ADDENDUM 1
DECEMBER 2010

EFFECTIVE DATE: JUNE 2011

Specification for Threading and Gauging of Rotary Shouldered Thread Connections

ANSI/API SPECIFICATION 7-2 (FORMERLY IN SPEC 7)
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ISO 10424-2:2007 (Identical), Petroleum and natural gas industries—Rotary drilling equipment—Part 2: Threading and gauging of rotary shouldered thread connection

AMERICAN PETROLEUM INSTITUTE

Addendum 1 to Specification for Threading and Gauging of Rotary Shouldered Thread Connections

Summary of changes

Clause 3: *Delete reference to* API Spec 7, *include reference to* API Spec 5DP.

Table 1, Column 9, *Change tolerance on* L_{PC} *from* 0/–3 *to* 0/–3,18

Table 1, footnote (c), *Replace* –5 mm *with* 0/ –5 mm

Figure 7 (b), *Replace as shown* [decrease groove depth from 6,4 (0.25) to 1,6 (0.062)]

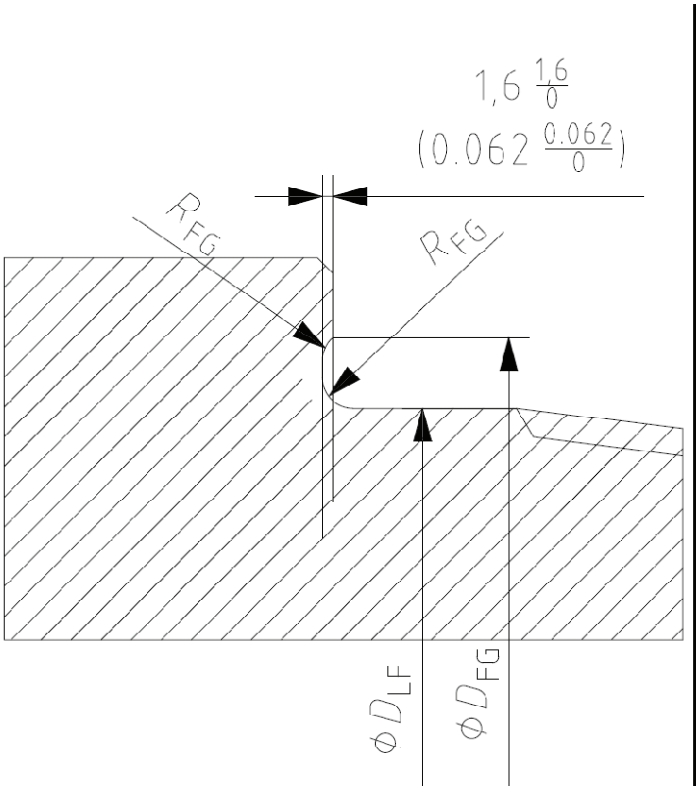


Table 5, Column 2, C*hange tolerance on* D_{CB} *from* +0,38/0 *to* +0,40/0

Table 5, Column 6, *Change tolerance on* L_{BG} *from* 0/–3,1 *to* 0/–3,18

Table 9, footnote (a), *Replace* A.5 *with* A.9

Figure 14, Key *add* « Note: For drill bit pins only, tolerance is +0,25/–0,79 mm (+0.010/–0.031 in) »

Figure 20, *Replace dimension* 177,8 ±3,2 (7 ±0.12) *with* 171,4 ±3,20 (6.75 ±0.13)

Clause 6.2, *Replace clause, including Table 3* (**see below**)

Table A.1, Column 9, *Change tolerance on* L_{PC} *from* 0/–0.12 *to* 0/–0.125

Table A.1, Column 12, *Change tolerance on* Q_C *from* +0.030/–0.015 *to* +0.031/–0.016

Table A.1, footnote (b), *Replace* –0.19 in *with* 0/–0.2 in

Table A.3, *Replace the table* (**see below**)

Table A.5, Column 2, *Change tolerance on* D_{CB} *from* +0.015/0 *to* +0.016/0

Table A.5, Column 6, *Change tolerance on* L_{BG} *from* 0/–0.13 *to* 0/–0.125

Annex F, *Replace completely* **(see below)**

Annex I, *Replace clause* I.4.4 *through* I.4.6 (**see below**)

6.2 Bevels for drill collars and tools that mate directly with drill collars

6.2.1 Purpose of bevel diameters

Bevels on connections serve two purposes. The first is to protect the outer edge of the sealing face from deformation in the form of mashes and fins. The second is to increase the contact pressure on the sealing face so as to minimize leaking and separation due to downhole bending.

Bevel diameters on the same OD's should be of equal size, within manufacturing tolerances, on mating pins and boxes to minimize the formation of grooves on the sealing faces. When mismatches of OD's greater than 6,35 mm (0.250 in), mismatches of bevel diameters will also occur.

Historically bevel diameters have been calculated every 6,35 mm (0.250 in) based on 75 percent of the shoulder width. This basic calculation is simple and depends only on the outside diameter and counter bore of the connection.

Effort has been made to preserve these historical bevel diameters because they are easy to calculate and have worked very well in most cases.

6.2.2 Methods to calculate bevel diameters

However it has been found that use of this process alone will result in some OD-ID combination having a compressive stress on the sealing face above the SMYS of the material. FEA analysis has shown yield of the seal face will not occur at 100 percent of SMYS.

Because the seal face has to handle the misapplication of make-up torque, unexpected downhole torque and bending of the drill string, the calculation of bevel diameters for drill collars and tools that mate with them is based on a two-step computation described in detail in Annex I.

The combination of the two methods ensures the stress levels on the sealing faces does not exceed 100 percent of the SMYS for connections with OD and ID combinations commonly used.

The two steps are identified as:

1. The 75 percent shoulder width method;

2. The mismatched outside diameter method.

The two methods are fully described in Annex I.

6.2.3 Other considerations

Table 3 (Table A.3) have bevel diameters that cover a range from a suggested minimum OD to a maximum OD. The tables also contain a Reference ID. The purpose of the Reference ID is to be able to calculate shoulder loads that will cause the seal face stress on mismatched OD's to exceed the SMYS of the product material.

When the ID of the drill collar or tools that mate directly with them is equal to or greater than the reference ID, the minimum OD listed for each connection in Table 3 (Table A.3) can be mated with the largest OD listed (or any OD in between) for that same connection in the table and the stress on the seal face will not exceed 100 percent of SMYS.

The smallest bevel diameter shown in Table 3 (Table A.3) is the smallest bevel diameter recommended for each connection if the seal face stress generated by mismatches of OD's is not to exceed the SMYS.

Bevel diameters for low-torque features have been arbitrarily set and shall not increase or decrease with diameter changes.

Bevel diameters in Table 3 (Table A.3) shall not apply to products that have specific requirements in API Spec 7-1, API Spec 5DP, ISO 10424-1 and ISO 11961, such as tool joints for drill pipe and HWDP, bits, or boxes that mate with bits.

Unless otherwise specified, bevel diameter tolerances shall be ±0,4 mm (± 0.016 in).

Caution: The bevel diameters set forth in this standard do not account for all potential mismatches that can occur when components with significantly different box OD, pin ID or bevel diameters are made up. Connections with such mismatched dimensions can result in seal stresses in excess of the specified minimum yield strength of the material which increases the risk of galling, finning and mechanical damage to the seal face.

Table 3 — Reference bevel diameters for Preferred connections when used on drill collars, in SI units

Dimensions in millimetres

Connection style and size	Ref ID [d]	Bevel diameters [a] for various OD's [b, c]								
NC 23	28,58	OD	79,38							
		BD	76,20							
NC 26	38,10	OD	85,72	88,90	92,08	95,25	98,42			
		BD	84,53 [e]	84,53 [e]	87,71	87,71	92,47			
NC 31	38,10	OD	104,78	107,95	111,12					
		BD	101,60 [e]	101,60 [e]	105,17					
NC 35	50,80	OD	114,30	117,48	120,65					
		BD	110,33	110,33	114,70					
NC 38	57,15	OD	120,65	123,82	127,00	130,18	133,35			
		BD	117,87 [e]	117,87 [e]	121,05	121,05	125,81			
NC 40	50,80	OD	133,35	136,52	139,70	142,88	146,05			
		BD	128,19 [e]	128,19 [e]	132,16	132,16	136,92			
NC 44	57,15	OD	139,70	142,88	146,05	149,22	152,40	155,58	158,75	
		BD	138,11 e	138,11 e	139,70	139,70	144,46	144,46	149,22	
NC 46	57,15	OD	152,40	155,58	158,75	161,92	165,10	168,28	171,45	174,62
		BD	145,25 [e]	145,25 [e]	150,02	150,02	154,78	154,78	159,54	159,54
NC 50	57,15	OD	161,92	165,10	168,28	171,45	174,62	177,80	180,98	184,15
		BD	161,14 [e]	161,14 [e]	161,14 [e]	161,14 [e]	164,70	164,70	169,46	169,46
NC 56	63,50	OD	184,15	187,32	190,50	193,68	196,85	200,02	203,20	
		BD	179,78 [e]	179,78 [e]	180,58	180,58	185,34	185,34	190,10	
NC 61	71,44	OD	203,20	209,55	212,72	215,90	219,08	222,25	225,42	228,60
		BD	197,25 [e]	198,44	198,44	203,20	203,20	207,96	207,96	212,72
NC 70	71,44	OD	234,95	238,12	241,30	244,48	247,65	250,82	254,00	
		BD	226,61 [e]	226,61 [e]	227,80	227,80	232,57	232,57	237,33	
1 REG	12,70	OD	39,69	42,86						
		BD	38,50	38,50						
1 1/2 REG	12,70	OD	52,39	55,56						
		BD	50,80	50,80						

Table 3 — Reference bevel diameters for Preferred connections when used on drill collars, in SI units (continued)

Dimensions in millimetres

Connection style and size	Ref.. ID [d]	Bevel diameters [a] for various OD's [b, c]								
2 3/8 REG	36,51	OD	79,38	82,55	85,72	88,90				
		BD	76,60	76,60	81,36	81,36				
2 7/8 REG	33,34	OD	98,42							
		BD	90,88							
3 1/2 REG	38,10	OD	111,12	114,30						
		BD	104,78 [e]	108.35						
4 1/2 REG	57,15	OD	139,70	142,88	146,05	149,22	152,40			
		BD	137,71 [e]	137,71 [e]	139,30	139,30	144,06			
5 1/2 REG	63,50	OD	177,80	180,98	184,15	187,32	190,50			
		BD	167,48	167,48	173,83	173,83	178,59			
6 5/8 REG	71,44	OD	190,50	193,68	196,85	200,02	203,20	206,38	209,55	
		BD	184,94	184,94	186,13	186,13	190,90	190,90	195,66	
7 5/8 REG FF	71,44	OD	225,42	228,60	231,78	234,95	238,12	241,30		
		BD	215,90 [e]	215,90 [e]	219,08	219,08	223,84	223,84		
7 5/8 REG LT	63,50	OD	241,30	244,48	247,65	250,82	254,00			
		BD	234,95	234,95	234,95	234,95	234,95			
8 5/8 REG FF	76,20	OD	254,00	257,18	260,35	263,52	266,70	269,88	273,05	276,22
		BD	246,86[e]	246,86 [e]	246,86[e]	246,86[e]	251,22	251,22	255,98	255,98
8 5/8 REG LT	76,20	OD	269,88	273,05	276,22	279,40				
		BD	266,70	266,70	266,70	266,70				
5 1/2 FH [e]	63,50	OD	184,15	187,32	190,50	193,68	196,85	200,02	203,20	
		BD	178,99 [e]	178,99 [e]	180,18	180,18	184,94	184,94	189,70	
6 5/8 FH	71,44	OD	215,90	219,08	222,25	225,42	228,60	231,78	234,95	
		BD	208,36 [e]	208,36 [e]	209,95	209,95	214,71	214,71	219,47	

[a] Tolerance on bevel diameters is ± 0.40 millimeters

[b] See Table A.15 in ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars

[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress will be less than 100 percent of SMYS when torqued up to the recommended torque value.

[d] When drill collars and tools of the smallest OD listed in the table above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.

[e] These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

Table A.3 — Reference bevel diameters for Preferred connections when used on drill collars, in USC units

Dimensions in inches

Connection style and size	Ref. ID [d]	Bevel diameters for various OD's [a b, c]								
NC 23	1.125	OD	3.125							
		BD	3.000							
NC 26	1.500	OD	3.375	3.500	3.625	3.750	3.875			
		BD	3.328 [e]	3.328 [e]	3.453	3.453	3.641			
NC 31	1.500	OD	4.125	4.250	4.375					
		BD	4.000 [e]	4.000 [e]	4.141					
NC 35	2.000	OD	4.500	4.625	4.750					
		BD	4.344	4.344	4.516					
NC 38	2.250	OD	4.750	4.875	5.000	5.125	5.250			
		BD	4.641 [e]	4.641 [e]	4.766	4.766	4.953			
NC 40	2.000	OD	5.250	5.375	5.500	5.625	5.750			
		BD	5.047 [e]	5.047 [e]	5.203	5.203	5.391			
NC 44	2.250	OD	5.500	5.625	5.750	5.875	6.000	6.125	6.250	
		BD	5.438 [e]	5.438 [e]	5.500	5.500	5.688	5.688	5.875	
NC 46	2.250	OD	6.000	6.125	6.250	6.375	6.500	6.625	6.750	6.875
		BD	5.719 [e]	5.719 [e]	5.906	5.906	6.094	6.094	6.281	6.281
NC 50	2.250	OD	6.375	6.500	6.625	6.750	6.875	7.000	7.125	7.250
		BD	6.344 [e]	6.344 [e]	6.344 [e]	6.344 [e]	6.484	6.484	6.672	6.672
NC 56	2.500	OD	7.250	7.375	7.500	7.625	7.750	7.875	8.000	
		BD	7.078 [e]	7.078 [e]	7.109	7.109	7.297	7.297	7.484	
NC 61	2.812	OD	8.000	8.250	8.375	8.500	8.625	8.750	8.875	9.000
		BD	7.766 [e]	7.812	7.812	8.000	8.000	8.188	8.188	8.375
NC 70	2.812	OD	9.250	9.375	9.500	9.625	9.750	9.875	10.000	
		BD	8.922 [e]	8.922 [e]	8.969	8.969	9.156	9.156	9.344	
1 REG	0.500	OD	1.563	1.688						
		BD	1.516	1.516						
1 1/2 REG	0.500	OD	2.063	2.188						
		BD	2.000	2.000						

Table A.3 — Reference bevel diameters for Preferred connections when used on drill collars, in USC units (continued)

Dimensions in inches

Connection style and size	Ref ID [d]	Bevel diameters for various OD's [a, b, c]								
2 3/8 REG	1.438	OD	3.125	3.250	3.375	3.500				
		BD	3.016	3.016	3.203	3.203				
2 7/8 REG	1.312	OD	3.875							
		BD	3.578							
3 1/2 REG	1.500	OD	4.375	4.500						
		BD	4.125 [e]	4.266						
4 1/2 REG	2.250	OD	5.500	5.625	5.750	5.875	6.000			
		BD	5.422 [e]	5.422 [e]	5.484	5.484	5.672			
5 1/2 REG	2.500	OD	6.750	6.875	7.000	7.125	7.250	7.375	7.500	
		BD	6.594 [e]	6.594 [e]	6.656	6.656	6.844	6.844	7.031	
6 5/8 REG	2.812	OD	7.500	7.625	7.750	7.875	8.000	8.125	8.250	
		BD	7.281	7.281	7.328	7.328	7.516	7.516	7.703	
7 5/8 REG FF	2.812	OD	8.875	9.000	9.125	9.250	9.375	9.500		
		BD	8.500 [e]	8.500 [e]	8.625	8.625	8.812	8.812		
7 5/8 REG LT	2.500	OD	9.500	9.625	9.750	9.875	10.000			
		BD	9.250	9.250	9.250	9.250	9.250			
8 5/8 REG FF	3.000	OD	10.000	10.125	10.250	10.375	10.500	10.625	10.750	10.875
		BD	9.719 [e]	9.719 [e]	9.719[e]	9.719[e]	9.891	9.891	10.078	10.078
8 5/8 REG LT	3.000	OD	10.625	10.750	10.875	11.000				
		BD	10.500	10.500	10.500	10.500				
5 1/2 FH	2.500	OD	7.250	7.375	7.500	7.625	7.750	7.875	8.000	
		BD	7.047 [e]	7.047 [e]	7.094	7.094	7.281	7.281	7.469	
6 5/8 FH	2.812	OD	8.500	8.625	8.750	8.875	9.000	9.125	9.250	
		BD	8.203 [e]	8.203 [e]	8.266	8.266	8.453	8.453	8.641	

[a] Tolerance on bevel diameters is ± 0.016 inches.

[b] See Table A.15 in ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars.

[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress will be less than 100 percent of SMYS when torqued up to the recommended torque value.

[d] When drill collars and tools of the smallest OD listed in the table above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.

[e] These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

Annex F
(informative)

Other rotary shouldered connections

F.1 Interchangeable connections

Connections defined in the main body of this part of ISO 10424 are considered preferred. They include NC23 to NC70, 1 REG to 8-5/8 REG, 5-1/2 FH and 6-5/8 FH. Connections in the NC style (column 1 of Table F.1) are interchangeable with several obsolete connections. When the obsolete connections are requested, they shall be replaced with the equivalent NC connections. Other non-preferred connections are also interchangeable; these are defined only once in the sections that follow.

Table F.1 — Interchangeable connections

NC	IF	FH	XH	SH	DSL	WO
Numbered Connection	Internal Flush	Full Hole	eXtra Hole	Slim Hole	Double StreamLine	Wide Open
NC26	2-3/8 IF	—	—	2-7/8 SH	—	—
NC31	2-7/8 IF	—	—	3-1/2 SH	—	—
NC38	3-1/2 IF	—	—	4-1/2 SH	—	—
NC40	—	4 FH	—	—	4-1/2 DSL	—
NC46	4 IF	—	4-1/2 XH	—	—	4 WO
NC50	4-1/2 IF	—	5 XH	—	5-1/2 DSL	4-1/2 WO
			2-7/8 XH	—	3-1/2 DSL	—
			3-1/2 XH	4 SH	—	—

F.2 GOST connections

The majority of connections specified by GOST are interchangeable with connections in this part of ISO 10424. The equivalence is listed below. The tolerances are slightly different between these standards.

Table F.2 — Equivalences for GOST connections

GOST	ISO	GOST	ISO	GOST	ISO
Z-30	NC10	Z-94	NC35	Z-147	5-1/2 FH
Z-35	NC12	Z-101	3-1/2 FH	Z-149	NC56
Z-38	NC13	Z-102	NC38	Z-152	6-5/8 REG
Z-44	NC16	Z-108	NC40	Z-163	NC61
Z-65	NC23	Z-117	4-1/2 REG	Z-171	6-5/8 FH
Z-66	2-3/8 REG	Z-118	NC44	Z-177	7-5/8 REG
Z-73	NC26	Z-121	4-1/2 FH	Z-185	NC70
Z-76	2-7/8 REG	Z-122	NC46	Z-201	8-5/8 REG
Z-86	NC31	Z-133	NC50	Z-203	NC77
Z-88	3-1/2 REG	Z-140	5-1/2 REG	—	—

F.3 Non-interchangeable connections

Certain connections have thread elements close enough to others that they can be mated, but without creating a connection of adequate strength. They are given in points a) through c):

a) Different pin length:

- NC38 and 3-1/2 WO,
- 2-7/8 OH SW and 2-7/8 OH LW,
- 4 OH SW and 4 OH LW;

b) Different taper:

- NC44 and 4 OH;

c) Pitch diameter within 1,5 mm (0.06 in):

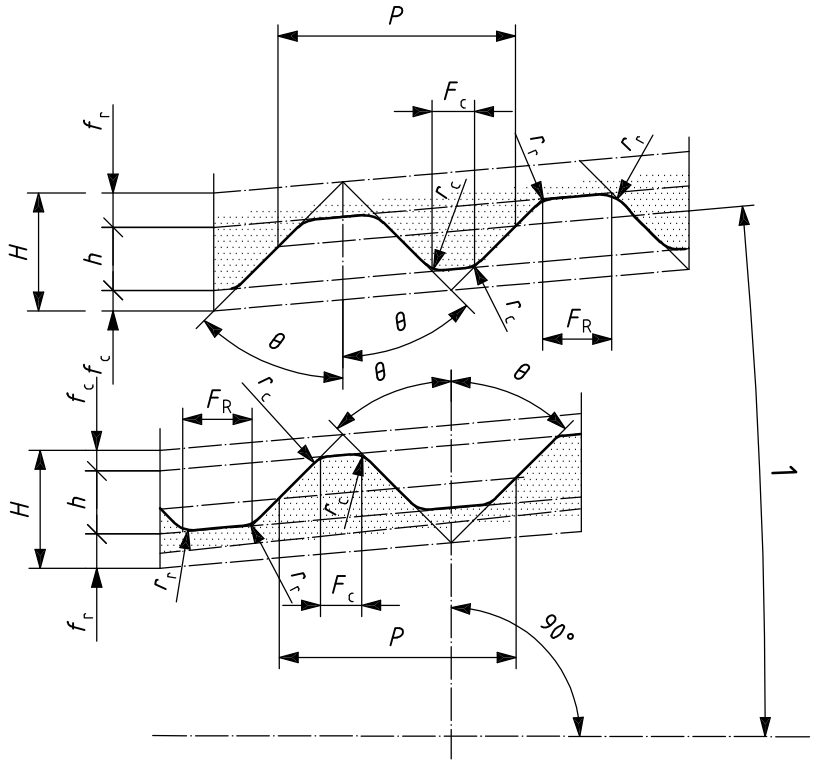
- NC26 and 2-3/8 WO,
- NC31 and 2-7/8 XH = 2-7/8 WO,
- NC35 and 4 SH.

F.4 Product threads for non-preferred connections

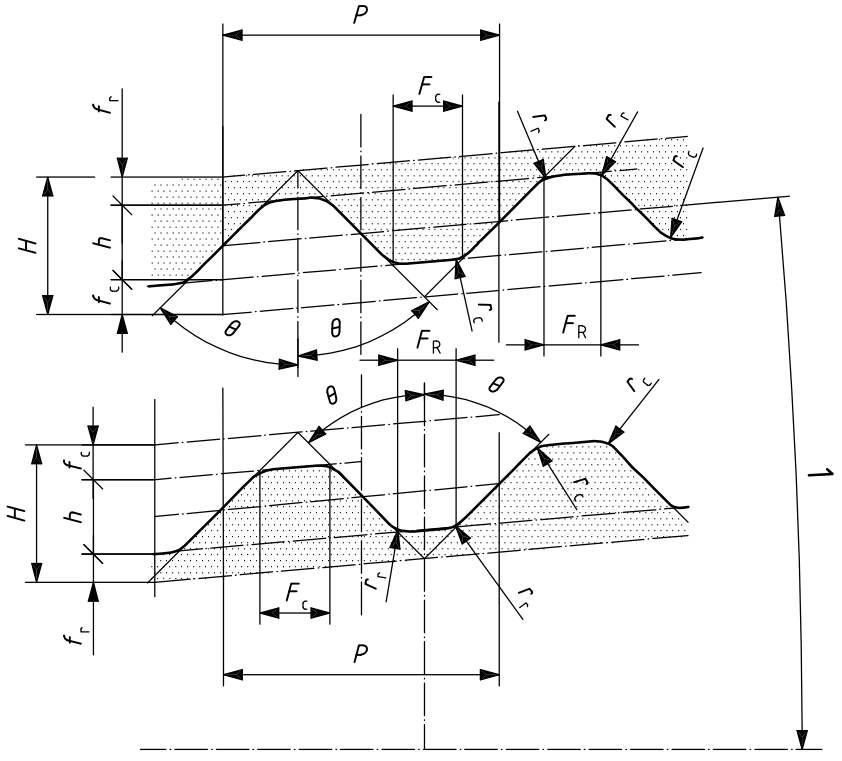
There are many rotary shouldered connections other than those defined as preferred above. Their thread elements are listed in Tables F.3 to F.6.

F.5 Product thread dimensions

There are several thread forms in use other than those specified in Tables 1 and 2 (Tables A.1 and A.2 give USC units). They are illustrated in Figure F.1, and the dimensions are given in Tables F.3 and F.5. (Tables F.4 and F.6 give USC units.)

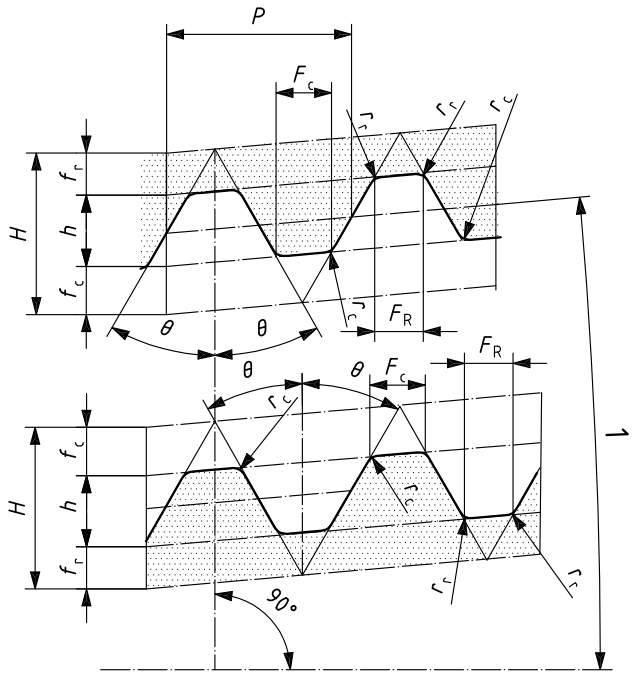


a) 90-V-050



b) 90-V-084

Figure F.1 — Thread forms for 90-V-050, 90-V-084 and V-076



c) V-076

Figure F.1 (*continued*)

Table F.3— Thread dimensions
(see Table F.4 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7
Thread form		**90-V-050**	**90-V-050**	**V-065[a]**	**V-076**	**90-V-084**
Threads per 25,4 mm	N	3,5	3,5	4	4	3
Lead, ref	—	7,257 14	7,257 14	6,35	6,35	8,466 67
Half angle	θ, deg ± 0,75	45	45	30	30	45
Taper, mm/mm	T	1/6	1/4	1/6	1/8	5/48
Crest flat width	F_c, ref	1,27	1,27	1,65	1,93	2,13
Root radius	R	N/A	N/A	N/A	N/A	N/A
Root flat width	F_r, ref	0,86	0,86	1,42	1,70	1,73
Root flat corner radius	r_r ± 0,05	0,76	0,76	0,38	0,38	0,76
Thread height, not truncated	H, ref	3,603 37	3,571 88	5,486 53	5,492 09	4,221 86
Crest truncation	F_c	0,630 49	0,625 16	1,426 49	1,670 61	1,069 52
Root truncation	F_r	0,432 87	0,425 02	1,228 98	1,471 88	0,866 32
Thread height truncated	$h^{+0,025}_{-0,076}$	2,540 00	2,521 71	2,831 06	2,349 50	2,286 00
Crest flat corner radius	r_c ± 0,2	0,38	0,38	0,38	0,38	0,38

see Figures 4, 5 and F.1.

[a] The V-065 thread form has been replaced by V-038R, but has been listed for historical purposes.

Table F.4 — Thread dimensions, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7
Thread form		**90-V-050**	**90-V-050**	**V-065[a]**	**V-076**	**90-V-084**
Threads per inch	n	3.5	3.5	4	4	3
Lead, ref		0.285 714	0.285 714	0.25	0.25	0.333 333
Half angle	θ, deg ± 0,75	45	45	30	30	45
Taper	T, in/ft	2	3	2	1.5	1.25
Crest flat width	F_c, ref	0.05	0.05	0.065	0.076	0.084
Root radius	R	N/A	N/A	N/A	N/A	N/A
Root flat width	F_r, ref	0.034	0.034	0.056	0.067	0.068
Root flat corner radius	r_r ± 0.002	0.03	0.03	0.015	0.015	0.03
Thread height, not truncated	H, ref	0.141 865	0.140 625	0.216 005	0.216 224	0.166 215
Crest truncation	f_c	0.024 823	0.024 613	0.056 161	0.065 772	0.042 107
Root truncation	f_r	0.017 043	0.016 733	0.048 385	0.057 948	0.034 107
Thread height truncated	$h^{+0,001}_{-0,003}$	0.100 000	0.099 280	0.111 459	0.092 504	0.090 000
Crest flat corner radius	r_c ± 0.008	0.015	0.015	0.015	0.015	0.015

See Figures 4, 5 and F.1.

[a] The V-065 thread form has been replaced by V-038R, but is listed for historical purposes.

The pin cylinder radius of some of these connections differs from the definition in clause 6 of this Standard: the differences are shown in the notes of tables F.5 and F.6, and in figure F.2.

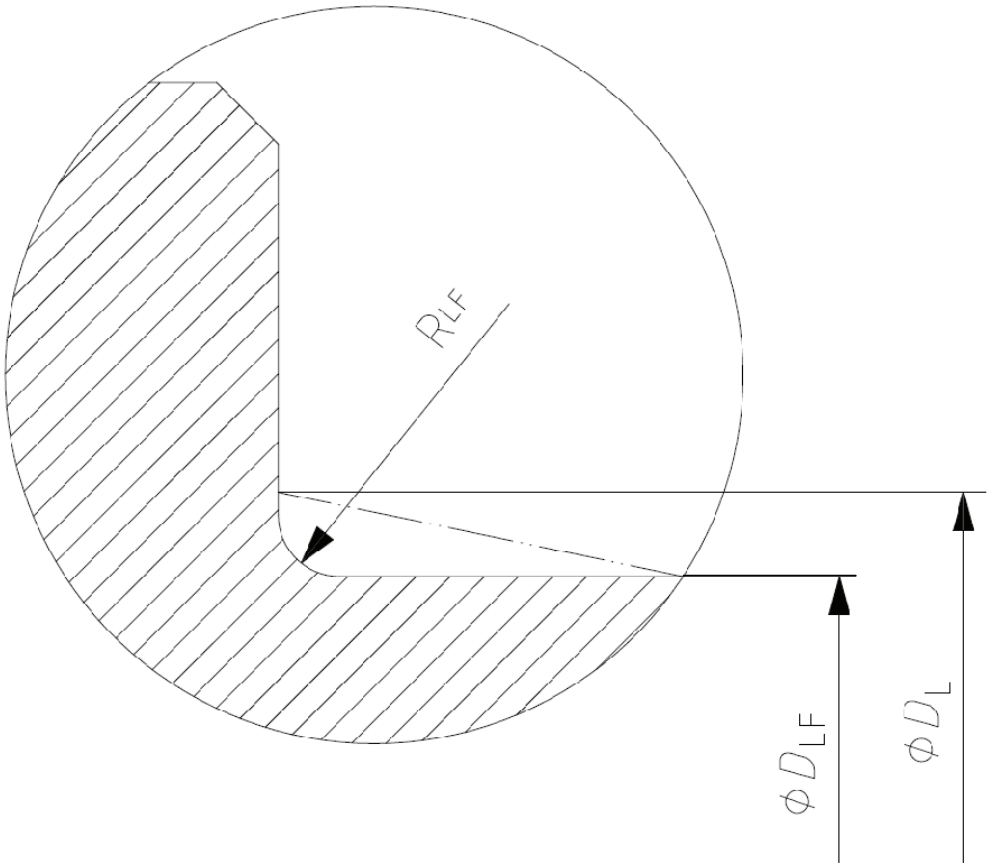


Figure F.2 — Pin Cylinder Radius

See tables F.5 and F.6.

Table F.5 — Product dimensions for non-preferred connections
(see Table F.6 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Connection style and size	**Thread form**	**Taper**[a]	**Threads per 25,4 mm**	**Pitch dia. at gauge point**	**Large dia. of pin**	**Pin cylinder dia.**	**Small dia. of pin**	**Pin length**[b]	**Depth of box threads**	**Total box depth**	**Box c/bore dia.**	**Depth of box c/bore**	
		T	n	C	D_L	D_{LF}	D_S	L_{PC}	L_{BT}	L_{BC}	Q_c	L_{Qc}	L_{ft}[c]
		mm/mm			ref	± 0,4	ref	$^{0}_{-318}$	min.	$^{+9}_{0}$	$^{+0,8}_{-0,4}$	$^{+1,6}_{-0,8}$	max.
NC10	V-055	1/8	6	27,000 20	30,23	29,03	25,47	38,10	41,28	53,98	30,58	11,13	10,16
NC12	V-055	1/8	6	32,131 00	35,36	34,16	29,80	44,45	47,62	60,32	35,71	11,13	10,16
NC13	V-055	1/8	6	35,331 40	38,56	37,36	33,00	44,45	47,62	60,32	38,91	11,13	10,16
NC16	V-055	1/8	6	40,868 60	44,10	42,90	38,54	44,45	47,62	60,32	44,48	11,13	10,16
NC77	V-038R	1/4	4	196,621 40	203,22	198,83	161,94	165,10	168,28	180,98	204,79	15,88	12,70
2-7/8 FH	V-040	1/4	5	85,445 46	92,08	87,71	69,85	88,90	92,08	104,78	93,66	15,88	12,70
3-1/2 FH	V-040	1/4	5	94,843 60	101,44	98,65	77,63	95,25	98,42	111,12	102,79	15,88	12,70
4-1/2 FH	V-040	1/4	5	115,112 80	121,71	118,92	96,31	101,60	104,78	111,12	123,82	15,88	12,70
5-1/2 IF	V-038R	1/6	4	157,200 60	162,48	159,31	141,31	127,00	130,18	142,88	163,91	15,88	12,70
6-5/8 IF	V-038R	1/6	4	184,175 40	189,45	186,28	168,29	127,00	130,18	142,88	190,90	15,88	12,70
2-3/8 OH LW	V-076	1/8	4	65,735 20	69,87	67,47	62,33	60,32	63,50	76,20	71,04	15,88	12,70
2-3/8 OH SW	V-076	1/8	4	65,735 20	69,87	68,28 [e]	62,33	60,32	63,50	76,20	71,04	15,88	12,70
2-7/8 OH LW	V-076	1/8	4	75,793 60	79,93	77,39	71,99	63,50	66,68	79,38	81,36	15,88	12,70
2-7/8 OH SW	V-076	1/8	4	75,793 60	79,93	78,33 [e]	70,80	73,02	76,20	98,42	81,36	15,88	12,70
3-1/2 OH LW	V-076	1/8	4	94,691 20	98,83	96,44	88,51	82,55	85,72	98,42	100,41	15,88	12,70
3-1/2 OH SW	V-076	1/8	4	94,691 20	98,83	96,44 [e]	88,51	82,55	85,72	98,42	100,41	15,88	12,70
4 OH LW	V-076	1/8	4	112,166 40	116,30	113,90	105,19	88,90	92,08	104,78	117,87	15,88	12,70
4 OH SW	V-076	1/8	4	112,166 40	116,30	113,90 [e]	103,60	101,60	104,78	117,48	117,87	15,88	12,70
4-1/2 OH LW	V-076	1/8	4	120,700 80	124,84	122,63	112,93	95,25	98,42	111,13	125,81	15,88	12,70
4-1/2 OH SW	V-076	1/8	4	120,700 80	124,84	122,63 [e]	112,93	95,25	98,42	111,13	125,81	15,88	12,70
2-3/8 PAC	V-076	1/8	4	55,956 20	60,09	58,50 [e]	52,55	60,32	63,50	76,20	61,12	9,52	6,35
2-7/8 PAC	V-076	1/8	4	60,172 60	64,31	62,71 [e]	56,77	60,32	63,50	76,20	65,48	9,52	6,35
3-1/2 PAC	V-076	1/8	4	73,253 60	77,39	76,20 [e]	67,07	82,55	85,72	98,43	78,98	9,52	6,35

Table F.5 — Product dimensions for non-preferred connections (continued)
(see Table F.6 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Connection style and size	**Thread form**	**Taper**[a] T mm/mm	**Threads per 25,4 mm** n	**Pitch dia. at gauge point** C	**Large dia. of pin** D_L ref	**Pin cylinder dia.** D_{LF} ± 0,4	**Small dia. of pin** D_S ref	**Pin length**[b] L_{PC} 0 −3,18	**Depth of box threads** L_{BT} min.	**Total box depth** L_{BC} +9 0	**Box c/bore dia.** Q_c +0,8 −0,4	**Depth of box c/bore** L_{Qc} +1,6 −0,8	L_{ft}[c] max.
2-3/8 SH	V-038R	1/6	4	56,642 00	61,92	58,80	49,75	73,02	79,38	92,08	63,50	15,88	12,70
2-3/8 WO	V-038R	1/6	4	66,192 40	71,48	68,66	61,42	60,32	63,50	76,20	72,63	15,88	12,70
2-7/8 WO	V-038R	1/6	4	79,273 40	84,55	81,71	71,85	76,20	79,38	92,08	85,72	15,88	12,70
3-1/2 WO	V-038R	1/6	4	96,723 20	102,00	99,21	87,19	88,90	92,08	104,78	103,58	15,88	12,70
2-7/8 XH	V-038R	1/6	4	79,222 60	84,50	81,30	67,57	101,60	104,78	117,48	85,33	15,88	9,53
3-1/2 XH	V-038R	1/6	4	91,541 60	96,82	93,62	82,00	88,90	92,08	104,78	98,42	15,88	12,70
3-1/2 H90	90-V-050	1/6	3.5	99,786 44	104,77	99,62[f]	87,84	101,60	104,78	117,48	106,36	15,88	12,70
4 H90	90-V-050	1/6	3.5	109,311 44	114,30	109,14[f]	96,31	107,95	111,13	123,83	115,89	15,88	12,70
4-1/2 H90	90-V-050	1/6	3.5	117,795 04	122,78	117,65[f]	103,73	114,30	117,48	130,18	124,22	15,88	12,70
5 H90	90-V-050	1/6	3.5	124,665 74	129,65	124,64[f]	109,55	120,65	123,83	136,53	131,37	15,88	12,70
5-1/2 H90	90-V-050	1/6	3.5	131,536 44	136,52	131,39[f]	116,42	120,65	123,83	136,53	138,11	15,88	12,70
6-5/8 H90	90-V-050	1/6	3.5	147,411 44	152,40	147,27[f]	131,23	127,00	130,18	142,88	153,99	15,88	12,70
7 H90	90-V-050	1/4	3.5	158,808 42	165,10	159,97[f]	130,17	139,70	142,88	155,58	166,69	15,88	12,70
7-5/8 H90	90-V-050	1/4	3.5	181,383 94	187,67	182,55[f]	148,78	155,58	158,75	171,45	189,31	15,88	12,70
8-5/8 H90	90-V-050	1/4	3.5	203,608 94	209,90	204,77[f]	167,83	168,28	171,45	184,15	211,53	15,88	12,70
2-3/8 SL H90	90-V-084	5/48	3	65,481 20	69,22	66,62	61,78	73,02[d]	66,20	87,31	70,25	15,88	12,70
2-7/8 SL H90	90-V-084	5/48	3	77,444 60	81,18	78,58	73,41	76,20[d]	79,38	90,49	82,15	15,88	12,70
3-1/2 SL H90	90-V-084	5/48	3	93,675 20	97,41	94,86	88,98	82,55[d]	85,72	96,84	98,42	15,88	12,70
GOST Z-161	V-050	1/6	4	155,962 25	161,90	160,05	140,73	127,00	130,18	142,88	163,93	15,88	12,70
GOST Z-189	V-050	1/6	4	183,462 25	189,40	187,55	168,23	127,00	130,18	142,88	191,76	15,88	12,70

[a] Taper (T) 1/6 mm/mm corresponds to a half-angle of $\varphi = 4{,}764°$.
1/4 mm/mm corresponds to a half-angle of $\varphi = 7{,}125°$.
1/8 mm/mm corresponds to a half-angle of $\varphi = 3{,}576°$.
5/48 mm/mm corresponds to a half-angle of $\varphi = 2{,}981°$.

[b] For roller cone drill bits only, the pin length may vary by +0/ −5 mm.

[c] Length to flank of first full depth pin thread. See Figure 6

[d] Pin Length Tolerance for 2 3/8 SL H90- 3 1/2 SL H90 connections is 0/ -1,59

[e] For OHSW and PAC styles, the radius R_{LF} at the pin cylinder is 0,8 +0,4/0 . See figure F.2

[f] For the H90 style, the radius R_{LF} at the pin cylinder is 3,18 +/- 0,4 See figure F.2

Table F.6— Product dimensions for non-preferred connections, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Small diameter of pin	**Thread form**	**Taper**[a] T in/ft	**Threads per inch** n	**Pitch dia. at gauge point** C	**Large dia. of pin** D_L ref	**Pin cylinder dia.** D_{LF} ± 0.016	**Small diameter of pin** D_S ref	**Pin length**[b] L_{PC} 0 −0.125	**Depth of box threads** L_{BT} min.	**Total box depth** L_{BC} +0.38 0	**Box c/bore dia.** Q_c +0.031 −0.016	**Depth of box c/bore** L_{Qc} +0.06 −0.03	L_{FT}[c] max.
NC10	V-055	1.5	6	1.063 00	1.190	1.143	1.003	1.500	1.625	2.125	1.204	0.438	0.40
NC12	V-055	1.5	6	1.265 00	1.392	1.345	1.173	1.750	1.875	2.375	1.406	0.438	0.40
NC13	V-055	1.5	6	1.391 00	1.518	1.471	1.299	1.750	1.875	2.375	1.532	0.438	0.40
NC16	V-055	1.5	6	1.609 00	1.736	1.689	1.517	1.750	1.875	2.375	1.751	0.438	0.40
NC77	V-038R	3	4	7.741 00	8.001	7.828	6.376	6.500	6.625	7.125	8.062	0.625	0.50
2-7/8 FH	V-040	3	5	3.364 00	3.625	3.453	2.750	3.500	3.625	4.125	3.688	0.625	0.50
3-1/2 FH	V-040	3	5	3.734 00	3.994	3.884	3.056	3.750	3.875	4.375	4.047	0.625	0.50
4-1/2 FH	V-040	3	5	4.532 00	4.792	4.682	3.792	4.000	4.125	4.625	4.875	0.625	0.50
5-1/2 IF	V-038R	2	4	6.189 00	6.397	6.272	5.564	5.000	5.125	5.625	6.453	0.625	0.50
6-5/8 IF	V-038R	2	4	7.251 00	7.459	7.334	6.626	5.000	5.125	5.625	7.516	0.625	0.50
2-3/8 OH LW	V-076	1.5	4	2.588 00	2.751	2.656	2.454	2.375	2.500	3.000	2.797	0.375	0.50
2-3/8 OH SW	V-076	1.5	4	2.588 00	2.751	2.688[e]	2.454	2.375	2.500	3.000	2.797	0.375	0.50
2-7/8 OH LW	V-076	1.5	4	2.984 00	3.147	3.047	2.834	2.500	2.625	3.125	3.203	0.375	0.50
2-7/8 OH SW	V-076	1.5	4	2.984 00	3.147	3.084[e]	2.787	2.875	3.000	3.500	3.203	0.375	0.50
3-1/2 OH LW	V-076	1.5	4	3.728 00	3.891	3.797	3.485	3.250	3.375	3.875	3.953	0.625	0.50
3-1/2 OH SW	V-076	1.5	4	3.728 00	3.891	3.797[e]	3.485	3.250	3.375	3.875	3.953	0.625	0.50
4 OH LW	V-076	1.5	4	4.416 00	4.579	4.484	4.141	3.500	3.625	4.125	4.641	0.625	0.50
4 OH SW	V-076	1.5	4	4.416 00	4.579	4.484[e]	4.079	4.000	4.125	4.625	4.641	0.625	0.50
4-1/2 OH LW	V-076	1.5	4	4.752 00	4.915	4.828	4.446	3.750	3.875	4.375	4.953	0.625	0.50
4-1/2 OH SW	V-076	1.5	4	4.752 00	4.915	4.828[e]	4.446	3.750	3.875	4.375	4.953	0.625	0.50
2-3/8 PAC	V-076	1.5	4	2.203 00	2.366	2.303[e]	2.069	2.375	2.500	3.000	2.406	0.375	0.25
2-7/8 PAC	V-076	1.5	4	2.369 00	2.532	2.469[e]	2.235	2.375	2.500	3.000	2.578	0.375	0.25
3-1/2 PAC	V-076	1.5	4	2.884 00	3.047	3.000[e]	2.641	3.250	3.375	3.875	3.109	0.375	0.25

Table F.6— Product dimensions for non-preferred connections, in USC units (continued)

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Connection style and size	**Thread form**	**Taper**[a] T in/ft	**Threads per inch** n	**Pitch dia. at gauge point** C	**Large dia. of pin** D_L ref	**Pin cylinder dia.** D_{LF} ± 0.016	**Small diameter of pin** D_S ref	**Pin length**[d] L_{PC} $^{0}_{-0.125}$	**Depth of box threads** L_{BT} min.	**Total box depth** L_{BC} $^{+0.38}_{0}$	**Box c/bore dia.** Q_c $^{+0.031}_{-0.016}$	**Depth of box c/bore** L_{Qc} $^{+0.06}_{-0.03}$	L_{ft}[c] max.
2-3/8 SH	V-038R	2	4	2.230 00	2.438	2.312	1.959	2.875	3.125	3.625	2.500	0.625	0.50
2-3/8 WO	V-038R	2	4	2.606 00	2.814	2.703	2.418	2.375	2.500	3.000	2.859	0.625	0.50
2-7/8 WO	V-038R	2	4	3.121 00	3.329	3.217	2.829	3.000	3.125	3.625	3.375	0.625	0.50
3-1/2 WO	V-038R	2	4	3.808 00	4.016	3.906	3.433	3.500	3.625	4.125	4.078	0.625	0.50
2-7/8 XH	V-038R	2	4	3.119 00	3.327	3.201	2.660	4.000	4.125	4.625	3.359	0.625	0.38
3-1/2 XH	V-038R	2	4	3.604 00	3.812	3.686	3.229	3.500	3.625	4.125	3.875	0.625	0.50
3-1/2 H90	90-V-050	2	3.5	3.928 60	4.125	3.922[f]	3.458	4.000	4.125	4.625	4.188	0.625	0.50
4 H90	90-V-050	2	3.5	4.303 60	4.500	4.297[f]	3.792	4.250	4.375	4.875	4.562	0.625	0.50
4-1/2 H90	90-V-050	2	3.5	4.637 60	4.834	4.632[f]	4.084	4.500	4.625	5.125	4.891	0.625	0.50
5 H90	90-V-050	2	3.5	4.908 10	5.104	4.907[f]	4.313	4.750	4.875	5.375	5.172	0.625	0.50
5-1/2 H90	90-V-050	2	3.5	5.178 60	5.375	5.173[f]	4.583	4.750	4.875	5.375	5.438	0.625	0.50
6-5/8 H90	90-V-050	2	3.5	5.803 60	6.000	5.798[f]	5.167	5.000	5.125	5.625	6.062	0.625	0.50
7 H90	90-V-050	3	3.5	6.252 30	6.500	6.298[f]	5.125	5.500	5.625	6.125	6.562	0.625	0.50
7-5/8 H90	90-V-050	3	3.5	7.141 10	7.389	7.187[f]	5.858	6.125	6.250	6.750	7.453	0.625	0.50
8-5/8 H90	90-V-050	3	3.5	8.016 10	8.264	8.062[f]	6.608	6.625	6.750	7.250	8.328	0.625	0.50
2-3/8 SL H90	90-V-084	1.25	3	2.578 00	2.725	2.623	2.432	2.875[d]	3.000	3.500	2.766	0.625	0.50
2-7/8 SL H90	90-V-084	1.25	3	3.049 00	3.196	3.094	2.890	3.000[d]	3.125	3.625	3.234	0.625	0.50
3-1/2 SL H90	90-V-084	1.25	3	3.688 00	3.835	3.735	3.503	3.250[d]	3.375	3.875	3.875	0.625	0.50
GOST Z-161	V-050	2	4	6.140 25	6.374	6.301	5.541	5.000	5.125	5.625	6.454	0.625	0.50
GOST Z-189	V-050	2	4	7.222 92	7.457	7.384	6.623	5.000	5.125	5.625	7.550	0.625	0.50

[a] Taper (T) 2 in/ft corresponds to a half-angle of $\varphi = 4.764°$.
3 in/ft corresponds to a half-angle of $\varphi = 7.125°$.
1.5 in/ft corresponds to a half-angle of $\varphi = 3.576°$.
1.25 in/ft corresponds to a half-angle of $\varphi = 2.981°$.

[b] For roller cone drill bits only, the pin length may vary by +0/ – 0.19 in.

[c] Length to flank of first full depth pin thread. See Figure 6

[d] Pin Length Tolerance for SL H90 style connections is +0/-0.062

[e] For OHSW and PAC styles, the radius R_{LF} at the pin cylinder is 0.031+0.016/-0. See figure F.2

[f] For the H90 style, the radius R_{LF} at the pin cylinder is 0.125 +/- 0.016 See figure F.2

F.6 Connection features for non-preferred connections

F.6.1 General

A number of connections have historically been used in drill collar sizes that would require excessively large bevels. To alleviate the problems, low-torque counterbores were designed. They shall be used on drill collars exceeding the diameter(s) indicated in Tables F.7 and F.8. The bevel diameter shall be as indicated, regardless of increase in collar diameter beyond these limits.

F.6.2 Low-torque features for H90 connections

Table F.7 — Low-torque feature

Dimensions in millimetres

Connection size and style	Used on ODs larger than	Face groove diameter D_{FG} +-0,8/-0,4
7 H90 LT	≥219,0	181,0
7-5/8 H90 LT	≥247,6	203,2
8-5/8 H90 LT	≥273,0	238,1

Table F.8 — Low-torque feature, in USC units

Dimensions in inches

Connection size and style	Used on ODs larger than	Face groove diameter D_{FG} +.032/-.016
7 H90 LT	≥8.625	7.12
7-5/8 H90 LT	≥9.75	8.0
8-5/8 H90 LT	≥10.75	9.38

F.6.3 Bevel diameters

Bevel diameters for threads with 60 degree included angles are listed in tables F.9 and F.10, and for threads with 90 degree included angles in tables F.11 and F.12.

Table F.9 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in SI units (see Table F.10 for USC units)

Dimensions in millimetres

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
NC10	18,26	OD	34,93						
		BD	34,53						
NC 12	23,02	OD	41,28						
		BD	40,08						
NC 13	23,81	OD	46,04						
		BD	44,84						
NC 16	25,40	OD	53,98						
		BD	52,78						
NC 77	71,44	OD	266,70	269,88	273,05	276,23	279,40	282,58	
		BD	251,23	251,23	255,98	255,98	260,75	260,75	
2 7/8 FH	53,98	OD	107,95	111,13	114,30	117,48			
		BD	106,36	106,36	109,14	109,14			
3 1/2 FH	50,80	OD	123,83	127,00	130,18	133,35			
		BD	120,65	120,65	123,43	123,43			
4 1/2 FH	63,50	OD	146,05	149,23	152,40	155,58	158,75		
		BD	142,08 [e]	142,08 [e]	145,26	145,26	150,02		
5 1/2 IF	57,15	OD	206,38	209,55	212,72	215,90	219,08	222,25	225,42
		BD	199,24 [e]	199,24 [e]	200,42	200,42	205,18	205,18	209,95
6 5/8 IF	57,15	OD	247,65	250,82	254,00	257,18	260,35	263,52	
		BD	234,54	234,54	238,12	238,12	243,28	243,28	

Table F.9 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in SI units (see Table F.10 for USC units) (continued)

Dimensions in millimetres

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
2 3/8 OH SW	49,21	OD	79,38	82,55	85,73	88,90			
		BD	77,79[e]	77,79[e]	82,14	82,14			
2 3/8 OH LW	49,21	OD	79,38	82,55	85,73	88,90			
		BD	77,79[e]	77,79[e]	82,14	82,14			
2 7/8 OH SW	44,45	OD	95,25	98,42	101,60	104,78			
		BD	93,66[e]	93,66[e]	95,25	95,25			
2 7/8 OH LW	44,45	OD	95,25	98,42	101,60	104,78			
		BD	93,66[e]	93,66[e]	95,25	95,25			
3 1/2 OH SW	53,98	OD	123,82	127,00	130,18	133,35			
		BD	117,87	117,87	123,04	123,04			
3 1/2 OH LW	53,98	OD	123,82	127,00	130,18	133,35			
		BD	117,87	117,87	123,04	123,04			
4 OH SW	63,50	OD	142,88	146,05	149,22	152,40			
		BD	136,53	136,53	141,29	141,29			
4 OH LW	63,50	OD	142,88	146,05	149,22	152,40			
		BD	136,53	136,53	141,29	141,29			
4 1/2 OH SW	53,98	OD	161,93	165,10	168,28	171,45			
		BD	153,19	153,19	157,96	157,96			
4 1/2 OH LW	53,98	OD	161,93	165,10	168,28	171,45			
		BD	153,19	153,19	157,96	157,96			
2 3/8 PAC	34,93	OD	69,85	73,03	76,20				
		BD	68,66	68,66	69,85				
2 7/8 PAC	38,10	OD	79,38						
		BD	76,20						
3 1/2 PAC	38,10	OD	95,25	98,42					
		BD	91,28	91,28					

Table F.9 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in SI units (see Table F.10 for USC units) (continued)

Dimensions in millimetres

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
2 3/8 WO	46,04	OD	82,55	85,73	88,90				
		BD	79,77 [e]	82,55	82,55				
2 7/8 WO	38,10	OD	101,60	104,78					
		BD	98,42 [e]	98,42 [e]					
3 1/2 WO	46,04	OD	127,00	130,18					
		BD	121,44	121,44					
2 3/8 SH	36,51	OD	76,20	77,79	79,38	80,96			
		BD	73,03	73,03	75,41	75,41			
2 7/8 XH	38,10	OD	104,78	107,95	111,13				
		BD	100,01	100,01	102,39				
3 1/2 XH	41,28	OD	120,65	123,82	127,00				
		BD	115,09	115,09	119,86				

[a] Tolerance on bevel diameters is ± 0.40 millimeters.
[b] See Table 15 in ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars.
[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress level will be less than 100 percent of SMYS when torqued up to the recommended torque value.
[d] When drill collars and tools of the smallest OD listed in the table above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.
[e] These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

Table F.10 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in USC units

Dimensions in inches

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
NC10	0.719	OD	1.375						
		BD	1.359						
NC 12	0.906	OD	1.625						
		BD	1.578						
NC 13	0.938	OD	1.812						
		BD	1.766						
NC 16	1.000	OD	2.125						
		BD	2.078						
NC 77	2.812	OD	10.500	10.625	10.750	10.875	11.000	11.125	
		BD	9.891	9.891	10.078	10.078	10.266	10.266	
2 7/8 FH	2.125	OD	4.250	4.375	4.500	4.625			
		BD	4.188	4.188	4.297	4.297			
3 1/2 FH	2.000	OD	4.875	5.000	5.125	5.250			
		BD	4.672	4.672	4.859	4.859			
4 1/2 FH	2.500	OD	5.750	5.875	6.000	6.125	6.250		
		BD	5.594 [e]	5.594 [e]	5.719	5.719	5.906		
5 1/2 IF	2.125	OD	8.125	8.250	8.375	8.500	8.625	8.750	8.875
		BD	7.844 [e]	7.844 [e]	7.891	7.891	8.078	8.078	8.266
6 5/8 IF	2.250	OD	9.750	9.875	10.000	10.125	10.250	10.375	
		BD	9.234 [e]	9.234 [e]	9.375	9.375	9.578	9.578	

Table F.10 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in USC units (continued)

Dimensions in inches

Connection style and size	ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
2 3/8 OH SW	1.938	OD	3.125	3.250	3.375	3.500			
		BD	3.062 [e]	3.062 [e]	3.234	3.234			
2 3/8 OH LW	1.938	OD	3.125	3.250	3.375	3.500			
		BD	3.062 [e]	3.062 [e]	3.234	3.234			
2 7/8 OH SW	1.750	OD	3.750	3.875	4.000	4.125			
		BD	3.641 [e]	3.641 [e]	3.750	3.750			
2 7/8 OH LW	1.750	OD	3.750	3.875	4.000	4.125			
		BD	3.641 [e]	3.641 [e]	3.750	3.750			
3 1/2 OH SW	2.125	OD	4.875	5.000	5.125	5.250			
		BD	4.641	4.641	4.844	4.844			
3 1/2 OH LW	2.125	OD	4.875	5.000	5.125	5.250			
		BD	4.641	4.641	4.844	4.844			
4 OH SW	2.500	OD	5.625	5.750	5.875	6.000			
		BD	5.375	5.375	5.562	5.562			
4 OH LW	2.500	OD	5.625	5.750	5.875	6.000			
		BD	5.375	5.375	5.562	5.562			
4 1/2 OH SW	2.125	OD	6.375	6.500	6.625	6.750			
		BD	6.031	6.031	6.219	6.219			
4 1/2 OH LW	2.125	OD	6.375	6.500	6.625	6.750			
		BD	6.031	6.031	6.219	6.219			
2 3/8 PAC	1.375	OD	2.750	2.875	3.000				
		BD	2.703	2.703	2.750				
2 7/8 PAC	1.500	OD	3.125						
		BD	3.000						
3 1/2 PAC	1.500	OD	3.750	3.875					
		BD	3.594	3.594					

Table F.10 — Reference bevel diameters for Non-preferred connections (60° included thread angle) when used on drill collars, in USC units (continued)

Dimensions in inches

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
2 3/8 WO	1.812	OD	3.250	3.375	3.500				
		BD	3.141 [e]	3.250	3.250				
2 7/8 WO	1.500	OD	4.000	4.125	4.250	4.375			
		BD	3.875 [e]	3.875 [e]	4.031	4.031			
3 1/2 WO	1.812	OD	5.000	5.125					
		BD	4.781	4.781					
2 3/8 SH	1.438	OD	3.000	3.063	3.125	3.188			
		BD	2.875	2.875	2.969	2.969			
2 7/8 XH	1.500	OD	4.125	4.250	4.375				
		BD	3.938	3.938	4.031				
3 1/2 XH	1.625	OD	4.750	4.875	5.000				
		BD	4.531	4.531	4.719				

[a] Tolerance on bevel diameters is ± 0.016 in.

[b] See Table A.15 in ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars.

[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress will be less than 100 percent of SMYS when torqued up to the recommended torque value.

[d] When drill collars and tools of the smallest OD listed in the table above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.

e These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

Table F.11 — Bevel diameters for connections with 90° included angle threads when used on drill collars, in SI units (see Table F.12 for USC units)

Dimensions in millimetres

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
3 1/2 H-90	50,80	OD	127,00	130,18	133,35	136,53	139,70		
		BD	122,22	122,22	127,00	127,00	127,00		
4 H--90	50,80	OD	139,70	142,88	146,05	149,23	152,40	155,58	158,75
		BD	134,95	134,95	139,70	139,70	139,70	146,05	146,05
4 1/2 H-90	50,80	OD	152,40	155,58	158,75	161,92	165,10	168,28	171,45
		BD	146,05	146,05	152,40	152,40	152,40	158,75	158,75
5 H-90	63,50	OD	165,10	168,28	171,45	174,63	177,80		
		BD	155,58	155,58	161,92	161,92	161,92		
5 1/2 H-90	57,15	OD	171,45	174,62	177,80	180,98	184,15	187,33	190,50
		BD	165,66 [f]	168,28	168,28	168,28	168,28	168,28	168,28
6 5/8 H-90	71,44	OD	193,68	196,85	200,03	203,20	206,38	209,55	
		BD	184,15	190,50	190,50	190,50	190,50	190,50	
7 H-90 FF	63,50	OD	209,55	212,73	215,90				
		BD	203,20	203,20	209,55				
7 H-90 LT	63,50	OD	219,08	222,25	225,42	228,60			
		BD	209,55	209,55	219,08	219,08			
7 5/8 H-90 FF	71,44	OD	238,13	241,30	244,48				
		BD	227,02	234,95	234,95				
7 5/8 H-90 LT	71,44	OD	247,65	250,82	254,00	257,18	260,35		
		BD	240,89[e]	244,48	244,48	244,48	244,48		
8 5/8 H-90 FF	71,44	OD	266,70	269,88					
		BD	254,00	254,00					
8 5/8 H-90 LT	71,44	OD	273,05	276,23	279,40	282,58	285,75	288,92	292,10
		BD	271,48[e]	271,48[e]	271,48[e]	273,05	273,05	273,05	275,03
2 3/8 SL H-90	31,75	OD	82,55	85,73					
		BD	79,38	79,38					
2 7/8 SL H-90	38,10	OD	101,60	104,78	107,95	120,65			
		BD	98,42	98,42	104,78	104,78			
3 1/2 SL H-90	47,62	OD	120,65	123,83	127,00	130,18	133,35		
		BD	117,48	117,48	123,82	123,82	124,61		

[a] Tolerance on bevel diameters is ± 0,40 millimeters.

[b] See Table 15 of ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars.

[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress will be less than 100 percent of SMYS for the OD's listed.

[d] When drill collars and tools of the smallest OD listed above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.

[e] These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

Table F.12 — Bevel diameters for connections with 90° included angle threads when used on drill collars, in USC units

Dimensions in inches

Connection style and size	Ref. ID [d]	Bevel diameters [a] for various OD's [b, c]							
3 1/2 H-90	2.000	OD	5.000	5.125	5.250	5.375	5.500		
		BD	4.812	4.812	5.000	5.000	5.000		
4 H-90	2.000	OD	5.500	5.625	5.750	5.875	6.000	6.125	6.250
		BD	5.312	5.312	5.500	5.500	5.500	5.750	5.750
4 1/2 H-90	2.000	OD	6.000	6.125	6.250	6.375	6.500	6.625	6.750
		BD	5.750	5.750	6.000	6.000	6.000	6.250	6.250
5 H-90	2.250	OD	6.500	6.625	6.750	6.875	7.000		
		BD	6.125	6.125	6.375	6.375	6.375		
5 1/2 H-90	2.250	OD	6.750	6.875	7.000	7.125	7.250	7.375	7.500
		BD	6.531 [e]	6.625	6.625	6.625	6.625	6.625	6.625
6 5/8 H-90	2.812	OD	7.625	7.750	7.875	8.000	8.125	8.250	
		BD	7.250	7.500	7.500	7.500	7.500	7.500	
7 H-90 FF	2.500	OD	8.250	8.375	8.500				
		BD	8.000	8.000	8.250				
7 H-90 LT	2.500	OD	8.625	8.750	8.875	9.000			
		BD	8.281 [e]	8.281 [e]	8.625	8.625			
7 5/8 H-90 FF	2.812	OD	9.375	9.500	9.625				
		BD	8.938 [e]	9.250	9.250				
7 5/8 H-90 LT	2.812	OD	9.750	9.875	10.000	10.125	10.250		
		BD	9.484 [e]	9.625	9.625	9.625	9.625		
8 5/8 H-90 FF	2.812	OD	10.500	10.625					
		BD	10.000	10.000					
8 5/8 H-90 LT	2.812	OD	10.750	10.875	11.000	11.125	11.250	11.375	11.500
		BD	10.688 [e]	10.688 [e]	10.688 [e]	10.750	10.750	10.750	10.828
2 3/8 SL H-90	1.250	OD	3.250	3.375					
		BD	3.125	3.125					
2 7/8 SL H-90	1.500	OD	4.000	4.125	4.250	4.375			
		BD	3.875	3.875	4.125	4.125			
3 1/2 SL H-90	1.875	OD	4.750	4.875	5.000	5.125	5.250		
		BD	4.625	4.625	4.875	4.875	4.906		

[a] Tolerance on bevel diameters is ± 0.016 in.

[b] See Table A.15 in ISO 10424-1 (API Spec 7-1) for tolerances on OD's of drill collars.

[c] When drill collars and tools of the same OD listed in the table above are mated, the maximum seal stress will be less than 100 percent of SMYS when mage up to the recommended torque value.

[d] When drill collars and tools of the smallest OD listed above are mated with the largest OD listed above, the maximum seal stress level will not exceed 100 percent of SMYS if the ID is not less than the Reference ID shown in column 2.

[e] These bevel diameters are calculated using the torsional make up load generated by using the largest OD and the Reference ID and then determining the seal face area needed to support the above torsional load to ensure the maximum seal stress for these bevel diameters is less than 100 percent of SMYS when the smallest OD is mated (mismatched) with the largest OD shown.

F.6.4 Stress-relief features for non-preferred connections

Stress-relief features are defined in the same way for all connections. They are optional. When such features are used, the dimensions shall be as defined in Tables F.13 and F.14. They shall not be used on connections smaller than those indicated in the tables.

Table F.13 — Stress-relief grooves and features dimensions for non-preferred connections
(see Table F.14 for USC units)

Dimensions in millimetres

1	2	3	4	5	6	7	8
Connection size and style	Box boreback contour			Box groove		Pin groove	
	Cylinder diameter $D_{CB}\ ^{+0,4}_{0}$	Depth to last thread scratch L_X ref	Depth to end of cylinder $L_{CYL} \pm 7,9$	Diameter of box groove $D_{BG}\ ^{+0,79}_{0}$	Depth to start of box groove $L_{BG}\ ^{0}_{-3,18}$	Diameter of pin groove $D_{SRG}\ ^{0}_{-0,79}$	Length of pin groove $L_{SRG} \pm 0,79$
NC77	166,29	152,40	203,20	167,48	155,58	188,01	25,40
3-1/2 FH	81,76	82,55	133,35	83,34	85,72	85,90	25,40
4-1/2 FH	100,41	88,90	139,70	102,00	92,08	106,17	25,40
5-1/2 IF	144,46	114,30	165,10	146,45	117,48	149,58	25,40
6-5/8 IF	171,45	114,30	165,10	173,43	117,48	176,56	25,40
3-1/2 OH LW	—	—	—	94,85	73,02	87,71	25,40
3-1/2 OH SW	—	—	—	94,85	73,02	87,71	25,40
4 OH LW	—	—	—	111,52	79,38	105,82	25,40
4 OH SW	105,57	88,90	139,70	109,88	92,08	105,82	25,40
4-1/2 OH LW	115,09	82,55	133,35	119,22	85,72	114,34	25,40
4-1/2 OH SW	115,09	82,55	133,35	119,22	85,72	114,34	25,40
3-1/2 XH	—	—	—	87,31	79,38	83,92	25,40
3-1/2 H90	90,49	88,90	139,70	93,66	92,08	92,48	25,40
4 H90	98,42	95,25	146,05	102,39	98,42	102,00	25,40
4-1/2 H90	106,36	101,60	152,40	109,54	104,78	110,49	25,40
5 H90	111,92	107,95	158,75	115,49	111,12	117,36	25,40
5-1/2 H90	119,06	107,95	158,75	122,24	111,12	124,23	25,40
6-5/8 H90	133,75	114,30	165,10	137,32	117,48	140,10	25,40
7 H90	133,75	127,00	177,80	136,52	130,18	151,01	25,40
7-5/8 H90	152,40	142,88	193,68	154,78	146,05	173,58	25,40
8-5/8 H90	171,45	155,58	206,38	173,83	158,75	195,81	25,40
3-1/2 SL H90	—	—	—	95,35	71,44	86,36	25,40
GOST Z-161	143,77	114,30	165,10	144,85	117,48	147,30	25,40
GOST Z-189	171,27	114,30	165,10	172,35	117,48	174,80	25,40
See Figures 8 through 10.							

Table F.14 — Stress-relief grooves and features dimensions for non-preferred connections, in USC units

Dimensions in inches

1	2	3	4	5	6	7	8
Connection size and style	Box boreback contour			Box groove		Pin groove	
	Cylinder diameter	Depth to last thread scratch	Depth to end of cylinder	Diameter of box groove	Depth to start of box groove	Diameter of pin groove	Length of pin groove
	$D_{CB}\ ^{+0.016}_{0}$	L_X ref	$L_{CYL} \pm 0.31$	$D_{BG}\ ^{+0.031}_{0}$	$L_{BG}\ ^{0}_{-0.125}$	$D_{SRG}\ ^{0}_{-0.031}$	$L_{SRG} \pm 0.031$
NC77	6.547	6.000	8.000	6.594	6.125	7.402	1.000
3-1/2 FH	3.219	3.250	5.250	3.281	3.375	3.382	1.000
4-1/2 FH	3.953	3.500	5.500	4.016	3.625	4.180	1.000
5-1/2 IF	5.688	4.500	6.500	5.766	4.625	5.889	1.000
6-5/8 IF	6.750	4.500	6.500	6.828	4.625	6.951	1.000
3-1/2 OH LW	—	—	—	3.732	2.875	3.453	1.000
3-1/2 OH SW	—	—	—	3.732	2.875	3.453	1.000
4 OH LW	—	—	—	4.389	3.125	4.166	1.000
4 OH SW	4.156	3.500	5.500	4.326	3.625	4.166	1.000
4-1/2 OH LW	4.531	3.250	5.250	4.694	3.375	4.502	1.000
4-1/2 OH SW	4.531	3.250	5.250	4.694	3.375	4.502	1.000
3-1/2 XH	—	—	—	3.438	3.125	3.304	1.000
3-1/2 H90	3.562	3.500	5.500	3.688	3.625	3.641	1.000
4 H90	3.875	3.750	5.750	4.031	3.875	4.016	1.000
4-1/2 H90	4.188	4.000	6.000	4.312	4.125	4.350	1.000
5 H90	4.406	4.250	6.250	4.547	4.375	4.620	1.000
5-1/2 H90	4.688	4.250	6.250	4.812	4.375	4.891	1.000
6-5/8 H90	5.266	4.500	6.500	5.406	4.625	5.516	1.000
7 H90	5.266	5.000	7.000	5.375	5.125	5.945	1.000
7-5/8 H90	6.000	5.625	7.625	6.094	5.750	6.834	1.000
8-5/8 H90	6.750	6.125	8.125	6.844	6.250	7.709	1.000
3-1/2 SL H90	—	—	—	3.754	2.812	3.400	1.000
GOST Z-161	5.660	4.500	6.500	5.703	4.625	5.799	1.000
GOST Z-189	6.743	4.500	6.500	6.785	4.625	6.882	1.000
See Figures 8 through 10.							

Table F.15 — Compensated thread lengths, thread heights and ball-point diameters
(see Table F.16 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7
Thread form	**Taper** T mm/mm	**Threads per 25,4 mm** n	**Compensated thread length**[a] L_{ct}	**Ball-point diameter for taper and lead** d_b ± 0,05	**Thread height compensated for taper** [b] h_{cn}	**Ball-point diameter for thread height** d_{bh} ± 0,05
90-V-050	1/6	3,5	50,976 1	5,13	2,531	1,83
90-V-050	1/4	3,5	51,195 3	5,13	2,502	1,83
V-065	1/6	4,0	25,488 0	3,67	2,821	1,83
V-076	1/8	4,0	25,449 6	3,67	2,345	1,83
90-V-084	5/48	3,0	25,434 4	5,99	2,283	1,83
See Figures 15 and 16 for meaning of dimensions.						

[a] Compensated thread length (L_{ct}) is for measurements parallel to the taper cone. Non-compensated thread length is parallel to thread axis.

[b] Compensated thread height (h_{cn}) is for measurements normal to the taper cone. Non-compensated thread height is normal to thread axis.

Table F.16 — Compensated thread lengths, thread heights and ball-point diameters, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7
Thread form	**Taper** T in/ft	**Threads per inch** n	**Compensated thread length**[a] L_{ct}	**Ball-point diameter for taper and lead** d_b ± 0.002	**Thread height compensated for taper** [b] h_{cn}	**Ball-point diameter for thread height** d_{bh} ± 0.002
90-V-050	2	3.5	2.006 93	0.202	0.099 7	0.072
90-V-050	3	3.5	2.015 56	0.202	0.098 5	0.072
V-065	2	4.0	1.003 47	0.144	0.111 1	0.072
V-076	1.5	4.0	1.001 95	0.144	0.092 3	0.072
90-V-084	1.25	3.0	1.001 36	0.236	0.089 9	0.072
See Figures 15 and 16 for meaning of dimensions.						

[a] Compensated thread length (L_{ct}) is for measurements parallel to the taper cone. Non-compensated thread length is parallel to thread axis.

[b] Compensated thread height (h_{cn}) is for measurements normal to the taper cone. Non-compensated thread height is normal to thread axis.

F.7 Gauge dimensions for non-preferred connections

F.7.1 General

Gauges for the connections listed above shall be made to the dimensions listed in Table F.17 through Table F.22.

F.7.2 Gauge thread dimensions

Table F.17 — Gauge thread form dimensions for non-preferred thread forms
(see Table F.18 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7	8	9
Form of thread	**Threads per 25,4 mm** n	**Lead**	**Half angle** θ degrees	**Taper** T mm/mm	**Thread height not truncated** H reference	**Gauge root truncation** f_{rg} max.	**Gauge crest truncation** f_{cg}	**Thread height truncated** h_g reference
90-V-050	3,5	7,257 14	45	1/6	3,603 37	0,757 50	0,732 360	2,139 163
90-V-050	3,5	7,257 14	45	1/4	3,571 88	0,752 07	0,726 770	2,118 436
V-065	4,0	6,350 00	30	1/6	5,486 53	1,528 09	1,651 000	2,308 454
V-076	4,0	6,350 00	30	1/8	5,492 09	1,797 71	1,797812	1,896 669
90-V-084	3,0	8,466 67	45	5/48	4,221 86	1,196 49	1,171143	1,879 676
See Figure 18 for meaning of dimensions.								
NOTE 1 In computing thread height and truncation, account has been taken of the effect of taper in reducing thread height for a given pitch, as compared with values for the same pitch on a cylinder. NOTE 2 See Tables 10 through 12 for tolerances on columns 2, 3, 4 and 7.								

Table F.18 — Gauge thread form dimensions for non-preferred thread forms, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7	8	9
Form of thread	**Threads per inch** n	**Lead**	**Half angle** θ degrees	**Taper** T in/ft	**Thread height not truncated** H reference	**Gauge root truncation** f_{rg} max.	**Gauge crest truncation** f_{cg}	**Thread height truncated** h_g reference
90-V-050	3.5	0.285 714	45	2	0.141 865	0.028 823	0.028 833	0.084 219
90-V-050	3.5	0.285 714	45	3	0.140 625	0.028 609	0.028 613	0.083 403
V-065	4	0.250 000	30	2	0.216 005	0.060 161	0.065 000	0.090 884
V-076	4	0.250 000	30	1.5	0.216 224	0.070 776	0.070 780	0.074672
90-V-084	3	0.333 333	45	1.25	0.166 215	0.046 106	0.046 108	0.074 003
See Figure 18 for meaning of dimensions.								
NOTE 1 In computing thread height and truncation, account has been taken of the effect of taper in reducing thread height for a given pitch, as compared with values for the same pitch on a cylinder. NOTE 2 See Tables A.10 through A.12 for tolerances on columns 2, 3, 4 and 7.								

Table F.19 — Gauge thread dimensions
(see Table F.20 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7	8	9
					Diameter at gauge point			
Style and size	**Thread form**	**Taper** T mm/mm	**Threads per 25,4 mm** n	**Pitch diameter at gauge point** [a] C	**Major (plug)** [a] **reference** D_{MP}	**Minor (ring)** [b] **reference** D_{MR}	**Pitch diameter at working gauge point** [c]	**Gauge stand-off** S
NC10	V-055	1/8	6	27,000 20	27,863	26,009	24,618 95	9,525
NC12	V-055	1/8	6	32,131 00	32,993	31,169	29,749 75	9,525
NC13	V-055	1/8	6	35,331 40	36,194	34,469	32,950 15	9,525
NC16	V-055	1/8	6	40,868 60	41,731	40,006	38,487 35	9,525
NC77	V-038R	1/4	4	196,621 40	198,790	194,453	191,858 90	15,875
2-7/8 FH	V-040	1/4	5	85,44 56	87,853	83,109	80,718 66	15,875
3-1/2 FH	V-040	1/4	5	94,843 60	97,215	92,472	90,081 10	15,875
4-1/2 FH	V-040	1/4	5	115,112 80	117,485	112,741	110,350 30	15,875
5-1/2 IF	V-038R	1/6	4	157,200 60	159,385	155,016	154,025 60	15,875
6-5/8 IF	V-038R	1/6	4	184,175 40	186,360	181,991	181,000 40	15,875
2-3/8 OH LW	V-076	1/8	4	65,735 20	67,632	63,839	63,353 95	15,875
2-7/8 OH LW	V-076	1/8	4	75,793 60	77,690	73,897	73,412 35	15,875
2-7/8 OH SW	V-076	1/8	4	75,793 60	77,690	73,897	73,412 35	15,875
3-1/2 OH SW	V-076	1/8	4	94,691 20	96,588	92,795	92,309 95	15,875
4 OH LW	V-076	1/8	4	112,166 40	114,063	110,270	109,785 15	15,875
4 OH SW	V-076	1/8	4	112,166 40	114,063	110,270	109,785 15	15,875
4-1/2 OH SW	V-076	1/8	4	120,700 80	122,597	118,804	118,319 55	15,875
2-3/8 PAC	V-076	1/8	4	55,956 20	57,853	54,060	53,574 95	15,875
2-7/8 PAC	V-076	1/8	4	60,172 60	62,069	58,276	57,791 35	15,875
3-1/2 PAC	V-076	1/8	4	73,253 60	75,150	71,357	70,872 35	15,875
2-3/8 SH	V-038R	1/6	4	56,642 00	58,827	54,457	53,467 00	15,875

Table F.19 — Gauge thread dimensions (continued)
(see Table F.20 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6	7	8	9
Style and size	**Thread form**	**Taper** T mm/mm	**Threads per 25,4 mm** n	**Pitch diameter at gauge point** [a] C	**Diameter at gauge point** **Major (plug)[a] reference** D_{MP}	**Minor (ring)[b] reference** D_{MR}	**Pitch diameter at working gauge point[c]**	**Gauge stand-off** S
2-3/8 WO	V-038R	1/6	4	66,192 40	68,377	64,007	61,429 90	15,875
2-7/8 WO	V-038R	1/6	4	79,273 40	81,458	77,089	76,098 40	15,875
3-1/2 WO	V-038R	1/6	4	96,723 20	98,908	94,539	93,548 20	15,875
2-7/8 XH	V-038R	1/6	4	79,222 60	81,407	77,038	76,047 60	15,875
3-1/2 XH	V-038R	1/6	4	91,541 60	93,726	89,357	88,366 60	15,875
3-1/2 H90	90-V-050	1/6	3,5	99,786 44	101,926	97,647	96,611 44	15,875
4 H90	90-V-050	1/6	3,5	109,311 44	111,451	107,172	106,136 44	15,875
4-1/2 H90	90-V-050	1/6	3,5	117,795 04	119,934	115,656	114,620 04	15,875
5 H90	90-V-050	1/6	3,5	124,665 74	126,805	122,527	121,490 74	15,875
5-1/2 H90	90-V-050	1/6	3,5	131,536 44	133,676	129,397	128,361 44	15,875
6-5/8 H90	90-V-050	1/6	3,5	147,411 44	149,551	145,272	144,236 44	15,875
7 H90	90-V-050	1/4	3,5	158,808 42	160,927	156,690	154,045 92	15,875
7-5/8 H90	90-V-050	1/4	3,5	181,383 94	183,502	179,265	176,621 44	15,875
8-5/8 H90	90-V-050	1/4	3,5	203,608 94	205,727	201,490	198,846 44	15,875
2-3/8 SL H90	90-V-084	5/48	3	65,481 20	67,361	63,602	63,496 83	15,875
2-7/8 SL H90	90-V-084	5/48	3	77,444 60	79,324	75,565	75,460 23	15,875
3-1/2 SL H90	90-V-084	5/48	3	93,675 20	95,555	91,796	91,690 83	15,875
GOST Z-161	V-050	1/6	4	155,962 25	159,000	152,924	152,787 25	15,875
GOST Z-189	V-050	1/6	4	183,462 25	186,500	180,424	180,287 25	15,875

See Figures 19 and 20 for meaning of dimensions.

[a] The values in columns 5 and 6 apply only to grand, regional, and reference master plug gauges.

[b] The values in column 7 apply only to ring gauges.

[c] The values in column 8 apply only to working plug gauges.

Table F.20 — Gauge thread dimensions, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7	8	9
Style and size	**Thread form**	**Taper** T in/ft	**Threads per inch** n	**Pitch diameter at gauge point** [a] C	**Diameter at gauge point** **Major (plug)** [a] **reference** D_{MP}	**Minor (ring)** [b] **reference** D_{MR}	**Pitch diameter at working gauge point** [c]	**Gauge stand-off** S
NC10	V-055	1.5	6	1.063 00	1.097 0	1.029 1	0.969 25	0.375
NC12	V-055	1.5	6	1.265 00	1.299 0	1.231 1	1.171 25	0.375
NC13	V-055	1.5	6	1.391 00	1.425 0	1.357 1	1.297 25	0.375
NC16	V-055	1.5	6	1.609 00	1.643 0	1.575 1	1.515 25	0.375
NC77	V-038R	3	4	7.741 00	7.826 4	7.655 6	7.553 50	0.625
2-7/8 FH	V-040	3	5	3.364 00	3.457 4	3.270 6	3.176 50	0.625
3-1/2 FH	V-040	3	5	3.734 00	3.827 4	3.640 6	3.546 50	0.625
4-1/2 FH	V-040	3	5	4.532 00	4.625 4	4.438 6	4.344 50	0.625
5-1/2 IF	V-038R	2	4	6.189 00	6.275 0	6.103 0	6.064 00	0.625
6-5/8 IF	V-038R	2	4	7.251 00	7.337 0	7.165 0	7.126 00	0.625
2-3/8 OH LW	V-076	1.5	4	2.588 00	2.662 7	2.513 3	2.494 25	0.625
2-7/8 OH LW	V-076	1.5	4	2.984 00	3.058 7	2.909 3	2.890 25	0.625
2-7/8 OH SW	V-076	1.5	4	2.984 00	3.058 7	2.909 3	2.890 25	0.625
3-1/2 OH SW	V-076	1.5	4	3.728 00	3.802 7	3.649 3	3.634 25	0.625
4 OH LW	V-076	1.5	4	4.416 00	4.490 7	4.337 3	4.322 25	0.625
4 OH SW	V-076	1.5	4	4.416 00	4.490 7	4.337 3	4.322 25	0.625
4-1/2 OH SW	V-076	1.5	4	4.752 00	4.826 7	4.677 3	4.658 25	0.625
2-3/8 PAC	V-076	1.5	4	2.203 00	2.277 7	2.128 3	2.109 25	0.625
2-7/8 PAC	V-076	1.5	4	2.369 00	2.443 7	2.294 3	2.275 25	0.625
3-1/2 PAC	V-076	1.5	4	2.884 00	2.958 7	2.809 3	2.790 25	0.625
2-3/8 SH	V-038R	2	4	2.230 00	2.316 0	2.144 0	2.105 00	0.625

Table F.20 — Gauge thread dimensions, in USC units (continued)

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6	7	8	12
Style and size	**Thread form**	**Taper** T in/ft	**Threads per inch** n	**Pitch diameter at gauge point**[a] C	**Diameter at gauge point** **Major (plug)**[a] **reference** D_{MP}	**Minor (ring)**[b] **reference** D_{MR}	**Pitch diameter at working gauge point**[c]	**Gauge stand-off** S
2-3/8 WO	V-038R	2	4	2.606 00	2.692 0	2.520 0	2.480 00	0.625
2-7/8 WO	V-038R	2	4	3.121 00	3.207 0	3.035 0	2.996 00	0.625
3-1/2 WO	V-038R	2	4	3.808 00	3.894 0	3.722 0	3.683 00	0.625
2-7/8 XH	V-038R	2	4	3.119 00	3.205 0	3.033 0	2.994 00	0.625
3-1/2 XH	V-038R	2	4	3.604 00	3.690 0	3.518 0	3.479 00	0.625
3-1/2 H90	90-V-050	2	3.5	3.928 60	4.012 8	3.844 4	3.803 60	0.625
4 H90	90-V-050	2	3.5	4.303 60	4.387 8	4.219 4	4.178 60	0.625
4-1/2 H90	90-V-050	2	3.5	4.637 60	4.721 8	4.553 4	4.512 60	0.625
5 H90	90-V-050	2	3.5	4.908 10	4.992 3	4.823 9	4.783 10	0.625
5-1/2 H90	90-V-050	2	3.5	5.178 60	5.262 8	5.094 4	5.053 60	0.625
6-5/8 H90	90-V-050	2	3.5	5.803 60	5.887 8	5.719 4	5.678 60	0.625
7 H90	90-V-050	3	3.5	6.252 30	6.335 7	6.168 9	6.064 80	0.625
7-5/8 H90	90-V-050	3	3.5	7.141 10	7.224 5	7.057 7	6.953 60	0.625
8-5/8 H90	90-V-050	3	3.5	8.016 10	8.099 5	7.932 7	7.828 60	0.625
2-3/8 SL H90	90-V-084	1.25	3	2.578 00	2.652 0	2.504 0	2.499 88	0.625
2-7/8 SL H90	90-V-084	1.25	3	3.049 00	3.123 0	2.975 0	2.970 88	0.625
3-1/2 SL H90	90-V-084	1.25	3	3.688 00	3.762 0	3.614 0	3.609 88	0.625
GOST Z-161	V-050	2	4	6.140 25	6.259 8	6.020 6	6.015 25	0.625
GOST Z-189	V-050	2	4	7.222 92	7.342 5	7.103 3	7.097 92	0.625

See Figures 19 and 20 for meaning of dimensions.

[a] The values in columns 5 and 6 apply only to grand, regional, and reference master plug gauges.

[b] The values in column 7 apply only to ring gauges.

[c] The values in column 8 apply only to working plug gauges.

Table F.21 — Gauge external dimensions
(see Table F.22 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6
Style and size	**Plug gauge length** L_{pg}	**Fitting plate diameter**[a] D_{FP} max.	**Ring gauge length** L_{rg}	**Ring gauge outside diameter** D_R reference	**Diameter of ring gauge counterbore** Q min.
NC10	38,1	22,45	28,58	52,64	29,85
NC12	44,45	27,58	34,83	58,80	34,98
NC13	44,45	30,78	34,83	62,64	38,18
NC16	44,45	36,32	34,83	69,28	43,71
NC77	165,1	190,69	149,23	257,84	200,85
2-7/8 FH	88,9	79,55	73,03	124,47	89,71
3-1/2 FH	95,25	88,92	79,38	135,71	99,07
4-1/2 FH	101,6	109,18	85,73	160,03	119,34
5-1/2 IF	127	151,27	111,13	210,55	161,43
6-5/8 IF	127	178,24	111,13	242,92	188,41
2-3/8 OH LW	60,325	60,23	44,45	100,27	69,54
2-7/8 OH LW	63,5	70,29	47,63	112,34	79,60
2-7/8 OH SW	73,025	70,29	57,15	112,34	79,60
3-1/2 OH SW	82,55	89,19	66,68	135,02	98,49
4 OH LW	88,9	106,66	73,03	155,99	115,97
4 OH SW	101,6	106,66	85,73	155,99	115,97
4-1/2 OH SW	95,25	115,20	79,38	166,23	124,50
2-3/8 PAC	60,325	50,50	44,45	88,47	59,71
2-7/8 PAC	60,325	54,72	44,45	93,53	63,92
3-1/2 PAC	82,55	67,80	66,68	109,23	77,00
2-3/8 SH	73,025	50,71	0,00	89,88	60,88

Table F.21 — Gauge external dimensions (continued)
(see Table F.22 for USC units)

Dimensions in millimetres, unless otherwise specified

1	2	3	4	5	6
Style and size	**Plug gauge length** L_{pg}	**Fitting plate diameter**[a] D_{FP} max.	**Ring gauge length** L_{rg}	**Ring gauge outside diameter** D_R reference	**Diameter of ring gauge counterbore** Q min.
2-3/8 WO	60,325	60,18	44,45	101,37	70,45
2-7/8 WO	88,9	73,29	73,03	117,09	83,56
3-1/2 WO	88,9	90,74	73,03	138,03	101,01
2-7/8 XH	101,6	73,24	85,73	117,03	83,51
3-1/2 XH	88,9	85,56	73,03	131,82	95,83
3-1/2 H90	101,6	94,09	85,73	141,36	103,78
4 H90	107,95	103,62	92,08	152,79	113,30
4-1/2 H90	114,3	112,10	98,43	162,97	121,79
5 H90	120,65	118,97	104,78	171,22	128,66
5-1/2 H90	120,65	125,84	104,78	179,46	135,53
6-5/8 H90	127	141,72	111,13	198,51	151,40
7 H90	139,7	153,13	123,83	212,16	162,78
7-5/8 H90	155,575	175,71	139,70	239,25	185,36
8-5/8 H90	168,275	197,93	152,40	265,92	207,58
2-3/8 SL H90	71,4248	60,05	55,55	99,88	69,22
2-7/8 SL H90	74,5998	72,01	58,72	114,24	81,18
3-1/2 SL H90	80,9625	88,24	65,09	133,72	97,41
GOST Z-161	127	149,37	111,13	209,85	160,85
GOST Z-189	127	176,87	111,13	242,85	188,35

See Figures 19 and 20 for meaning of dimensions.

[a] The thickness of fitting plates, T_{FP}, shall be 9,53 mm maximum for all gauge sizes with pitch diameter less than 143,0 mm and 11,10 mm maximum for all larger gauge sizes.

Table F.22 — Gauge external dimensions, in USC units

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6
Style and size	**Plug gauge length** L_{pg}	**Fitting plate diameter**[a] D_{FP} max.	**Ring gauge length** L_{rg}	**Ring gauge outside diameter** D_R reference	**Diameter of ring gauge counterbore** Q min.
NC10	1.500	0.884	1.125	2.072	1.175
NC12	1.750	1.086	1.375	2.315	1.377
NC13	1.750	1.212	1.375	2.466	1.503
NC16	1.750	1.430	1.375	2.728	1.721
NC77	6.500	7.508	5.875	10.151	7.907
2-7/8 FH	3.500	3.132	2.875	4.901	3.532
3-1/2 FH	3.750	3.501	3.125	5.343	3.900
4-1/2 FH	4.000	4.299	3.375	6.300	4.698
5-1/2 IF	5.000	5.955	4.375	8.289	6.356
6-5/8 IF	5.000	7.017	4.375	9.564	7.418
2-3/8 OH LW	2.375	2.371	1.750	3.948	2.738
2-7/8 OH LW	2.500	2.767	1.875	4.423	3.134
2-7/8 OH SW	2.875	2.767	2.250	4.423	3.134
3-1/2 OH SW	3.250	3.511	2.625	5.316	3.878
4 OH LW	3.500	4.199	2.875	6.141	4.566
4 OH SW	4.000	4.199	3.375	6.141	4.566
4-1/2 OH SW	3.750	4.535	3.125	6.544	4.902
2-3/8 PAC	2.375	1.988	1.750	3.483	2.351
2-7/8 PAC	2.375	2.154	1.750	3.682	2.517
3-1/2 PAC	3.250	2.669	2.625	4.300	3.032
2-3/8 SH	2.875	1.996	0.000	3.538	2.397

Table F.22 — Gauge external dimensions, in USC units (continued)

Dimensions in inches, unless otherwise specified

1	2	3	4	5	6
Style and size	**Plug gauge length** L_{pg}	**Fitting plate diameter**[a] D_{FP} max.	**Ring gauge length** L_{rg}	**Ring gauge outside diameter** D_R reference	**Diameter of ring gauge counterbore** Q min.
2-3/8 WO	2.375	2.369	1.750	3.991	2.774
2-7/8 WO	3.500	2.885	2.875	4.610	3.290
3-1/2 WO	3.500	3.572	2.875	5.434	3.977
2-7/8 XH	4.000	2.883	3.375	4.608	3.288
3-1/2 XH	3.500	3.368	2.875	5.190	3.773
3-1/2 H90	4.000	3.704	3.375	5.565	4.086
4 H90	4.250	4.079	3.625	6.015	4.461
4-1/2 H90	4.500	4.413	3.875	6.416	4.795
5 H90	4.750	4.684	4.125	6.741	5.065
5-1/2 H90	4.750	4.954	4.125	7.065	5.336
6-5/8 H90	5.000	5.579	4.375	7.815	5.961
7 H90	5.500	6.029	4.875	8.353	6.409
7-5/8 H90	6.125	6.918	5.500	9.419	7.298
8-5/8 H90	6.625	7.793	6.000	10.469	8.173
2-3/8 SL H90	2.812	2.364	2.187	3.932	2.725
2-7/8 SL H90	2.937	2.835	2.312	4.498	3.196
3-1/2 SL H90	3.188	3.474	2.563	5.264	3.835
GOST Z-161	5.000	5.881	4.375	8.262	6.333
GOST Z-189	5.000	6.963	4.375	9.561	7.416
See Figures 19 and 20 for meaning of dimensions.					

[a] The thickness of fitting plates, T_{FP}, shall be 0.375 in maximum for all gauge sizes with pitch diameter less than 5.63 in and 0.437 in maximum for all larger gauge sizes

Annex I, Clause I.4.4

I.4.4 Bevel diameters; see Figure 1.

I.4.4.1 Calculation

Calculation of the correct bevel diameter (BD) requires a two (2) part approach. Bevel diameters shall be calculated every 6,35 mm (0.250 in) starting at the Reference OD regardless of the method used except as noted in sub-clause I.4.4.3.4. See sub-clause I.4.4.3.4 for further details. Bevel diameters have traditionally been calculated in USC units and then converted to the metric system. In USC units the data for bevel diameters is recorded in divisions of 1/64 in (0.0156 in) for defining the mathematical scale used in the tables.

I.4.4.2 Part 1 - Bevel diameters by the 75 percent shoulder width method.

The bevel diameter calculated by this method is a nominal bevel diameter.

Table F.25 (F.26) contains Reference OD's and corresponding Reference bevel diameters' The reference OD is the recommended minimum OD where the bevel diameter can be calculated by the 75 percent shoulder with method. Use of OD's smaller than the reference OD can lead to seal face stresses greater than the SMYS of the material.

I.4.4.2.1 Basic 75 percent shoulder width formula

BD**1** = (OD – CB)(0.75) + CB

where:

CB = nominal counter bore dimension from Table 1 (Table A.1)

OD = outside diameter of the product

BD**1** = bevel diameter by the 75 percent shoulder width method

I.4.4.2.2 Alternate 75 percent shoulder width method

Table F.25 (F.26) contains Reference OD's and corresponding Reference bevel diameters for use as an alternate 75 percent shoulder width method to calculate bevel diameters for OD's larger than the reference OD. The reference OD is the smallest OD where the bevel diameter can be calculated by the 75 percent shoulder width method.(The results by either method are the same).

For OD's larger than the Reference OD add 4,76 mm (0.1875) in to the Reference BD for each 6,35 mm (0.250 in) increase in OD.

Metric units

BD**1** = Reference BD + (4,76 mm)(Number of 6,35 mm increases in OD)

USC units

BD**1** = Reference BD + (0.1875 in)(Number of 0.250 in increases in OD)

The seal face stress for bevel diameters calculated by the 75 percent increases as the OD of the connection decreases. At some small OD the seal face stress will exceed the SMYS.

I.4.4.3 Part 2 – Mismatched outside diameters

There is a minimum bevel diameter required for mismatched OD's to keep stress level on seal face below SMYS.

To calculate the required bevel diameter, the largest OD in the table and the reference ID are used to calculate the maximum torsional load from the make up torque. Table 3 (Table A.3) lists the reference ID used in these tables.

I.4.4.3.1 Calculate the seal face load

Calculate the seal face load from make-up torque of largest OD of the connection in the table and the reference ID.

Load**1** = (S_{mu})(A1)

where:

S_{mu} = 431 MPa (62 500 psi) for Preferred connections in Table 3 (Table A.3)

A1 = torsional area of pin (A_p)

L1 = Load generated by make up torque

Use the reference ID shown in Table 3 (Table A.3) to calculate the torsional area of the pin. The formulas to calculate the torsional areas of the pin or box are found in Appendix A of ISO 10407 or API RP7G

I.4.4.3.2 Calculate required area of seal face

Calculate the required area of seal face to keep seal stress below SMYS.

A2 = (Load1)/SMYS

where:

A2 = area of seal face required to support the load from make up torque

I.4.4.3.3 Calculate the new bevel diameter

Calculate the new bevel diameter to support the load and not exceed SMYS.

$BD2 = (CB^2 + 4A2/\pi)^{0.5}$

where:

BD2 = the minimum bevel diameter (OD of the area) required to support the load generated by make up torque and the reference ID.

I.4.4.3.4 Interpretation of calculations

1. Compare the bevel diameters found in Part 1 and Part 2 for each OD in the table for that connection.

2. Select the largest bevel diameter for each OD calculated by Part 1 and Part 2 as the bevel diameter for that OD.

3. The smallest OD and bevel diameter in Table 3 (Table A.3) is the smallest OD and bevel diameter recommended for each connection regardless of the calculation method used. The use of smaller bevel diameters will result in a stress level in the seal face stress that is above the SMYS of the product material when a mismatch with the largest OD and reference ID occurs. If OD's smaller than those in the tables are used, the smallest bevel in the tables shall be used until the bevel diameter becomes larger than the tool OD. At this point, each further reduction of 6,35 mm (0.250 in) in OD, the new bevel diameter shall be determined by subtracting 1,587 mm (0.0625 in) from the reduced OD.

4. Bevel diameters are calculated every 6,35 mm (0.250 in). For OD's between the 6,35 mm (0.250 in) intervals, the bevels are the same as the bevel diameter of the smaller OD.

Example:

For the NC 46 connection, one of the calculation points is at 165,10 mm (6.500 in) OD with a bevel diameter of 154,79 mm (6.094 in). The next calculation point occurs at 171,45 mm (6.750 in) OD. For the interval between 165,10 and 154,79 mm (6.500 and 6.750 in), the bevel diameter remains 154,79 mm (6.094 in).

That is:

- the bevel diameter for 166,6 mm (6.562 in) OD is 154,79 mm (6.094 in),
- for 168,28 mm (6.625 in) OD it is 154,79 mm (6.094 in),
- for 169,8 mm (6.687 in) OD it is still 154,79 mm (6.094 in).
- at 171,45 mm (6.750 in) OD the bevel diameter is recalculated

5. For OD's larger than the largest OD currently in Table 3 (Table A.3), the bevel diameter shall be determined by adding 4,76 mm (0.188 in) to the largest bevel diameter in the Table for each 6,35 mm (0.250 in) of OD increase.

6. The ID of the connection can not be smaller than the Reference ID if all seal faces in Table 3 (Table A.3) are to have stress levels less than the SMYS when the OD's are mismatched.

NOTES:

Bevel diameters calculated in Method 1 are nominal and are rounded up or down to the nearest 1/64 in.

Bevel diameters calculated by Method 2 are minimum and are rounded up to the nearest 1/64 in and then increased in size by 0,40 mm (0.016 in) to become the nominal values in the tables.

I.4.5 Boreback diameter, D_{CB}, and boreback length, L_X; see Figure 8:

$L_X = L_{PC}$ – 12,7 mm (0.5 in)

$$D_{CB} = C + L_{GP}\,T + H - 2f_r - L_X\,T$$

I.4.6 Box groove diameter, D_{BG}, and box groove length, L_{BG}; see Figure 10:

$L_{BG} = L_P$ – 9,52 mm

($L_{RB} = L_P$ – 0.375 in)

h_{bg} = 5,16 mm (0.203 in)

R_{bg} = 6,35 mm (0.250 in)

$$D_{BG} = C - T(L_{BG} - L_{GP}) + 2B$$

$$B = \left\{h_{BG} - R_{bg}\left[1 - \cos\left(45° + \varphi\right)\right]\right\}\left[\frac{\sin(45°)}{\sin\left(45° + \varphi\right)}\right] + R_{bg}\left(1 - \cos 45°\right) - (H/2 - f_c)$$

Values of B are listed in Table I.2

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