanha:	almoment
Flange	conjic Parria	omoring,	External	F	Bolt Force K	N		it bonoaiga	o dannadin	inomoni ari	Torque Nr	1		nuo aanna	amomon
size			axial force					Oil 0.15		M	lolycoat 0.	08	No I	ubrication	0.25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	11,8	34	113	67	20	68	40	11	36	21	33	113	67
20	M12	4	15,7	56	91	67	33	54	40	18	29	21	55	90	67
25	M12	4	19,6	75	98	84	45	59	50	24	31	27	75	98	83
32	M16	4	25,1	93	205	128	72	160	100	38	85	53	120	267	167
40	M16	4	31,4	124	197	154	97	153	120	52	82	64	162	255	200
50	M16	4	39,3	157	196	167	122	153	130	65	82	69	203	255	217
65	M16	8	19,7	184	318	257	72	124	100	38	66	53	120	207	167
80	M16	8	62,9	249	364	283	97	142	110	52	76	59	162	237	183
100	M20	8	78,6	294	416	329	143	202	160	76	108	85	238	337	267
125	M24	8	87,8	342	538	434	197	310	250	105	165	133	328	517	417
150	M24	8	96,2	418	749	521	241	431	300	129	230	160	402	718	500
200	1107	40	444.4	508	1050	807	259	459	350	138	245	187	432	765	583
	M27	12	111,1	330	1033	: 001								100	
250	M27 M30	12 12	124,2	784	1571	1227	383	768	600	204	410	320	638	1280	1000
250 300	M27 M30 M30	12 12 16	124,2 136,1	784 965	1571 2053	1227 1636	383 354	768 753	600 600	204 189	410 402	320 320	638 590	1280 1255	1000 1000
250 300 350	M27 M30 M30 M33	12 12 16 16	124,2 136,1 160,4	784 965 1239	1571 2053 2721	1227 1636 2003	383 354 495	768 753 1087	600 600 800	204 189 264	410 402 580	320 320 427	638 590 825	1280 1255 1812	1000 1000 1333

8.10 Table 10: Pipe class M120, M170, M190 / PN10 – PTFE + insert gasket

Pipe cla	ss			M120, M	170, M19	0						Table 10			
Pipe sys	stem			PN10											
Flange N	/laterial			PVDF/FF	RP, PP/FF	RP, PVC-	J/FRP								
Bolt Mat	erial			4.6 HDG											
Gasket I	Material			VSP Pita	a gasket										
Gasket I	Manufactu	re		VSP/ Kli	nger										
Gasket t	type			IBC											
Leak tig	nness			L0.01											
Friction				0,14											
Design p	pressure			7 barg											
Design T	Temperatur	re		95°C con	isidered in	the calcu	lation								
External	force and	moments		DN15 - D	0N600: ac	cording El	V1092 -1	(reduced)							
Remark	S III				1.6										
- Depend	aing on lub	rication, s	tate of bo	It and ext	ernal force	s the acti	ual require	ed torque m	hay differ fro	om the belo	w advised	calculated	1 torque		
- Afnank	elijk van de	e smering	, staat var	1 de boute	en en exte	rne kracni	en kan n	et werkelijk	benodigae	aannaaim	oment atw	ijken van n	et nierona	er bereken	de momen
- Waxim	um torque	is based	on nange	materiai, i	r you teel	or near cr	acking of	the flange	stop and co	onsult the		act person			
- II more	than z gas	skets are	External		olt Earon I	Lorquing is	required	, to be advi	sea by sup	pliel/ PTC-					
Flange			External		OIL FOICE I		- Co	ppor grooo	0.14	N	Torque Nin	1	No	ubrigation	0.25
	Bolt size	Number	forco	Min	Max	Llead	Min	Max	lleod	Min	Max	lleod	Min	Max	U,25
	Duit Size	Number	IUICE	IVIIII	IVIAA	USEU	IVIIII	IVIAA	Useu	IVIIII	IVIAA	Useu	IVIIII	IVIAA	Useu
15	M12	4													
20	M12	4			.å	Å									
25	M12	4				39			20						
32	M16	4													
40	M16	4				59			40						
50	M16	4			•	59			40						
65	M16	8				66			45						
80	M16	8	1			132			45						
100	M16	8				132			45		De net un			Denet	
125	M16	8		1		147			50	1	Do not us	e		Do not us	е
150				1						1					
	M20	8				141			60						
200	M20 M20	8 8				141 141			60 60						
200 250	M20 M20 M20	8 8 12				141 141 247			60 60 70						
200 250 300	M20 M20 M20 M20	8 8 12 12				141 141 247 265			60 60 70 75						
200 250 300 350	M20 M20 M20 M20 M20 M20	8 8 12 12 12 16				141 141 247 265 353			60 60 70 75 75	•					
200 250 300 350 400	M20 M20 M20 M20 M20 M20 M20	8 8 12 12 16 16				141 141 247 265 353 412			60 60 70 75 75 105						
200 250 300 350 400 450	M20 M20 M20 M20 M20 M24 M24	8 8 12 12 16 16 20				141 141 247 265 353 412			60 60 70 75 75 105						

8.11 Table 11: Pipe class M120, M170, M190 / PN10 – Top-chem gasket

Table not yet available. For details contact the gasket supplier.

8.12 Table 12: Pipe class A010, A060, A061, A120, I010, I011 / PN10 – Fiber gasket

Pipe clas	s			A060, A12	20, A061, A	010, 1011, 1	010					Table 12			
Pipe syst	tem			PN10											
Flange M	aterial			P250GH											
Bolt Mate	erial			25CrMo4 /	8.8										
Gasket N	laterial			KLINGERS	IL C-4400 2	2mm									
Gasket N	lanufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket ty	ype			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculati	on								
-	· ·														
External	force and	moments		DN15 DI	V350 = acc	ording EN1	092 -1 (red	duced)							
				DN400 -DN	1.35	times of int	ernal pres	sure							
				DN600 & a	above - 1 ti	mes of inter	rnal pressu	ire							
Remark	s														
- Depend	ling on lubr	rication, st	ate of bolt an	d external f	orces the a	ctual requi	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en e	externe kra	chten kan h	iet werkelij	k benodigd	le aanhaaln	noment afv	wijken van	het hierond	ler bereke	nde aanha	almoment
Flange			External	E	Bolt Force K	N					Torque Nm	1			
size			axial force					Oil 0,15		N	lolycoat 0,0)8	No L	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	13,6	68	121	84	40	72	50	21	38	27	67	120	83
20	M12	4	18,1	74	124	85	43	73	50	23	39	27	72	122	83
25	M12	4	22,6	92	119	103	54	70	60	29	37	32	90	117	100
32	M16	4	29	108	229	196	83	175	150	44	93	80	138	292	250
40	M16	4	36,2	135	230	196	103	176	150	55	94	80	172	293	250
50	M16	4	45,3	160	236	196	123	181	150	66	97	80	205	302	250
65	M16	8	58,8	172	420	313	66	161	120	35	86	64	110	268	200
80	M16	8	72,4	208	482	392	80	185	150	43	99	80	133	308	250
100	M16	8	90,5	255	488	392	98	187	150	52	100	80	163	312	250
125	M16	8	101,2	280	488	392	107	187	150	57	100	80	178	312	250
150	M20	8	122,5	345	695	515	168	338	250	90	180	133	280	563	417
200	M20	8	128	398	695	515	193	338	250	103	180	133	322	563	417
250	M20	12	143,1	461	1040	772	149	337	250	79	180	133	248	562	417
300	M20	12	156,8	544	1051	772	176	340	250	94	181	133	293	567	417
350	M20	16	169,3	814	1328	1029	198	323	250	106	172	133	330	538	417
400	M24	16	135,4	868	1525	1042	250	439	300	133	234	160	417	732	500
450	M24	20	182,9	1111	1545	1302	256	356	300	137	190	160	427	593	500
500	M24	20	227,5	1356	1603	1389	312	369	320	166	197	171	520	615	533
600	M27	20	196,8	1614	1908	1652	420	497	430	224	265	229	700	828	717
700	M27	24	203,9	1713	2458	1983	372	533	430	198	284	229	620	888	717
800	M30	24	298,1	2159	2882	2454	528	705	600	282	376	320	880	1175	1000
900	M30	28	335,2	2573	3733	2863	539	782	600	287	417	320	898	1303	1000
1000	M33	28	416,5	3097	4144	3506	707	946	800	377	505	427	1178	1577	1333

8.13 Table 13: Pipe class A210, A211, A241, I200 / PN16 – Fiber gasket

Pipe clas	s			A210, A21	11, A241, I2	00						Table 13			
Pipe sys	tem			PN16											
Flange M	laterial			P250GH											
Bolt Mate	erial			25CrMo4 /	8.8										
Gasket N	laterial			KLINGERS	IL C-4400 2	2mm									
Gasket N	lanufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket t	уре			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	е		200°C con	sidered in t	he calculati	ion								
External	force and i	moments		DN15 DI	V1000 = ac	cording EN	1092 -1 (re	educed)							
Remark	S														
- Depend	ding on lubr	ication, st	ate of bolt an	d external f	forces the a	ctual requi	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en	externe kra	chten kan h	net werkelij	ik benodigd	le aanhaalr	noment af	wijken van	het hierond	der bereke	nde aanha	almoment
Flange	· ·		External	E	Bolt Force K	N					Torque Nm	1			
size			axial force					Oil 0,15		N	lolycoat 0,0	08	No	Lubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	13,6	82	115	100	49	69	60	26	37	32	82	115	100
20	M12	4	20	83	113	100	50	68	60	27	36	32	83	113	100
25	M12	4	22,6	77	107	100	46	64	60	25	34	32	77	107	100
32	M16	4	29	131	214	180	102	167	140	54	89	75	170	278	233
40	M16	4	36,2	156	215	180	121	167	140	65	89	75	202	278	233
50	M16	4	45,3	176	220	193	137	171	150	73	91	80	228	285	250
65	M16	8	58,8	218	415	360	85	162	140	45	86	75	142	270	233
80	M16	8	72,4	244	452	360	95	176	140	51	94	75	158	293	233
100	M16	8	88,1	286	452	385	111	176	150	59	94	80	185	293	250
125	M16	8	101,2	336	452	385	131	176	150	70	94	80	218	293	250
150	M20	8	110,8	411	681	515	200	331	250	107	177	133	333	552	417
200	M20	12	128	538	859	772	174	278	250	93	148	133	290	463	417
250	M24	12	143,1	620	1010	781	238	388	300	127	207	160	397	647	500
300	M24	12	173,2	751	1467	1042	288	563	400	154	300	213	480	938	667
350	M24	16	164,8	1005	1830	1389	289	527	400	154	281	213	482	878	667
400	M27	16	176,1	1150	2023	1537	374	658	500	199	351	267	623	1097	833
450	M27	20	186,8	1458	2121	1729	379	552	450	202	294	240	632	920	750
500	M30	20	196,9	1751	2237	1875	514	656	550	274	350	293	857	1093	917
600	M33	20	310,5	2446	3168	2661	781	1012	850	417	540	453	1302	1687	1417
700	M33	24	319,6	2532	3310	2817	674	881	750	359	470	400	1123	1468	1250
800	M36	24	415,3	3271	3629	3316	947	1051	960	505	561	512	1578	1752	1600
900	M36	28	467,7	954	4371	3908	954	1085	970	509	579	517	1590	1808	1617
1000	M39	28	520,6	4243	5671	4848	1138	1521	1300	607	811	693	1897	2535	2167

8.14 Table 14: Pipe class A400, A401, A450 / PN40 – Fiber gasket

										-					-
Pipe clas	s			A400, A40	1, A450							Table 14			
Pipe sys	tem			PN40											
Flange M	aterial			P250GH											
Bolt Mate	erial			25CrMo4 /	8.8										
Gasket M	laterial			KLINGERS	IL C-4400 2	2mm									
Gasket M	lanufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket t	уре			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculati	on								
External	force and	moments		DN15 DI	1600 = acc	ording EN1	092 -1 (red	duced)							
Extornal				51110 51		in a ling citra									
Remark	S														
- Depend	ling on lubr	ication, st	ate of bolt an	d external f	orces the a	ictual requir	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Athank	elijk van de	smering,	staat van de	bouten en e	externe kra	chten kan h	iet werkelij	k benodigo	de aanhaair	noment afv	vijken van	het hierond	ler berekei	ide aanha	almomen
Flange			External	F	oπ Force K	N		010.45			I orque Nm		N	- the star of the	0.05
SIZE	Dallacion	Mumber	axiai torce	115-	Maria	Uned	Min	010,15	Head	Min	olycoat 0,0	llood	NO L	Max	0,25
(UN)	DOIT SIZE	Number	(KN)	MIN	мах	Used	MIN	Max	used	MIII	Max	used	MIII	Max	used
15	M42	<u>/</u>	12.6												
20	M12	4	12,0	00	112	100	52	69	60	28	26	32	88	113	100
20	M12	4	22.6	83	113	100	50	64	00	20	30	32	83	107	100
32	M12	4	22,0	133	214	180	104	167	140	55	24	75	173	278	232
40	M16	4	36.2	158	214	180	123	168	140	66	90	75	205	280	233
50	M16	4	45.3	191	216	193	149	168	150	79	90	80	248	280	250
65	M16	8	58.8	227	443	385	88	172	150	47	92	80	147	287	250
80	M16	8	72 4	252	448	385	98	174	150	52	93	80	163	290	250
100	M20	8	88.1	338	680	515	164	330	250	87	176	133	273	550	417
125	M24	8	101.2	420	833	608	242	480	350	129	256	187	403	800	583
150	M24	8	110.8	487	1005	781	280	579	450	149	309	240	467	965	750
200	M27	12	128	739	1484	1153	321	644	500	171	343	267	535	1073	833
250	M30	12	143,1	971	2125	1636	475	1039	800	253	554	427	792	1732	1333
300	M30	16	152,5	1136	2690	2182	417	986	800	222	526	427	695	1643	1333
350	M33	16	164,8	1138	3241	2504	454	1294	1000	242	690	533	757	2157	1667
400	M36	16	180,5	1366	4304	3454	593	1869	1500	316	997	800	988	3115	2500
450	M36	20	230,6	1465	4706	4029	509	1635	1400	271	872	747	848	2725	2333
500	M39	20	291	1776	5445	3995	667	2044	1500	356	1090	800	1112	3407	2500
600	M45	20	394.4	2220	7390	5466	975	3245	2400	520	1731	1280	1625	5408	4000

8.15 Table 15: Pipe class F020, F022, H130 / PN10 – Fiber gasket

													1	1	1
Pipe clas	s			F020, F022	2, H130							Table 15			
Pipe sys	tem			PN10											
Flange M	aterial			1.4404 / 1.	4539 / 1.45	71									
Bolt Mate	erial			A4-70											
Gasket N	laterial			KLINGERS	IL C-4400 2	mm									
Gasket N	lanufactur	е		KLINGER®	GmbH & C	o. KG									
Gasket t	уре			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculati	on								
External	force and	moments		DN15 DN	1600 = acc	ording EN1	092 -1 (red	duced)							
Remark	S														
- Depend	ling on lubr	rication, st	ate of bolt an	d external f	orces the a	ctual requir	ed torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	e smering,	staat van de	bouten en e	externe kra	chten kan h	et werkelij	ik benodigo	de aanhaaln	noment afv	vijken van	het hierond	ler bereke	nde aanha	almoment
Flange			External	B	olt Force K	N					Torque Nn	1			
size			axial force					Oil 0,15		M	olycoat 0,	08	No L	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
45						400					~~~				400
15	M12	4	11,8	/4	11/	100	44	/0	60	23	37	32	/3	11/	100
20	M12	4	15,7	/6	11/	100	45	/0	60		3/	32	/5	11/	100
25	M1Z	4	19,6	94	117	100	56	/0	60	30	3/	32	93	11/	100
32	M16	4	25,1	112	227	193	8/	1//	150	46	94	00	145	295	250
40	M16	4	31,4	136	227	193	106	1//	150	5/	94	00	1//	295	250
50	M16	4	39,3	159	221	193	124	1//	150	00	94	0U 52	207	295	250
65	M16	õ	51,1	169	3/4	257	50	140	100	35	/8	00	110	243	16/
00	M10	0	02,9	203	462	305	/9	160	150	42	90	00	132	300	250
100	MIO	0	/0,0	220	402	200	407	100	100	4/ 57	90	20	140	200	200
120	M10	0 0	0/,0	2/4	402	202	107	240	100	02	30	422	260	517	200
100	M20	0 0	90,2	321	714	010 E4E	100	245	200	404	100	422	200	51/ 575	41/
200	M20	40	124.2	392	000	210	190	340	250	04	104	422	252	522 522	41/
200	M20	12	124,2	400	300	772	170	320	200	01	104	422	202	E75	41/
250	M20	12	130,1	014	1000	1020	1/0	343	250	30	104	422	231	100	41/
300	M20	10	147	014	1227	1029	190	200	200	1/2	104	160	330	642	41/ 500
400	M24 M24	20	107,1	1005	1001	1042	200	200	200	140	200	1/0	207	E22	467
400	M24	20	100,7	11000	1300	1210	202	320	200	129	1/1	145	307	EC0	+0/
600	M24 M27	20	102.5	1217	1401	1460	200	341	300	109	102	203	433	740	622
000	· m2/	: <u>2</u> 0	152.3	1 1317	: 1703	: 1400	J43		: 300	100	: 231	. 200	1 3/2	: /40	: 033

8.16 Table 16: Pipe class F210, F212 / PN16 – Fiber gasket

Pipe clas	-			CO40 CO44	2							T-LL- 40			
	S			FZ10, FZ14	2							Table 16			
Pipe sys	tem			PN16											
Flange N	laterial			1.4307 / 1.	4571										
Bolt Mate	erial			A4-70											
Gasket N	laterial			KLINGERS	IL C-4400 2	mm									
Gasket N	lanufactur	e		KLINGER®	GmbH & Co	o. KG									
Gasket t	уре			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in th	he calculation	on								
External	force and	moments		DN15 DI	1600 = acc	ording EN1	092 -1 (red	luced)							
CAtornal	loree and	nomenta		Divis - Di	000 - 400		002 -1 (100	10000)							
Remark	S														
- Depend	ting on lubr	ication, st	ate of bolt and	d external f	orces the a	ctual requir	ed torque i	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en (externe krac	chten kan h	et werkelij	k benodigo	te aanhaaln	noment afv	vijken van	het hierond	ler bereke	nde aanha	almomer
-			E de la compañía de la	-							LOCOLLO MIN				
Flange			External	E	olt Force K	N		010.45			Torque Nil		N	where the set	0.05
Flange	Dallaise	Number	External axial force	E	olt Force K	N	Min	Oil 0,15	Unad	Mia	olycoat 0,0	08	No L	ubrication	0,25
Flange size (DN)	Bolt size	Number	External axial force (KN)	Min	Max	N Used	Min	Oil 0,15 Max	Used	M Min	olycoat 0,0 Max	08 Used	No L Min	ubrication Max	0,25 Used
Flange size (DN)	Bolt size	Number	External axial force (KN)	Min	Max	N Used	Min	Oil 0,15 Max	Used	Min	olycoat 0,1 Max	08 Used	No L Min	ubrication Max	0,25 Used
Flange size (DN) 15	Bolt size	Number 4	External axial force (KN) 11,8	Min	Max	Used	Min	Oil 0,15 Max	Used	Min	olycoat 0,0 Max	08 Used	No L Min	ubrication Max	0,25 Usec
Flange size (DN) 15 20 25	Bolt size M12 M12	Number 4 4	External axial force (KN) 11,8 15,7	Min 90	Max	Used 100	Min 54	Oil 0,15 Max 70 70	Used 60	Min 29	olycoat 0,1 Max 37	08 Used 32	No L Min 90	Ubrication Max 117	0,25 Usec 100
Flange size (DN) 15 20 25 32	Bolt size M12 M12 M12 M12 M16	Number 4 4 4	External axial force (KN) 11,8 15,7 19,6 25 1	Min 90 86 133	Max 117 227	N Used 100 100	Min 54 51	Oil 0,15 Max 70 70	Used 60 60	Min 29 27 55	37 94	08 Used 32 32 80	No L Min 90 85 173	ubrication Max 117 117 295	0,25 Usec 100 100
Flange size (DN) 15 20 25 32 40	Bolt size M12 M12 M12 M16 M16	Number 4 4 4 4	External axial force (KN) 11,8 15,7 19,6 25,1 31.4	Min 90 86 133 155	117 117 227 227	N Used 100 100 193	Min 54 51 104	Oil 0,15 Max 70 70 177	Used 60 60 150	Min 29 27 55 65	37 37 94	08 Used 32 32 80 80	No L Min 90 85 173 202	Ubrication Max 117 117 295 295	0,25 Usec 100 100 250
Flange size (DN) 15 20 25 32 40 50	Bolt size M12 M12 M12 M16 M16 M16	Number 4 4 4 4 4 4 4	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3	90 86 133 155 175	0lt Force K Max 117 117 227 227 227	N Used 100 100 193 193	Min 54 51 104 121 136	Oil 0,15 Max 70 70 177 177	Used 60 60 150 150	Min 29 27 55 65 73	olycoat 0,1 Max 37 37 94 94	08 Used 32 32 80 80 80	No L Min 90 85 173 202 227	ubrication Max 117 117 295 295 295	0,25 Usec 100 100 250 250
Flange size (DN) 15 20 25 32 40 50 65	Bolt size M12 M12 M12 M16 M16 M16 M16	Number 4 4 4 4 4 4 4 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1	90 86 133 155 175 235	olt Force K Max 117 117 227 227 227 371	N Used 100 193 193 193 308	Min 54 51 104 121 136 91	Oil 0,15 Max 70 70 177 177 177	Used 60 60 150 150 150 120	Min 29 27 55 65 73 49	0/ycoat 0,1 Max 37 37 94 94 94 77	08 Used 32 32 80 80 80 64	No L Min 90 85 173 202 227 152	ubrication Max 117 117 295 295 295 240	0,25 Used 100 100 250 250 250
Flange size (DN) 15 20 25 32 40 50 65 80	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9	90 86 133 155 175 235 252	olt Force K Max 117 117 227 227 227 371 462	N Used 100 193 193 193 308 385	Min 54 51 104 121 136 91 98	Oil 0,15 Max 70 70 177 177 177 177 144 180	Used 60 150 150 150 150 150	Min 29 27 55 65 73 49 52	0/ycoat 0,1 Max 37 37 94 94 94 77 96	08 Used 32 32 80 80 80 64 80	No L Min 90 85 173 202 227 152 163	Ubrication Max 117 117 295 295 295 295 295 240 300	0,25 User 100 100 250 250 250 250 250
Flange size (DN) 15 20 25 32 40 50 65 80 100	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6	90 86 133 155 175 235 235 252 304	olt Force K Max 117 117 227 227 227 227 371 462 462	N Used 100 193 193 193 308 385 385	Min 54 51 104 121 136 91 98 118	Oil 0,15 Max 70 70 177 177 177 177 144 180 180	Used 60 150 150 150 120 150	Min 29 27 55 65 73 49 52 63	0/ycoat 0,1 Max 37 37 94 94 94 77 96 96	08 Used 32 32 80 80 80 64 80 80 80 80	No L Min 90 85 173 202 227 152 163 197	Ubrication Max 117 117 295 295 295 295 295 295 240 300 300	0,25 Usei 100 250 250 250 250 250 250 250
Flange size (DN) 15 20 25 32 40 50 65 80 100 125	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8	90 86 133 155 175 235 252 304 347	olt Force K Max 117 117 227 227 227 227 371 462 462 462	N Used 100 193 193 193 308 385 385 385	Min 54 51 104 121 136 91 98 118 135	Oil 0,15 Max 70 70 177 177 177 177 180 180 180	Used 60 150 150 150 120 150 150	Min 29 27 55 65 73 49 52 63 72	0/ycoat 0,1 Max 37 37 94 94 94 77 96 96 96	08 Used 32 32 80 80 80 64 80 80 80 80 80 80	No L Min 90 85 173 202 227 152 163 197 225	ubrication Max 117 117 295 295 295 240 300 300 300	0,25 Usei 100 250 250 250 250 250 250 250 250
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2	90 86 133 155 175 235 252 304 347 420	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 626	N Used 100 193 193 193 308 385 385 385 515	Min 54 51 104 121 136 91 98 118 135 204	Oil 0,15 Max 70 70 177 177 177 177 180 180 180 304	Used 60 150 150 150 120 150 150 150 250	Min 29 27 55 65 73 49 52 63 72 109	0/ycoat 0,1 Max 37 37 94 94 94 77 96 96 96 96	08 Used 32 32 80 80 64 80 80 80 80 80 80 80 80 80 80 80 80 80	No L Min 90 85 173 202 227 152 163 197 225 340	ubrication Max 117 295 295 295 240 300 300 300 507	0,25 Use 100 250 250 250 250 250 250 250 250 250 2
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20	Number 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1	90 86 133 155 175 235 252 304 347 420 544	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 626 791	N Used 100 193 193 193 308 385 385 385 515 618	Min 54 51 104 121 136 91 98 118 135 204	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 304 256	Used 60 60 150 150 150 150 150 150 250 200	Min 29 27 55 65 73 49 52 63 72 109 94	0/ycoat 0,1 Max 37 37 94 94 94 94 94 94 94 96 96 96 162 137	08 Used 32 32 80 80 80 64 80 80 80 80 133 107	No L Min 90 85 173 202 227 152 163 197 225 340 293	ubrication Max 117 295 295 295 295 295 240 300 300 300 300 507 427	0,25 User 100 250 250 250 250 250 250 250 250 250 2
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M24	Number 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2	90 86 133 155 175 235 252 304 347 420 544 601	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 626 791 931	N Used 100 193 193 193 308 385 385 385 385 515 618 781	Min 54 51 104 121 136 91 98 118 135 204 176 231	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 304 256 357	Used 60 60 150 150 150 150 150 150 150 150 250 200 300	Min 29 27 55 65 73 49 52 63 72 109 94 123	0/ycoat 0,1 Max 37 37 94 94 94 94 94 94 94 96 96 96 162 137 190	08 Used 32 32 80 80 80 64 80 80 80 80 80 133 107 160	No L Min 90 85 173 202 227 152 163 197 225 340 293 385	ubrication Max 117 295 295 295 295 295 240 300 300 300 300 507 427 595	0,25 User 100 250 250 250 250 250 250 250 250 250 2
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M24 M24	Number 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 12 12 12	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2 136,1	90 86 133 155 175 235 252 304 347 420 544 601 714	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 626 791 931 1277	N Used 100 193 193 193 308 385 385 385 385 515 618 781 781	Min 54 51 104 121 136 91 98 118 135 204 176 231 274	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 304 256 357 490	Used 60 60 150 150 150 150 150 150 150 150 250 200 300 300	Min 29 27 55 65 73 49 52 63 72 109 94 123 146	0/ycoat 0,1 Max 37 37 94 94 94 94 94 96 96 96 96 162 137 190 261	08 Used 32 32 80 80 80 64 80 80 80 80 80 80 80 107 160 160	No L Min 90 85 173 202 227 152 163 197 225 340 293 385 457	ubrication Max 117 117 295 295 295 295 295 240 300 300 300 300 300 507 427 595 817	0,25 Use 100 250 250 250 250 250 250 417 333 500 500
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20 M24 M24 M24	Number 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2 136,1 147	E Min 90 86 133 155 175 235 252 304 347 420 544 601 714 859	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 462 626 791 931 1277 1762	N Used 100 193 193 193 308 385 385 385 385 515 618 781 781 781 1389	Min 54 51 104 121 136 91 98 118 135 204 176 231 274 247	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 304 256 357 490 507	Used 60 60 150 150 150 150 150 150 150 150 250 200 300 300 400	Min 29 27 55 65 73 49 52 63 72 109 94 123 146 132	0/ycoat 0,1 Max 37 37 94 94 94 94 94 96 96 96 96 162 137 190 261 270	08 Used 32 32 80 80 80 64 80 80 80 133 107 160 160 213	No L Min 90 85 173 202 227 152 163 197 225 340 293 385 457 412	ubrication Max 117 117 295 295 295 295 295 295 240 300 300 300 300 300 507 427 595 817 845	0,25 Use 100 250 250 250 250 250 250 250 250 250 2
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20 M24 M24 M24 M27	Number 4 4 4 4 4 4 4 8 8 8 8 8 8 12 12 12 16 16 16	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2 136,1 147 157,1	90 86 133 155 175 235 252 304 347 420 544 601 714 859 961	olt Force K Max 117 117 227 227 227 227 371 462 462 462 462 462 462 462 462 931 1277 1762 1962	N Used 100 193 193 193 308 385 385 385 385 515 618 781 781 781 1389 1537	Min 54 51 104 121 136 91 98 118 135 204 176 231 274 247 313	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 304 256 357 490 507 638	Used 60 60 150 150 150 150 150 150 150 250 200 300 300 400 500	Min 29 27 55 65 73 49 52 63 72 109 94 123 146 132 167	0/ycoat 0,1 Max 37 37 94 94 94 94 77 96 96 96 96 96 162 137 190 261 270 340	08 Used 32 32 80 80 80 64 80 80 80 133 107 160 160 213 267	No L Min 90 85 173 202 227 152 163 197 225 340 293 385 457 412 522	ubrication Max 117 117 295 295 295 295 295 295 240 300 300 300 300 300 507 427 595 817 845 1063	0,25 User 100 250 250 250 250 250 250 250 250 250 2
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400 450	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20 M24 M24 M24 M27 M27	Number 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 12 12 12 16 16 20	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2 136,1 147 157,1 166,7	90 86 133 155 175 235 252 304 347 420 544 601 714 859 961 1119	olt Force K Max 117 227 227 227 227 371 462 462 462 462 462 462 462 462 462 462	N Used 100 193 193 193 308 385 385 385 385 515 618 781 781 1389 1537 1729	Min 54 51 104 121 136 91 98 118 135 204 176 231 274 247 313 291	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 180 304 256 357 490 507 638 539	Used 60 60 150 150 150 150 150 150 150 250 200 300 300 400 500 450	Min 29 27 55 65 73 49 52 63 72 109 94 123 146 132 167 155	0lycoat 0,1 Max 37 37 94 94 94 94 94 96 96 96 96 96 162 137 190 261 270 340 287	08 Used 32 32 80 80 80 64 80 80 80 133 107 160 160 213 267 240	No L Min 90 85 173 202 227 152 163 197 225 340 293 385 457 412 522 485	ubrication Max 117 117 295 295 295 295 295 295 295 240 300 300 300 300 507 427 595 817 845 1063 898	0,25 User 100 250 250 250 250 250 250 250 417 333 500 667 833 750
Flange size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 350 400 450 500	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	External axial force (KN) 11,8 15,7 19,6 25,1 31,4 39,3 51,1 62,9 78,6 87,8 96,2 111,1 124,2 136,1 147 157,1 166,7 175,7	E Min 90 86 133 155 175 235 252 304 347 420 544 601 714 859 961 1119 1307	olt Force K Max 117 227 227 227 227 371 462 462 462 462 462 462 626 791 931 1277 1762 1962 2070 2207	N Used 100 193 193 193 308 385 385 385 385 515 618 781 781 781 1389 1537 1729 1704	Min 54 51 104 121 136 91 98 118 135 204 176 231 274 247 313 291 383	Oil 0,15 Max 70 70 177 177 177 177 144 180 180 180 180 180 304 256 357 490 507 638 539 647	Used 60 60 150 150 150 150 150 150 150 250 200 300 300 400 500 450 500	Min 29 27 55 65 73 49 52 63 72 109 94 123 146 132 167 155 204	0lycoat 0,1 Max 37 37 94 94 94 94 94 94 77 96 96 96 96 96 162 137 190 261 270 340 287 345	08 Used 32 32 80 80 80 64 80 80 64 80 80 133 107 160 160 213 267 240 267	No L Min 90 85 173 202 227 152 163 197 225 340 293 385 457 412 522 485 638	ubrication Max 117 117 295 295 295 295 295 295 240 300 300 300 300 300 507 427 595 817 817 845 1063 898 1078	0,25 User 100 250 250 250 250 250 250 250 250 417 333 500 500 607 833 750 833

8.17 Table 17: Pipe class F400, F401 / PN40 – Fiber gasket

Pipe clas	ss			F400, F40	1							Table 17			
Pipe sys	tem			PN40											
Flange N	laterial			1.4404 / 1.	4571										
Bolt Mate	erial			21CrMo5-7	/ A4-70										
Gasket I	Material			KLINGERS	IL C-4400 2	2mm									
Gasket I	Manufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket t	уре			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	Temperatur	e		200°C con	sidered in t	he calculati	on								
External	force and	moments		DN15 DI	400 = acc	ording EN1	092 -1 (rec	luced)							
Entorna	loree and			51110 51		ion dang zinn		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
Remark	(S														
- Depend	ding on lubi	rication, st	ate of bolt an	d external f	orces the a	actual requir	red torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	kelijk van de	e smering,	staat van de	bouten en e	externe kra	chten kan h	iet werkelij	k benodigd	de aanhaalr	noment afv	vijken van	het hierond	der bereke	nde aanha	almoment
Flange			External	E	lolt Force K	N					Torque Nn	n			
size			axial force					Oil 0,15		M	olycoat 0,	08	No L	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	11,8	50	136	100	30	81	60	16	43	32	50	135	100
20	M12	4	15,7	76	127	100	45	76	60	24	41	32	75	127	100
25	M12	4	19,6	68	122	100	41	73	60	22	39	32	68	122	100
32	M16	4	25,1	124	244	193	97	190	150	52	101	80	162	317	250
40	M16	4	31,4	150	246	193	117	192	150	62	102	80	195	320	250
50	M16	4	39,3	185	243	193	144	189	150	77	101	80	240	315	250
65	M16	8	19,7	184	441	385	72	172	150	38	92	80	120	287	250
80	M16	8	62,9	243	504	385	95	196	150	51	105	80	158	327	250
100	M20	8	78,6	320	550	412	155	267	200	83	142	107	258	445	333
125	M24	8	87,8	379	658	521	218	379	300	116	202	160	363	632	500
150	M24	8	96,2	450	839	608	259	483	350	138	258	187	432	805	583
200	M27	12	111,1	645	1155	922	280	501	400	149	267	213	467	835	667
250	M30	12	124,2	828	1681	1227	405	822	600	216	438	320	675	1370	1000
300	M30	16	136,1	1021	2171	1636	374	796	600	199	425	320	623	1327	1000
350	M33	16	160,4	1351	2839	2003	540	1134	800	288	605	427	900	1890	1333
400	M36	16	161	1832	3614	2533	796	1570	1100	425	837	587	1327	2617	1833

8.17 A Table 17a: Pipe class F400 / PN40 – Fiber gasket – Oxygen system

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Pipe clas	ss			F400								Table 17a			
Pipe sys	tem			PN40											
Flange N	laterial			1.4404 / 1.	4571										
Bolt Mate	erial			21CrMo5	7										
Gasket N	Material			KLINGERS	IL C-4400 2	mm									
Gasket N	Manufactur	е		KLINGER®	GmbH & Co	o. KG									
Gasket t	уре			IBC											
Leak tigh	nness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	Femperature	е		200°C con	sidered in t	he calculation	on								
External	force and	moments		DN15 DN	1400 = acc	ording EN1	092 -1 (red	luced)							
Remark	(S														
- Depend	ding on lubr	ication, sta	ate of bolt and	d external f	orces the a	ctual requir	ed torque i	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	kelijk van de	smering,	staat van de	bouten en e	externe krad	chten kan h	et werkelij	k benodigd	e aanhaaln	noment afv	vijken van	het hierond	ler bereker	nde aanhaa	almoment
Flange			External	B	olt Force K	N					Torque Nm	1			
size			axial force				Paral	IL OV 40 E			E OV 400 I	CD 0 40	N		
				1			Dereit	10 UX 40 E	P 0,23	Berulu	D UX 1001	EP 0,16	NOL	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	0,25 Used
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	0,25 Used
(DN) 15	Bolt size M12	Number 4	(KN) 11,8	Min 50	Max 136	Used 100	Min 46	Max 124	90,23 Used 92	Min 36	Max 97	Used 72	Min 50	Max 135	0,25 Used 100
(DN) 15 20	Bolt size M12 M12	Number 4 4	(KN) 11,8 15,7	Min 50 76	Max 136 127	Used 100 100	46 69	Max 124 117	90,23 Used 92 92	Min 36 54	97 91	Used 72 72	50 75	Max 135 127	0,25 Used 100 100
(DN) 15 20 25	Bolt size M12 M12 M12 M12	Number 4 4 4	(KN) 11,8 15,7 19,6	Min 50 76 68	Max 136 127 122	Used 100 100 100	Min 46 69 63	124 117 112	92 92 92 92 92	Berulu Min 36 54 49	97 91 88	72 72 72 72	No L Min 50 75 68	135 127 122	0,25 Used 100 100 100
(DN) 15 20 25 32	Bolt size M12 M12 M12 M12 M16	Number 4 4 4 4	(KN) 11,8 15,7 19,6 25,1	Min 50 76 68 124	Max 136 127 122 244	Used 100 100 100 193	Min 46 69 63 149	124 117 112 291	92 92 92 92 92 230	Berulu Min 36 54 49 116	97 91 88 228	72 72 72 72 72 180	No L Min 50 75 68 162	135 127 122 317	0,25 Used 100 100 100 250
(DN) 15 20 25 32 40	Bolt size M12 M12 M12 M12 M16 M16	Number 4 4 4 4 4 4	(KN) 11,8 15,7 19,6 25,1 31,4	Min 50 76 68 124 150	Max 136 127 122 244 246	Used 100 100 100 193 193	Min 46 69 63 149 179	Max 124 117 112 291 294	92 92 92 92 230 230	Berulu Min 36 54 49 116 140	Max 97 91 88 228 230	72 72 72 72 180 180	No L Min 50 75 68 162 195	135 127 122 317 320	0,25 Used 100 100 250 250
(DN) 15 20 25 32 40 50	Bolt size M12 M12 M12 M16 M16 M16 M16	Number 4 4 4 4 4 4 4 4	(KN) 11,8 15,7 19,6 25,1 31,4 39,3	Min 50 76 68 124 150 185	Max 136 127 122 244 246 243	Used 100 100 193 193 193	46 69 63 149 179 221	Max 124 117 112 291 294 290	92 92 92 92 230 230 230	Berulu Min 36 54 49 116 140 173	97 97 91 88 228 230 227	72 72 72 72 180 180 180	No L Min 50 75 68 162 195 240	Ubrication Max 135 127 122 317 320 315	0,25 Used 100 100 250 250 250
(DN) 15 20 25 32 40 50 65	Bolt size M12 M12 M12 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7	Min 50 76 68 124 150 185 184	Max 136 127 122 244 246 243 441	Used 100 100 193 193 193 385	Min 46 69 63 149 179 221 110	Max 124 117 112 291 294 290 264	90,23 92 92 92 230 230 230 230	Berulu Min 36 54 49 116 140 173 86	97 91 88 228 230 227 206	72 72 72 72 180 180 180 180	No L Min 50 75 68 162 195 240 120	Max 135 127 122 317 320 315 287	0,25 Used 100 100 250 250 250 250 250
(DN) 15 20 25 32 40 50 65 80	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9	Min 50 76 68 124 150 185 184 243	Max 136 127 122 244 246 243 441 504	Used 100 100 193 193 193 385 385	Min 46 69 63 149 179 221 110 146	Max 124 117 112 291 294 290 264 301	90,23 92 92 92 230 230 230 230 230 230	Berulu Min 36 54 49 116 140 173 86 114	97 97 91 88 228 230 227 206 235	72 72 72 180 180 180 180 180	No L Min 50 75 68 162 195 240 120 158	Max 135 127 122 317 320 315 287 327	0,25 Used 100 100 250 250 250 250 250 250
(DN) 15 20 25 32 40 50 65 80 100	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20	Number 4 4 4 4 4 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6	Min 50 76 68 124 150 185 184 243 320	Max 136 127 122 244 246 243 441 504 550	Used 100 100 193 193 193 385 385 412	Min 46 69 63 149 179 221 110 146 238	Max 124 117 112 291 294 290 264 301 409	90,23 92 92 92 230 230 230 230 230 230 230 307	Berulu Min 36 54 49 116 140 173 86 114 186	97 97 91 88 228 230 227 206 235 320	72 72 72 180 180 180 180 180 240	No L Min 50 75 68 162 195 240 120 158 258	Max 135 127 122 317 320 315 287 327 445	0,25 Used 100 100 250 250 250 250 250 250 333
(DN) 15 20 25 32 40 50 65 80 100 125	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24	Number 4 4 4 4 8 8 8 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8	Min 50 76 68 124 150 185 184 243 320 379	Max 136 127 122 244 246 243 441 504 550 658	Used 100 100 193 193 193 385 385 412 521	Min 46 69 63 149 179 221 110 146 238 334	Max 124 117 112 291 294 290 264 301 409 581	90,23 92 92 92 230 230 230 230 230 230 307 460	Berulu Min 36 54 49 116 140 173 86 114 186 262	97 97 91 88 228 230 227 206 235 320 455	72 72 72 180 180 180 180 180 180 240 360	No L Min 50 75 68 162 195 240 120 158 258 363	Max 135 127 122 317 320 315 287 327 445 632	0,25 Used 100 100 250 250 250 250 250 250 333 500
(DN) 15 20 25 32 40 50 65 80 100 125 150	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24	Number 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2	Min 50 76 68 124 150 185 184 243 320 379 450	Max 136 127 122 244 246 243 441 504 550 658 839	Used 100 100 193 193 193 385 385 412 521 608	Min 46 69 63 149 179 221 110 146 238 334 397	Max 124 117 112 291 294 290 264 301 409 581 741	90,23 92 92 92 230 230 230 230 230 230 307 460 537	Berulu Min 36 54 49 116 140 173 86 114 186 262 311	Max 97 91 88 228 230 227 206 235 320 455 580	72 72 72 180 180 180 180 180 180 240 360 420	No L Min 50 75 68 162 195 240 120 158 258 363 432	Max 135 127 122 317 320 315 287 327 445 632 805	0,25 Used 100 100 250 250 250 250 250 250 333 500 583
(DN) 15 20 25 32 40 50 65 80 100 125 150 200	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24 M27	Number 4 4 4 4 8 8 8 8 8 8 8 8 8 8 12	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1	Min 50 76 68 124 150 185 184 243 320 379 450 645	Max 136 127 122 244 246 243 441 504 550 658 839 1155	Used 100 100 193 193 193 385 385 412 521 608 922	Min 46 69 63 149 179 221 110 146 238 334 397 429	Max 124 117 112 291 294 290 264 301 409 581 741 768	90,23 92 92 92 230 230 230 230 230 230 230 230 230 307 460 537 613	Berulu Min 36 54 49 116 140 173 86 114 186 262 311 336	Max 97 91 88 228 230 227 206 235 320 455 580 601	72 72 72 180 180 180 180 180 180 180 240 360 420 480	No L Min 50 75 68 162 195 240 120 158 258 363 432 467	Max 135 127 122 317 320 315 287 327 445 632 805 835	0,25 Used 100 100 250 250 250 250 250 250 333 500 583 667
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M20 M24 M24 M24 M27 M30	Number 4 4 4 4 8 8 8 8 8 8 8 8 8 12 12	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2	Min 50 76 68 124 150 185 184 243 320 379 450 645 828	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681	Used 100 100 193 193 193 385 385 412 521 608 922 1227	Min 46 69 63 149 179 221 110 146 238 334 397 429 621	Max 124 117 112 291 294 290 264 301 409 581 741 768 1260	90,23 92 92 92 230 230 230 230 230 230 230 230 230 307 460 537 613 920	Berulu Min 36 54 49 116 140 173 86 114 186 262 311 336 486	Max 97 91 88 228 230 227 206 235 320 455 580 601 986	72 72 72 72 180 180 180 180 180 180 180 240 360 420 480 720	No L Min 50 75 68 162 195 240 120 158 258 363 432 467 675	Max 135 127 122 317 320 315 287 327 445 632 805 835 1370	0,25 Used 100 100 250 250 250 250 250 250 333 500 583 667 1000
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M20 M24 M24 M24 M27 M30 M30	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 12 12 12 16	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2 136,1	Min 50 76 68 124 150 185 184 243 320 379 450 645 828 1021	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681 2171	Used 100 100 193 193 193 385 385 412 521 608 922 1227 1636	Min 46 69 63 149 179 221 110 146 238 334 397 429 621 573	Max 124 117 112 291 294 290 264 301 409 581 741 768 1260 1221	90,23 92 92 92 230 230 230 230 230 230 230 230 230 23	Berulu Min 36 54 49 116 140 173 86 114 186 262 311 336 486 449	Max 97 91 88 228 230 227 206 235 320 455 580 601 986 955	72 72 72 72 180 180 180 180 180 180 180 240 360 420 480 720 720	No L Min 50 75 68 162 195 240 120 158 258 363 432 467 675 623	Ubrication Max 135 127 122 317 320 315 287 327 445 632 805 835 1370 1327	0,25 Used 100 100 250 250 250 250 250 250 333 500 583 667 1000 1000
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M20 M24 M24 M24 M24 M27 M30 M30 M33	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 12 12 12 16 16	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2 136,1 160,4	Min 50 76 68 124 150 185 184 243 320 379 450 645 828 1021 1351	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681 2171 2839	Used 100 100 193 193 193 385 385 412 521 608 922 1227 1636 2003	Min 46 69 63 149 179 221 110 146 238 334 397 429 621 573 828	Max 124 117 112 291 294 290 264 301 409 581 741 768 1260 1221 1739	90,23 92 92 92 230 230 230 230 230 230 230 23	Berulu Min 36 54 49 116 140 173 86 114 186 262 311 336 486 489 648	Max 97 91 88 228 230 227 206 235 320 455 580 601 986 985 1361	72 72 72 72 180 180 180 180 180 180 180 240 360 420 480 720 720 960	No L Min 50 75 68 162 195 240 120 158 258 363 432 467 675 623 900	Ubrication Max 135 127 122 317 320 315 287 327 445 632 805 835 1370 1327 1890	0,25 Used 100 100 250 250 250 250 250 250 333 500 583 667 1000 1000 1333

8.17 B Table 17b: Pipe class F401 / PN40 – Fiber gasket – Oxygen system

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Dine elec															
Pipe clas	s			F401								Table 17b)		
Pipe sys	tem			PN40											
Flange M	laterial			1.4404 / 1.	4571										
Bolt Mate	erial			A4-70											
Gasket N	/aterial			KLINGERS	IL C-4400 2	2mm									
Gasket N	lanufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket t	уре			IBC											
Leak tigh	iness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculati	on								
External	force and	moments		DN15 DI	V400 = acc	cording EN1	092 -1 (red	luced)							
Remark	s														
- Depend	ding on lubr	rication, st	ate of bolt an	d external f	orces the a	actual requir	red torque i	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en (externe kra	chten kan h	et werkelij	k benodigd	le aanhaaln	noment afv	vijken van	het hierond	der berekei	nde aanha	almoment
Flange			External	E	olt Force K	N					Torque Nm	1			
size			avial force		1		Devel	1.014.40.5							
			axial luice				Bereil	ID OX 40 E	P 0,26	Berulu	6 OX 100 I	EP 0,26	NOL	ubrication	0,50
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	P 0,26 Used	Berulu Min	Max	Used	Min	max	0,50 used
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	P 0,26 Used	Berulu Min	Max	Used	Min	max	0,50 used
(DN) 15	Bolt size M12	Number 4	(KN) 11,8	Min 50	Max 136	Used 100	Min 52	Max 140	P 0,26 Used 104	Berulu Min 52	6 OX 100 I Max 140	Used 104	No L Min 100	ubrication max 270	0,50 used 200
(DN) 15 20	Bolt size M12 M12	Number 4 4	(KN) 11,8 15,7	Min 50 76	Max 136 127	Used 100 100	Min 52 78	Max 140 132	P 0,26 Used 104 104	Berulu Min 52 78	Max 140 132	Used 104 104	No L Min 100 150	270 253	0,50 used 200 200
(DN) 15 20 25	Bolt size M12 M12 M12 M12	Number 4 4 4	(KN) 11,8 15,7 19,6	Min 50 76 68	Max 136 127 122	Used 100 100 100	52 78 71	140 140 127	P 0,26 Used 104 104 104	Berulu Min 52 78 71	Max 140 132 127	104 104 104	No L Min 100 150 137	270 253 243	0,50 used 200 200 200
(DN) 15 20 25 32	Bolt size M12 M12 M12 M12 M16	Number 4 4 4 4 4	(KN) 11,8 15,7 19,6 25,1	Min 50 76 68 124	Max 136 127 122 244	Used 100 100 100 193	52 78 71 168	140 140 132 127 329	P 0,26 Used 104 104 104 260	Berulu Min 52 78 71 168	140 132 127 329	104 104 104 104 260	No L Min 100 150 137 323	270 253 243 633	0,50 used 200 200 200 500
(DN) 15 20 25 32 40	Bolt size M12 M12 M12 M16 M16	Number 4 4 4 4 4 4	(KN) 11,8 15,7 19,6 25,1 31,4	Min 50 76 68 124 150	Max 136 127 122 244 246	Used 100 100 100 193 193	52 78 71 168 203	Max 140 132 127 329 333	P 0,26 Used 104 104 104 260 260	Berulu Min 52 78 71 168 203	Max 140 132 127 329 333	104 104 104 104 260 260	No L Min 100 150 137 323 390	270 253 243 633 640	0,50 used 200 200 500 500
(DN) 15 20 25 32 40 50	Bolt size M12 M12 M12 M16 M16 M16 M16	Number 4 4 4 4 4 4 4	(KN) 11,8 15,7 19,6 25,1 31,4 39,3	Min 50 76 68 124 150 185	Max 136 127 122 244 246 243	Used 100 100 193 193 193	Bereil Min 52 78 71 168 203 250	Max 140 132 127 329 333 328	P 0,26 Used 104 104 260 260 260	Berulu Min 52 78 71 168 203 250	Max 140 132 127 329 333 328	104 104 104 260 260 260	No L Min 100 150 137 323 390 480	ubrication max 270 253 243 633 640 630	0,50 used 200 200 200 500 500 500
(DN) 15 20 25 32 40 50 65	Bolt size M12 M12 M12 M12 M12 M16 M16 M16 M16	Number 4 4 4 4 4 4 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7	Min 50 76 68 124 150 185 184	Max 136 127 122 244 246 243 441	Used 100 100 193 193 193 385	Bereil Min 52 78 71 168 203 250 125	Max 140 132 127 329 333 328 298	P 0,26 Used 104 104 260 260 260 260	Berulu Min 52 78 71 168 203 250 125	Max 140 132 127 329 333 328 298	104 104 104 260 260 260 260	No L Min 100 150 137 323 390 480 240	ubrication max 270 253 243 633 640 630 573	0,50 used 200 200 200 500 500 500 500
(DN) 15 20 25 32 40 50 65 80	Bolt size M12 M12 M12 M12 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9	Min 50 76 68 124 150 185 184 243	Max 136 127 122 244 246 243 441 504	Used 100 100 193 193 193 385 385	Bereil Min 52 78 71 168 203 250 125 165	Max 140 132 127 329 333 328 298 340	P 0,26 Used 104 104 260 260 260 260 260 260	Berulu Min 52 78 71 168 203 250 125 165	Max 140 132 127 329 333 328 298 340	104 104 104 260 260 260 260 260	No L Min 100 150 137 323 390 480 240 317	ubrication max 270 253 243 633 640 630 573 653	0,50 used 200 200 500 500 500 500 500
(DN) 15 20 25 32 40 50 65 80 100	Bolt size M12 M12 M12 M12 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6	Min 50 76 68 124 150 185 184 243 320	Max 136 127 122 244 246 243 441 504 550	Used 100 100 193 193 193 385 385 412	Bereil Min 52 78 71 168 203 250 125 165 269	Max 140 132 127 329 333 328 298 340 463	P 0,26 Used 104 104 260 260 260 260 260 260 347	Berulu Min 52 78 71 168 203 250 125 165 269	6 0X 100 F Max 140 132 127 329 333 328 298 340 463	104 104 104 260 260 260 260 260 347	No L Min 100 150 137 323 390 480 240 317 517	ubrication max 270 253 243 633 640 630 573 653 890	0,50 used 200 200 500 500 500 500 500 667
(DN) 15 20 25 32 40 50 65 80 100 125	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24	Number 4 4 4 4 4 8 8 8 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8	Min 50 76 68 124 150 185 184 243 320 379	Max 136 127 122 244 246 243 441 504 550 658	Used 100 100 193 193 193 385 385 412 521	Bereil Min 52 78 71 168 203 250 125 165 269 378	Max 140 132 127 329 333 328 298 340 463 657	P 0,26 Used 104 104 260 260 260 260 260 260 347 520	Berulu Min 52 78 71 168 203 250 125 165 269 378	6 0X 100 F Max 140 132 127 329 333 328 298 340 463 657	104 104 104 260 260 260 260 260 347 520	No L Min 100 150 137 323 390 480 240 317 517 727	Ubrication max 270 253 243 633 640 630 573 653 890 1263	0,50 used 200 200 500 500 500 500 500 667 1000
(DN) 15 20 25 32 40 50 65 80 100 125 150	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2	Min 50 76 68 124 150 185 184 243 320 379 450	Max 136 127 122 244 246 243 441 504 550 658 839	Used 100 100 193 193 193 385 385 412 521 608	Bereil Min 52 78 71 168 203 250 125 165 269 378 449	Max 140 132 127 329 333 328 298 340 463 657 837	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607	Berulu Min 52 78 71 168 203 250 125 165 269 378 449	6 0X 100 F Max 140 132 127 329 333 328 298 340 463 657 837	104 104 104 260 260 260 260 260 347 520 607	No L Min 100 150 137 323 390 480 240 317 517 727 863	Ubrication max 270 253 243 633 640 630 573 653 890 1263 1610	0,50 used 200 200 500 500 500 500 500 667 1000 1167
(DN) 15 20 25 32 40 50 65 80 100 125 150 200	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24 M27	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 12	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1	Min 50 76 68 124 150 185 184 243 320 379 450 645	Max 136 127 122 244 246 243 441 504 550 658 839 1155	Used 100 100 193 193 193 385 385 412 521 608 922	Bereil Min 52 78 71 168 203 250 125 165 269 378 449 485	Max 140 132 127 329 333 328 298 340 463 657 837 868	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693	Berulu Min 52 78 71 168 203 250 125 165 269 378 449 485	6 0X 100 F Max 140 132 127 329 333 328 298 340 463 657 837 868	104 104 104 260 260 260 260 260 260 347 520 607 693	No L Min 100 150 137 323 390 480 240 317 517 727 863 933	Ubrication max 270 253 243 633 640 630 573 653 890 1263 1610 1670	0,50 used 200 200 500 500 500 500 667 1000 1167 1333
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24 M24 M27 M30	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 12 12	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2	Min 50 76 68 124 150 185 184 243 320 379 450 645 828	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681	Used 100 100 193 193 193 385 385 412 521 608 922 1227	Bereil Min 52 78 71 168 203 250 125 165 269 378 449 485 702	Max 140 132 127 329 333 328 298 340 463 657 837 868 1425	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693 1040	Berulu Min 52 78 71 168 203 250 125 165 269 378 449 485 702	Max 140 132 127 329 333 328 298 340 463 657 837 868 1425	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693 1040	No L Min 100 150 137 323 390 480 240 317 517 727 863 933 1350	ubrication max 270 253 243 633 640 630 573 653 890 1263 1610 1670 2740	0,50 used 200 200 500 500 500 500 667 1000 1167 1333 2000
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M24 M24 M24 M27 M30 M30	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 12 12 12 16	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2 136,1	Min 50 76 68 124 150 185 184 243 320 379 450 645 828 1021	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681 2171	Used 100 100 193 193 193 385 385 412 521 608 922 1227 1636	Bereil Min 52 78 71 168 203 250 125 165 269 378 449 485 702 648	Max 140 132 127 329 333 328 298 340 463 657 837 868 1425 1380	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693 1040 1040	Berulu Min 52 78 71 168 203 250 125 165 269 378 449 485 702 648	Max 140 132 127 329 333 328 298 340 463 657 837 868 1425 1380	P 0,26 Used 104 104 260 260 260 260 260 260 260 347 520 607 693 1040 1040	No L Min 100 150 137 323 390 480 240 317 517 727 863 933 1350 1247	Ubrication max 270 253 243 633 640 630 573 653 890 1263 1610 1670 2740 2653	0,50 used 200 200 500 500 500 500 500 667 1000 1167 1333 2000 2000
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M20 M24 M24 M24 M27 M30 M30 M33	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 12 12 12 16 16	(KN) 11,8 15,7 19,6 25,1 31,4 39,3 19,7 62,9 78,6 87,8 96,2 111,1 124,2 136,1 160,4	Min 50 76 68 124 150 185 184 243 320 379 450 645 828 1021 1351	Max 136 127 122 244 246 243 441 504 550 658 839 1155 1681 2171 2839	Used 100 100 193 193 193 385 385 412 521 608 922 1227 1636 2003	Bereil Min 52 78 71 168 203 250 125 165 269 378 449 485 702 648 936	Max 140 132 127 329 333 328 298 340 463 657 837 868 1425 1380 1966	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693 1040 1040 1387	Berulu Min 52 78 71 168 203 250 125 165 269 378 449 485 702 648 936	6 0X 100 F Max 140 132 127 329 333 328 298 340 463 657 837 868 1425 1380 1966	P 0,26 Used 104 104 260 260 260 260 260 260 347 520 607 693 1040 1040 1387	No L Min 100 150 137 323 390 480 240 317 517 727 863 933 1350 1247 1800	Ubrication max 270 253 243 633 640 630 573 653 890 1263 1610 1670 2740 2653 3780	0,50 used 200 200 500 500 500 500 500 667 1000 1167 1333 2000 2000 2667

8.18 Table 18: Pipe class A060 / PN10 – PTFE based gasket

Pipe clas	s			A060								Table 18			
Pipe syst	tem			PN10											
Flange M	aterial			P250GH											
Bolt Mate	rial			25CrMo4											
Gasket N	laterial			KLINGER®	top-chem2	000 2.0mm									
Gasket N	lanufactur	e		KLINGER®	GmbH & C	o. KG									
Gasket t	vpe			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			According	to the pipe	class									
Design T	emperature	e		200°C con	sidered in t	he calculation	on								
_															
External	force and	moments		DN15 DI	V350 = acc	ording EN10	092 -1 (red	duced)							
				DN400 -DN	1.35 - 1.35	times of inte	ernal press	sure							
				DN600 &	above - 1 tir	mes of inter	nal pressu	ire							
Remark	s														
- Depend	ling on lubr	rication, st	tate of bolt an	d external f	orces the a	ctual requir	ed torque	may differ	from the be	elow advis	ed calcula	ted torque			
- Afhank	elijk van de	smering,	staat van de	bouten en	externe kra	chten kan h	et werkelij	k benodigd	le aanhaaln	noment afv	vijken van	het hierond	der bereke	nde aanha	almoment
Flange			External	E	Bolt Force K	N					Torque Nn	1			
size			axial force					Oil 0,15		M	lolycoat 0,	08	No I	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
15	M12	4	13,6												
20	M12	4	18,1	37	119	85	22	70	50	12	37	27	37	117	83
25	M12	4	22,6	48	117	85	28	68	50	15	36	27	47	113	83
32	M16	4	29	61	240	196	47	184	150	25	98	80	78	307	250
40	M16	4	36,2	77	239	196	59	183	150	31	98	80	98	305	250
50	M16	4	50	99	240	196	76	184	150	41	98	80	127	307	250
65	M16	8	58,8	161	485	392	62	184	150	33	98	80	103	307	250
80	M16	8	72,4	184	488	392	70	187	150	37	100	80	117	312	250
100	M16	8	100	258	488	392	99	187	150	53	100	80	165	312	250
125	M16	8	101,2	266	488	392	102	187	150	54	100	80	170	312	250
150	M20	8	122,5	354	695	515	172	338	250	92	180	133	287	563	417
200	M20	8	128	387	695	515	188	338	250	100	180	133	313	563	417
250	M20	12	143,1	470	1051	772	152	340	250	81	181	133	253	567	417
300	M20	12	156,8	556	1051	772	180	340	250	96	181	133	300	567	417
350	M20	16	169,3	827	1408	1029	201	342	250	107	182	133	335	570	417
400	M24	16	135,4	879	1719	1215	253	495	350	135	264	187	422	825	583
450	M24	20	170,5	1159	1733	1302	267	399	300	142	213	160	445	665	500
500	M24	20	227,5	1423	1786	1519	328	411	350	175	219	187	547	685	583
600	M27	20	196,8	1664	2098	1729	433	546	450	231	291	240	722	910	750
700	M27	24	203,9	1764	2671	2075	383	579	450	204	309	240	638	965	750
800	M30	24	298,1	2213	3095	2454	541	757	600	289	404	320	902	1262	1000
900	M30	28	335,2	2635	3998	3341	552	838	700	294	447	373	920	1397	1167
1000	M33	28	416.5	3159	4405	3506	721	1005	800	385	536	427	1202	1675	1333

8.19 Table 19: Pipe class F020, F022 / PN10 – PTFE based gasket

Pipe clas	s			F020, F02	2							Table 19				
Pipe sys	tem			PN10												
Flange N	aterial			1.4404 /1.4	4571											
Bolt Mate	erial			A4-70												
Gasket N	laterial			KLINGER®	top-chem2	000 2,0mm										
Gasket M	lanufactur	e		KLINGER®	GmbH & C	o. KG										
Gasket t	уре			IBC												
Leak tigh	ness			L0.01												
Friction				0,15												
Design p	ressure			According	to the pipe	class										
Design T	emperature	e		200°C con	sidered in t	he calculati	on									
External	force and	moments		DN15 DI	V600 = acc	ording EN1	092 -1 (red	duced)								
Remark	S															
- Depend	ling on lubr	rication, st	tate of bolt an	d external f	orces the a	ctual requir	red torque	may differ	from the b	elow advis	ed calcula	ted torque				
- Afhank	elijk van de	e smering,	staat van de	bouten en	externe kra	chten kan h	iet werkelij	k benodigo	de aanhaalr	noment afv	wijken van	het hierond	ler bereker	nde aanha	almoment	
Flange			External	E	olt Force K	N	Torque Nm									
size			axial force					Oil 0,15		Molycoat 0,08			No Lubrication 0,25			
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used	
15	M12	4	11,8													
20	M12	4	15,7	38	117	100	23	70	60	12	37	32	38	117	100	
25	M12	4	19,6	49	117	100	29	70	60	15	37	32	48	117	100	
32	M16	4	25,1	62	227	193	48	177	150	26	94	80	80	295	250	
40	M16	4	31,4	78	227	193	61	177	150	33	94	80	102	295	250	
50	M16	4	39,3	100	227	193	78	177	150	42	94	80	130	295	250	
65	M16	8	51,1	157	437	385	61	170	150	33	91	80	102	283	250	
80	M16	8	62,9	186	462	385	72	180	150	38	96	80	120	300	250	
100	M16	8	78,6	241	462	385	94	180	150	50	96	80	157	300	250	
125	M16	8	87,8	269	462	385	105	180	150	56	96	80	175	300	250	
150	M20	8	96,2	335	711	618	163	345	300	87	184	160	272	575	500	
200	M20	8	111,1	393	711	618	191	345	300	102	184	160	318	575	500	
250	M20	12	124,2	477	1075	926	154	348	300	82	186	160	257	580	500	
300	M20	12	136,1	563	1075	926	182	348	300	97	186	160	303	580	500	
350	M20	16	147	822	1363	1029	200	331	250	107	177	133	333	552	417	
400	M24	16	157,1	977	1531	1215	281	441	350	150	235	187	468	735	583	
450	M24	20	166,7	1051	1580	1302	242	364	300	129	194	160	403	607	500	
500	M24	20	175,7	1174	1671	1302	270	385	300	144	205	160	450	642	500	
600	M27	20	192,5	1364	1896	1729	355	493	450	189	263	240	592	822	750	

8.20 Table 20: Pipe class F212 / PN16 – PTFE based gasket

Pipe clas	s			F212								Table 20				
Pipe sys	tem			PN16												
Flange M	aterial			1,4571												
Bolt Mate	rial			A4-70												
Gasket N	laterial			KLINGER®	top-chem2	2000 2,0mm										
Gasket N	lanufactur	е		KLINGER®	GmbH & C	o. KG										
Gasket t	уре			IBC												
Leak tigh	ness			L0.01												
Friction				0,15												
Design p	ressure			According	to the pipe	class										
Design T	emperature	e		200°C con	sidered in t	he calculation	on									
External	force and	moments		DN15 DI	V600 = acc	ording EN1	092 -1 (rec	luced)								
Remark	S					-			for the h	aları adı. Az	a di a al a da					
- Depend	ling on lubr oliik von de	lication, st	ate of bolt an	d external t	orces the a	ictual requir	ed torque	may differ	from the be	elow advis	ed calcula	ted torque	lar haraka	ndo conho	almaman	
Flance	elijk van de	smering,	Staat van de	bouten en	externe kra Rott Force K	CITELL VALUE	et werkelij	k benodigo	ue aannaan	noment an	Vijken van Torguo Mr	net merono	ier bereke	nue aanna	amomen	
eize			external avial force		T Force K			010.46			object 0.4	1	No.	ubrigation	0.25	
SIZC (DNI)	Bolt size	Number	(KN)	Min	Max	llead	Min	May	llead	Min Max Used			Min	Min Max		
(DN)	DUILBIZE	Number	((N))	10101	max	USCU	MIII	max	USCU		mux	USCU		in uA	USCU	
15	M12	4	11.8													
20	M12	4	15.7	52	117	100	31	70	60	17	37	32	52	117	100	
25	M12	4	19.6	67	117	100	40	70	60	21	37	32	67	117	100	
32	M16	4	25.1	83	227	193	65	177	150	35	94	80	108	295	250	
40	M16	4	31.4	102	227	193	79	177	150	42	94	80	132	295	250	
50	M16	4	39.3	126	227	193	98	177	150	52	94	80	163	295	250	
65	M16	8	51,1	337	435	385	131	169	150	70	90	80	218	282	250	
80	M16	8	62,9	267	462	385	104	180	150	55	96	80	173	300	250	
100	M16	8	78.6	321	462	385	125	180	150	67	96	80	208	300	250	
125	M16	8	87,8	358	462	385	139	180	150	74	96	80	232	300	250	
150	M20	8	96,2	500	711	618	243	345	300	130	184	160	405	575	500	
200	M20	12	111,1	619	953	772	200	309	250	107	165	133	333	515	417	
250	M24	12	124,2	672	1098	912	258	422	350	138	225	187	430	703	583	
300	M24	12	136,1	724	1462	1172	278	561	450	148	299	240	463	935	750	
350	M24	16	147	870	1981	1563	251	570	450	134	304	240	418	950	750	
400	M27	16	157,1	973	2186	1691	317	711	550	169	379	293	528	1185	917	
450	M27	20	166,7	1130	2298	1921	294	598	500	157	319	267	490	997	833	
500	M30	20	175,7	1338	2431	1875	393	713	550	210	380	293	655	1188	917	
600	M33	20	244	1830	3053	2504	585	975	800	312	520	427	975	1625	1333	

8.21 Table 21: Pipe class M120, M170, M190 / PN10 – Hypalon gasket

Table not yet available. For details contact the gasket supplier.

8.22 Table 22: Pipe class A060, A120, I010, F020, F022 / PN10 – Rubber gasket

Pipe clas	s			A060, A12	20, I010, F0	20, F022						Table 22				
pipe sys	tem			PN10												
lange N	laterial			P250GH /	1.4404 / 1.4	571										
Bolt Mate	erial			25CrMo4 /	A4-70											
Gasket N	/aterial			NBR												
Gasket N	/anufacture	e		Eriks												
asket t	vne	-		IBC												
eak tigh	iness			L0.01												
riction				0.15												
)esian a	ressure			5 bar (o)												
)esion T	emperature	•		75°C cons	idered in th	e calculatio	n									
xternal	force and	moments		DN15 - DN	150 - 1.6 tir	mes of inter	nal pressu	ire								
				DN200 -DN	250 - 1.35	times of int	ernal press	sure								
				DN300 & I	DN500 - 1 ti	imes of inte	rnal pressi	ure								
				DN600 & a	bove -100k	<n c<="" td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></n>										
Remark	s														-	
Depend	tina on lubr	ication st	ate of bolt an	d external f	orces the a	actual requir	ed torque	may differ	from the be	elow advis	ed calculat	ted torque			-	
A fhank	eliik van de	smerina	staat van de	bouten en e	externe kra	chten kan h	et werkeli	ik benodia	le aanhaaln	noment af	wiiken van	het hierond	ler bereke	de aanha	almomer	
Flange	and a second a		External	F	Bolt Force K	N				and and	Torque Nm	1				
size			axial force	<u> </u>				Oil 0.15		M	lolycoat 0 (08	No Lubrication 0.25			
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	llsed	Min	Max	Used	Min	Max	Used	
(2.1)			()													
15	M12	4	0.2	5	14	8	3	8	5	2	4	3	5	13	8	
20	M12	4	0.3	7	24	17	4	14	10	2	7	5	7	23	17	
25	M12	4	0.5	9	32	17	5	19	10	3	10	5	8	32	17	
32	M16	4	1.4	12	39	26	9	30	20	5	16	11	15	50	33	
40	M16	4	1.2	15	50	26	11	38	20	6	20	11	18	63	33	
50	M16	4	1.9	18	63	39	14	48	30	7	26	16	23	80	50	
65	M16	8	3.1	25	85	52	10	33	20	5	18	11	17	55	33	
80	M16	8	4.3	31	106	52	12	41	20	6	22	11	20	68	33	
100	M16	8	6.1	35	114	78	13	44	30	7	23	16	22	73	50	
125	M16	8	9.2	49	153	78	19	59	30	10	31	16	32	98	50	
150	M20	8	13.5	57	168	103	28	82	50	15	44	27	47	137	83	
200	M20	8	22.6	88	247	165	43	120	80	23	64	43	72	200	133	
250	M20	12	35.9	119	305	185	39	99	60	21	53	32	65	165	100	
300	M20	12	37.7	142	349	185	46	113	60	25	60	32	77	188	100	
350	M20	16	45.8	239	639	329	58	155	80	31	83	43	97	258	133	
400	M24	16	60.4	295	733	417	85	211	120	45	113	64	142	352	200	
450	M24	20	77	357	808	521	82	186	120	44	99	64	137	310	200	
500	M24	20	96	430	928	521	99	214	120	53	114	64	165	357	200	
600	M27	20	100	524	1071	615	136	279	160	73	149	85	227	465	267	
700	M27	20	100	689	1471	830	149	319	180	79	170	96	248	532	300	
800	M21 M30	24	100	005	14/1	000	244	313	100	13	000	420	240	742	400	
000						1 MOL 4			- 2/10		· //×	: 1/0				
000	M30	24	100	1022	1/40	1241	211	427	240	113	228	120	357	668	422	
900	M30	24 28 28	100	1022	1740	902 1241	211 214	427	240 260 200	113	228	120	357	668	433	

8.23 Table 23: Pipe class A060, A120, A210, I010, I200 / PN10/16 – Rubber gasket

											1				
Pipe clas	s			A060, A12	20, I010, A2	10, 1200						Table 23			
Pipe syst	tem			PN10 / PN1	16										
Flance M	aterial			P250GH											
Bolt Mate	rial			25CrMo4											
Gasket N	laterial			G-ST-P/S F	EPDM 4.0mr	m									
Gasket N	lanufactur	e		Kroll + Zille	er GmbH & (Co KG									
Gasket h	/ne	Ĩ		IBC											
Leak tinh	ness			10.01											
Eriction	1033			0.15											
Design n	receiire			10 har (a)	or accordin	na to the nin	ne clase								
Decign T	amnaratur	•		75°C cone	idered in th	e calculatio	n								
Dealgh h	emperature	-		75 0 0013		Calculatio									
External	force and	momente		DN22 DI	190 - 164	imee interns	al proceure								
LAternal	IUICE allu	nomenta		DN100_DN	100 - 1.01	times interne	arpicssure								
				DN100 -DR	NZOU - 1.00	unes of inter	ernarpres	sure							
				DN500 -D	N430 - 1 UII	N External	force								
Domark	-			DIVOUU & a	DOVE 150K	NEXternal	lorce								
Remark	.S line on lube			d automal f		atural anamir		and differen	from the b	alasse advia	ad a staula	ted territe			
- Depend	ing on lubr	ication, st	ate of bolt an	d external r	orces the a	ictual requi	red torque	may differ	from the bi	elow advis	ed calcula	ted torque			
- Athank	elijk van de	smering,	staat van de	bouten en e	externe kra	Conten kan n	iet werkelij	k benodiga	ie aannaair	noment arv	vijken van	net nierono	ier berekei	nde aanna	aimoment
Flange			External		OIT FORCE K	N		010.45			I orque Nn	1			0.05
size			axial force					010,15		Min	olycoat u,	8	NO L	ubrication	0,25
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	MIN	мах	Used	Min	мах	Used
					:										
15	M12	4			<u>.</u>										
20	M12	4													
25	M12	4					.		ļ						
32	M16	4	1,4	27	120	65	21	92	50	11	49	27	35	153	83
40	M16	4	1,9	34	152	65	26	116	50	14	62	27	43	193	83
50	M16	4	3,1	42	190	78	32	145	60	17	77	32	53	242	100
65	M16	8	5,2	58	239	131	22	91	50	12	49	27	37	152	83
80	M16	8	7,1	72	287	131	28	110	50	15	59	27	47	183	83
100	M16	8	12,2	86	323	157	33	124	60	18	66	32	55	207	100
125	M16	8	15,3	117	399	209	45	153	80	24	82	43	75	255	133
150	M20	8	26,9	143	450	247	69	219	120	37	117	64	115	365	200
200	M20	8	39,8	219	630	309	106	306	150	57	163	80	177	510	250
250	M20	12	59,7	297	756	463	96	245	150	51	131	80	160	408	250
300	M20	12	62,5	355	872	463	115	282	150	61	150	80	192	470	250
350	M20	16	80,6	519	1209	618	126	294	150	67	157	80	210	490	250
400	M24	16	100,3	654	1333	764	188	384	220	100	205	117	313	640	367
450	M24	20	126,3	813	1379	955	187	318	220	100	170	117	312	530	367
500	M24	20	150	933	1500	1085	215	346	250	115	185	133	358	577	417
600	M27	20	150	1153	1757	1268	300	457	330	160	244	176	500	762	550
700	M27	24	150	1219	2268	1383	264	492	300	141	262	160	440	820	500
800	M30	24	150	1539	2749	1718	376	672	420	201	358	224	627	1120	700
900	M30	28	150	1806	3487	1909	378	731	400	202	390	213	630	1218	667
1000	M33	28	150	2216	3826	2410	506	873	550	270	466	293	843	1455	917

8.24 Table 24: Pipe class F020, F022, F212, H130 / PN10/16 – Rubber gasket

Diana di Ang															
Pipe clas	s			F020, F022	2, H130, F21	12						Table 24			
Pipe syst	em			PN10 / PN1	16										
Flange M	aterial			1.4404 / 1.	4539 / 1.45	71									
Bolt Mate	rial			A4-70											
Gasket N	laterial			G-ST-P/S E	EPDM 4,0mm	n									
Gasket N	lanufactur	e		Kroll + Zille	er GmbH & C	Co.KG.									
Gasket ty	/pe			IBC											
Leak tigh	ness			L0.01											
Friction				0,15											
Design p	ressure			10 bar (g)	or accordin	g to the pip	e class								
Design T	emperature	e		75°C cons	idered in the	e calculatio	n								
External	force and	moments		DN32 DN	v80 = 1.6 ti	mes interna	al pressure								
				DN100 -DN	250 - 1.35	times of int	ernal press	sure							
				DN300 -D	N500 - 1 tim	es of interr	nal pressur	e							
				DN600 15	0KN Extern	al force									
Remark	s														
 Depend 	ing on lubr	ication, st	ate of bolt an	d external f	orces the a	ctual requir	red torque i	may differ	from the be	low advis	ed calcula	ted torque			
 Afhank 	elijk van de	smering,	staat van de	bouten en e	externe kra	chten kan h	et werkelij	k benodigd	e aanhaalm	oment afv	vijken van	het hierond	er berekei	nde aanha	almoment
Flange			External	E	olt Force K	N					Torque Nm	1			
			and all formers	1		01046		M 14	No Lubrication 0,25						
SIZE			axiai torce					010,15		10	Ulycoat 0,0	10	NUL	ubrication	0,20
(DN)	Bolt size	Number	(KN)	Min	Мах	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
(DN)	Bolt size	Number	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
(DN)	Bolt size	Number 4	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
(DN) 15 20	Bolt size M12 M12	Number 4 4	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
(DN) 15 20 25	Bolt size M12 M12 M12	Number 4 4 4	(KN)	Min	Max	Used	Min	Max	Used	Min	Max	Used	Min	Max	Used
(DN) 15 20 25 32	Bolt size M12 M12 M12 M12 M16	Number 4 4 4 4	1,6	Min 28	Max	Used	Min 22	93	Used 60	Min 12	Max 50	Used 32	Min 37	Max 155	Used 100
(DN) 15 20 25 32 40	Bolt size M12 M12 M12 M16 M16	Number 4 4 4 4 4	1,6 2,2	Min 28 35	Max 120 152	Used	Min 22 27	93 118	Used 60 60	Min 12 14	50 63	Used 32 32	Min 37 45	155 197	Used 100 100
(DN) 15 20 25 32 40 50	Bolt size M12 M12 M12 M16 M16 M16 M16	Number 4 4 4 4 4 4 4	1,6 2,2 3,5	Min 28 35 44	Max 120 152 190	Used 77 77 103	Min 22 27 34	93 118 148	Used 60 60 80	Min 12 14 18	50 63 79	Used 32 32 43	37 45 57	Max 155 197 247	Used 100 100 133
(DN) 15 20 25 32 40 50 65 20	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 8	1,6 2,2 3,5 5,8 9	Min 28 35 44 60	Max 120 152 190 240	Used 77 77 103 128	Min 22 27 34 23	93 118 148 93	Used 60 60 80 50	Min 12 14 18 12	50 63 79 50	Used 32 32 43 27	37 45 57 38	Max 155 197 247 155 197	Used 100 133 83
(DN) 15 20 25 32 40 50 65 80 100	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 8 8 8	1,6 2,2 3,5 5,8 8 44,2	Min 28 35 44 60 75	Max 120 152 190 240 289 247	Used 77 77 103 128 154	Min 22 27 34 23 29	93 93 118 148 93 112	Used 60 60 80 50 60	Min 12 14 18 12 15	50 63 79 50 60	Used 32 32 43 27 32 32	Min 37 45 57 38 48	Max 155 197 247 155 187 205	Used 100 100 133 83 100
(DN) 15 20 25 32 40 50 65 80 100 125	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3	Min 28 35 44 60 75 86 44	Max 120 152 190 240 289 317 404	Used 77 77 103 128 154 154	Min 22 27 34 23 29 33 33	93 93 118 148 93 112 123	Used 60 60 80 50 60 60 60 60	Min 12 14 18 12 15 15	Max 50 63 79 50 60 66	Used 32 32 43 27 32 32 32 32 32	Min 37 45 57 38 48 55 77	Max 155 197 247 155 187 205 205	Used 100 100 133 83 100 100
size (DN) 15 20 25 32 40 50 65 80 100 125	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 2,5	Min 28 35 44 60 75 86 118	Max 120 152 190 240 289 317 404	Used 77 77 103 128 154 154 206 247	Min 22 27 34 23 29 33 46 60	93 93 118 148 93 112 123 157 215	Used 60 60 80 50 60 60 60 80 60 80 60 80 60 80 80 80 80 80 80 80 80 80 80 80 80 80	Min 12 14 18 12 15 18 25 25	50 63 79 50 66 84	Used 32 32 43 27 32 32 32 43 43	Min 37 45 57 38 48 55 77 77 445	Max 155 197 247 155 187 205 262 262	Used 100 100 133 83 100 100 133 200
(DN) 15 20 25 32 40 50 65 80 100 125 150 20 20 20 20 20 20 20 25 32 40 25 20 25 32 40 25 20 20 25 20 25 20 25 20 25 20 25 20 20 25 20 20 25 20 20 25 20 20 25 20 20 20 25 20 20 20 20 20 20 20 20 20 20	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25	Min 28 35 44 60 75 86 118 141 141	Max 120 152 190 240 289 317 404 443	Used 77 77 103 128 154 154 206 247 230	Min 22 27 34 23 29 33 46 69 407	93 93 118 148 93 112 123 157 215 214	Used 60 60 80 50 60 60 80 120	Min 12 14 18 12 15 18 25 37 57	50 63 79 50 66 84 115	Used 32 32 43 27 32 32 32 43 64 64	Min 37 45 57 38 48 55 77 115 479	Max 155 197 247 155 187 205 262 358 549	Used 100 100 133 83 100 133 200 267
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M16	Number 4 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 07	Min 28 35 44 60 75 86 118 141 221 200	Max 120 152 190 240 289 317 404 443 641	Used 77 77 103 128 154 154 206 247 329 402	Min 22 27 34 23 29 33 46 69 107	93 118 148 93 112 123 157 215 311 252	Used 60 60 80 50 60 60 80 120 160	Min 12 14 18 12 15 18 25 37 57 52	50 63 79 50 66 84 115 166	Used 32 32 43 27 32 32 43 64 85 85	Min 37 45 57 38 48 55 77 115 178 462	Max 155 197 247 155 187 205 262 358 518 422	0,25 Used 100 100 133 83 100 133 200 267 267
size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20	Number 4 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 67 70	Min 28 35 44 60 75 86 118 141 221 299 260	Max 120 152 190 240 289 317 404 443 641 781 202	Used 77 77 103 128 154 154 206 247 329 432	Min 22 27 34 23 29 33 46 69 107 97 97	93 118 148 93 112 123 157 215 311 253 200	Used 60 60 80 50 60 60 80 120 160 140	Min 12 14 18 12 15 18 25 37 57 52 62	50 63 79 50 66 84 115 166 135	32 32 32 43 27 32 32 43 64 85 75 75	Min 37 45 57 38 48 55 77 115 178 162 162	Max 155 197 247 155 187 205 262 358 518 422 497	0,25 Used 100 100 133 83 100 133 200 267 233 267
size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 250	Bolt size M12 M12 M16 M16 M16 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20 M20	Number 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 67 70	Min 28 35 44 60 75 86 118 141 221 299 358 558	Max 120 152 190 240 289 317 404 443 641 781 903 4005	Used 77 77 103 128 154 154 206 247 329 432 494	Min 22 27 34 23 29 33 46 69 107 97 116	93 118 148 93 112 123 157 215 311 253 292 292	Used 60 60 80 50 60 60 80 120 160 140 160	Min 12 14 18 12 15 18 25 37 57 52 62 62	50 63 79 50 66 84 115 166 135 156	Used 32 32 43 27 32 32 32 43 64 85 75 85 85	Min 37 45 57 38 48 55 77 115 178 162 193 212	Max 155 197 247 155 187 205 262 358 518 422 487 442	Used Used 100 100 133 83 100 100 133 200 267 233 267 200
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20 M20 M20 M20 M20	Number 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 67 70 83,3 83,3	Min 28 35 44 60 75 86 118 141 221 299 358 524 524	Max 120 152 190 240 289 317 404 443 641 781 903 1095 424	Used 77 77 103 128 154 154 206 247 329 432 494 741 764	Min 22 27 34 23 29 33 46 69 107 97 116 127 117	93 93 118 148 93 112 123 157 215 311 253 292 266 260	Used 60 60 80 50 60 60 80 120 160 140 160 180 130	Min 12 14 18 12 15 18 25 37 57 52 62 68 04	50 63 79 50 66 84 115 166 135 156 142	Used 32 32 43 27 32 32 32 43 64 85 75 85 96 96	Min 37 45 57 38 48 55 77 115 178 162 193 212 205	Max 155 197 247 155 187 205 262 358 518 422 487 443 582	Used Used 100 100 133 83 100 100 133 200 267 233 267 300 267
(DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20 M20 M20 M20 M20 M20 M20	Number 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8	axial force (KN) 1.6 2.2 3.5 5.8 8 11,3 17,1 25 42 67 70 83,3 93 100	Min 28 35 44 60 75 86 118 141 221 299 358 524 615 664	Max 120 152 190 240 289 317 404 443 641 781 903 1095 1214 4230	Used 77 77 103 128 154 154 206 247 329 432 494 741 764 966	Min 22 27 34 23 29 33 46 69 107 97 116 127 177 177	93 93 118 148 93 112 123 157 215 311 253 292 266 350 292	Used 60 60 80 50 60 60 80 120 160 140 160 180 220 220	Min 12 14 18 12 15 18 25 37 57 52 62 68 94 92	50 63 79 50 66 84 115 166 135 156 142 142	Used 32 32 43 27 32 43 64 85 75 85 96 117 117	Min 37 45 57 38 48 55 77 115 178 162 193 212 295 266	Max 155 197 247 155 187 205 262 358 518 422 487 443 583 499	Used Used 100 100 133 83 100 100 133 200 267 233 267 300 367 300
size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400 450 500	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20 M20 M20 M20 M20 M20 M20	Number 4 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8	1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 67 70 83,3 93 100 124,5	Min 28 35 44 60 75 86 118 141 221 299 358 524 615 664 904	Max 120 152 190 240 289 317 404 443 641 781 903 1095 1214 1270 4266	Used 77 77 103 128 154 154 206 247 329 432 494 741 764 868 868	Min 22 27 34 29 33 46 69 107 97 116 127 117 117 153 195	93 93 118 148 93 112 123 157 215 311 253 292 266 350 293 245	Used 60 60 80 50 60 60 80 120 160 140 160 180 220 200 200	Min 12 14 18 12 15 18 25 37 57 52 62 68 94 82 94 82 94	50 63 79 50 66 66 84 115 166 135 156 142 187 156 142	Used 32 32 43 27 32 43 64 85 75 85 96 117 107 107	Min 37 45 57 38 48 55 77 115 178 162 193 212 295 255 208	Max 155 197 247 155 187 205 262 358 518 422 487 443 583 488 525	Used Used 100 100 133 83 100 100 133 200 267 233 267 300 367 333 267
size (DN) 15 20 25 32 40 50 65 80 100 125 150 200 250 300 350 400 450 500	Bolt size M12 M12 M12 M16 M16 M16 M16 M16 M16 M16 M20 M20 M20 M20 M20 M20 M20 M20 M20 M20	Number 4 4 4 4 4 4 4 4 4 4 8 8 8 8 8 8 8 8 8	axial force (KN) 1,6 2,2 3,5 5,8 8 11,3 17,1 25 42 67 70 83,3 93 100 124,5 150	Min 28 35 44 60 75 86 118 141 221 299 358 524 615 664 804	Max 120 152 190 240 289 317 404 443 641 781 903 1095 1214 1270 1366 4602	Used 77 77 103 128 154 154 206 247 329 432 494 741 764 868 955	Min 22 27 34 23 29 33 46 69 107 97 116 127 177 153 185 246	93 93 118 148 93 112 123 157 215 311 253 292 266 350 293 315	Used 60 60 80 50 60 60 80 120 160 140 160 180 220 200 220 230	Min 12 14 18 12 15 18 25 37 57 52 62 68 94 82 99 124	Max 50 63 79 50 60 66 84 115 166 135 156 142 187 156 142 187	Used 32 32 43 27 32 43 64 85 75 85 96 117 107 117	Min 37 45 57 38 48 55 77 115 178 162 193 212 295 255 308 440	Max 155 197 247 155 187 205 262 358 518 422 487 443 583 488 525	Used Used 100 100 133 83 100 100 133 200 267 233 267 300 367 333 367 333