INTERNATIONAL STANDARD 1971

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Aircraft — Accessory drives and mounting pads

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FOREWORD

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Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1971 was drawn up by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, and circulated to the Member Bodies in March 1970.

It has been approved by the Member Bodies of the following countries :

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Aircraft — Accessory drives and mounting pads

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard provides a design for quick-release couplings with involute spline drive, intended primarily for aircraft engine/gearbox accessories which require to be removed whilst the engine/gearbox is in service.

1.2 This International Standard comprises

— clauses 3 to 12 : Design notes and recommendations;

— figure 1/tables 1a) to 1e) : Accessory flanges up to spigot reference 250;

— figure 2/tables 2a) to 2d) : Engine/gearbox pads up to spigot reference 250;

— figure 3/tables 3a) to 3e) : Accessory flanges above spigot reference 250;

— figure 4/tables 4a) to 4e) : Engine/gearbox pads above spigot reference 250;

— figure 5/tables 5a) and 5b) : Coupling clamps;

— figure 6/tables 6a) and 6b) : Selected involute splines.

1.3 Items subject to agreement between engine/gearbox manufacturer and accessory manufacturer are listed in an annex.

2 REFERENCES

ISO 48, *Vulcanized rubbers — Determination of hardness.*

ISO/R 468, *Surface roughness.*

ISO/R 1078, *Dimensions of elastomeric toroidal sealing rings for aircraft (Inch series — Class 1 tolerances).*

3 REQUIREMENTS FOR ASSEMBLY SEQUENCE

3.1 The engine/gearbox pads and accessory flanges shall be dimensioned so that the locating pin (or transfer tube) is engaged in its mating hole before the interference on the spigot sealing rings prevents rotation of the accessory casing.

3.2 In fixing the protrusion of the drive shaft, consideration shall be given to engaging the spline before the locating pin (or transfer tube) is engaged, in order to ease assembly.

3.3 In the case of heavy accessories, the design shall preclude the fitter allowing the weight of the unit to hang on the splines rather than on the spigot. This can usually be arranged by keeping the amount of spline engagement to a minimum before the spigot is engaged.

3.4 The quill shaft shall be as long as practicable in relation to the length of the splines, to reduce the effect of out-of-alignment due to manufacturing tolerances. Unless otherwise agreed, the engine/gearbox manufacturer shall be responsible for design and supply.

4 SEALING RINGS FOR TRANSFER TUBES AND FLANGE SPIGOTS

4.1 The radial compression on cross-section, and the stretch during assembly, allowed for in this International Standard are based on nitrile, fluorocarbon and silicone elastomers having a capability of 80 % stretch and a hardness of the order of 70 IRHD (see ISO 48). It may be necessary to modify the groove and "land" dimensions should materials of different characteristics be used.

4.2 The materials shall be selected by the engine/gearbox manufacturer, who shall also be responsible for the supply of the rings.

5 TRANSFER TUBES AND LOCATING AND/OR TORQUE REACTING PINS

5.1 Any transfer tubes or locating pins shall be retained in the engine/gearbox mounting pad.

5.2 If more than one transfer tube or locating pin is to be fitted, the angular positions shall be agreed between the engine/gearbox manufacturer and the accessory manufacturer.

5.3 The method of retention and the supply of tubes or pins shall be the engine/gearbox manufacturer's responsibility.

5.4 The provision for accepting the torque reaction of the accessory shall be as agreed between the engine/gearbox manufacturer and the accessory manufacturer.

6 COUPLING CLAMPS

6.1 The coupling clamp design and supply shall be the engine/gearbox manufacturer's responsibility.

6.2 A fail-safe device shall be fitted to obviate the possibility of straining the bolt (or bolts) on assembly. All nuts and bolts shall be locked in accordance with the requirements of the Design Authority.

6.3 All edges in contact with taper surfaces shall be relieved to avoid "dig in" on tightening.

7 TIGHTENING THE COUPLING CLAMP

7.1 All taper and abutment surfaces shall be wiped clean and subsequently given a thin coating of a lubricant approved by the engine/gearbox manufacturer.

7.2 The clamp shall be tightened, using an approved torque wrench, to the value specified in the engine/gearbox manufacturer's instructions.

7.3 If the clamp includes more than one bolt, the nuts shall be tightened uniformly, using small increments of torque until the final value is achieved.

7.4 The nut(s) shall be slackened and retightened at least twice without altering the position of the clamp.

8 ADAPTORS

8.1 In order to avoid having to machine the taper flange on large casings, or in cases where such machining is impracticable, it is permissible to introduce an adaptor having a taper flange at one end and a bolted flange at the other, for attachment to the engine/gearbox casing.

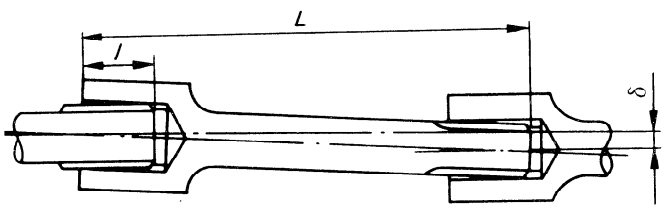
8.2 The design and supply of adaptor flanges shall be the responsibility of the engine/gearbox manufacturer.

9 SELECTION AND DESIGN OF SPLINE DRIVES

9.1 Drive shaft sizes shall be selected from the list in table 6. The size, length of engagement and other details shall be subject to agreement between the engine/gearbox manufacturer and the accessory manufacturer. Figure 6 gives male spline particulars having a 30° pressure angle, fillet root side fit to ISO . . .[1], modified to provide increased circumferential clearance (backlash). The female splines shall be to ISO . . .[1] without modification.

9.2 Linear and geometrical tolerances affecting the splined drive, namely squareness, concentricity and the like, shall be subject to agreement between the accessory manufacturer and the engine/gearbox manufacturer and shall be declared on the appropriate drawings.

9.3 The position and alignment of the accessory drive shall be of such accuracy as to meet the following requirements :



$$\frac{xL}{\delta l} > 1$$

where

x is the minimum effective circumferential clearance in splines (backlash);

L is the length between splines (as large as possible);

l is the length of spline drive (as small as possible);

δ is the "out-of-alignment" of splines in the drive and the accessory due to manufacturing tolerances.

1) In preparation.

10 LUBRICATION OF SPLINES

The arrangements for lubricating the splined drive shall be agreed between the engine/gearbox manufacturer and the accessory manufacturer; the responsibility shall rest with the former. An efficient seal shall be incorporated in the accessory to prevent ingress or egress of oil or other fluid.

11 SAFEGUARDING OF ENGINE OR GEARBOX

It shall be the joint responsibility of the engine/gearbox and accessory manufacturers to ensure that the failure of the accessory does not hazard the efficiency or safety of the engine by, for example, vibration, overloading the drive, ingress of debris or loss or contamination of engine oil.

12 IDENTIFICATION

The number of this International Standard, followed by the nominal spigot diameter and the required spline drive, shall be specified as in the following example :

ISO 1971, MOUNTING PAD AND DRIVE

SPIGOT REFERENCE 412

DRIVE : 11 SPLINES 24/48 PITCH [11,64 mm (0.458 3 in)].

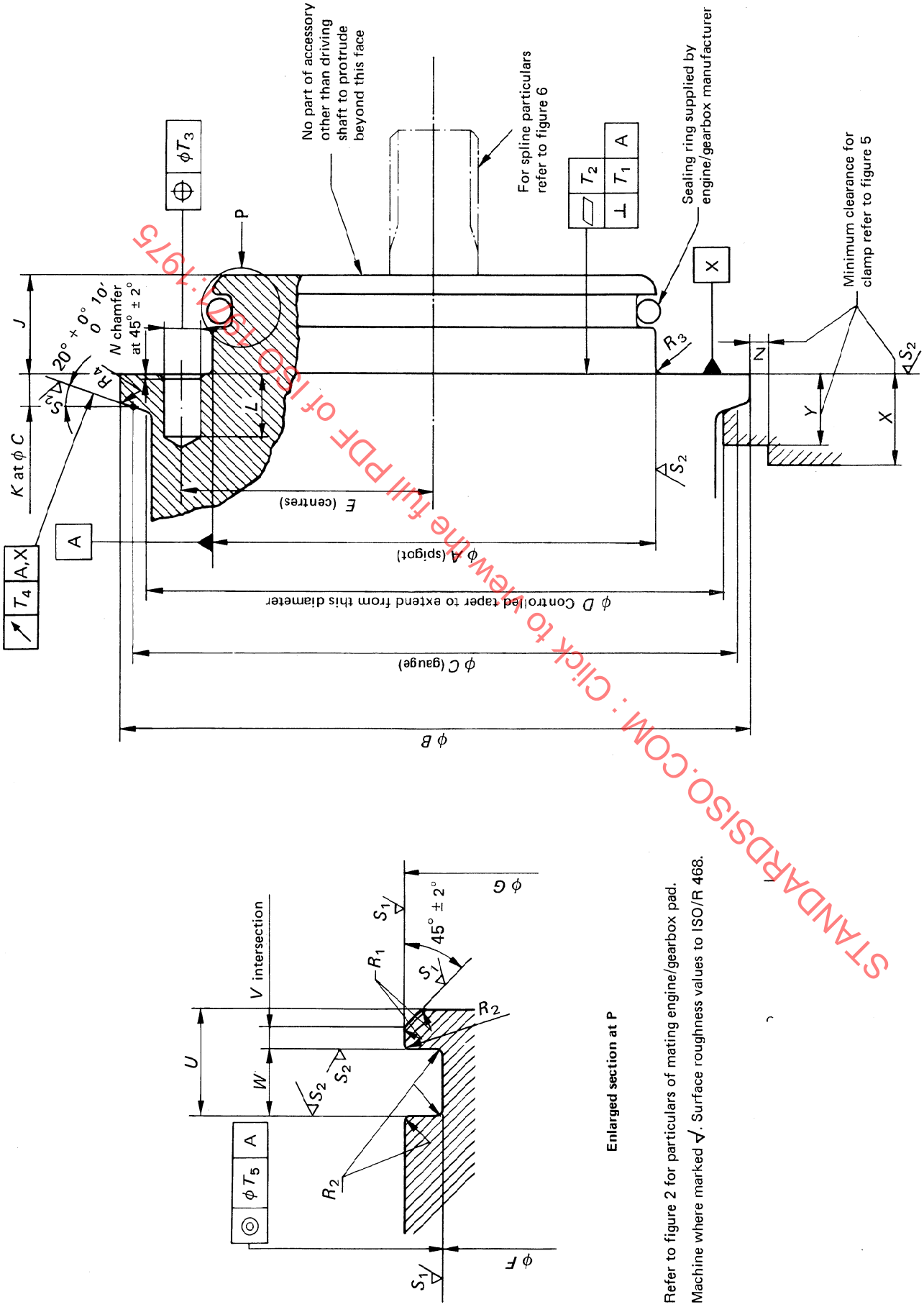


FIGURE 1 — **Accessory flanges (up to spigot reference 250)**

Refer to figure 2 for particulars of mating engine/gearbox pad.

Machine where marked ∇. Surface roughness values to ISO/R 468.

TABLES 1a) to 1e) — **Dimensions for accessory flanges (up to spigot reference 250)**

TABLE 1a)

Spigot ref.	ϕA		ϕB		ϕC		ϕD max.		E		ϕF		ϕG	
	mm	in (f7)	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
150	38,075 38,049	1.500	65,02 64,52	2.560 2.540	60,96	2.400	57,15	2.250	23,495	0.925	32,385 32,309	1.275 1.272	37,846 37,719	1.490 1.485
200	50,770 50,739	2.000	77,72 77,22	3.060 3.040	73,66	2.900	69,85	2.750	29,845	1.175	45,085 45,009	1.775 1.772	50,546 50,419	1.990 1.985
250	63,470 63,439	2.500	90,42 89,92	3.560 3.540	86,36	3.400	82,55	3.250	36,195	1.425	57,785 57,709	2.275 2.272	63,246 63,119	2.490 2.485

TABLE 1b)

Dimension	mm	in
J	14,22 13,72	0.560 0.540
K	4,572 4,521	0.180 0.178
L	8,89 min.	0.350 min.
M	5,81 5,51	0.228 8 0.216 8
N	0,76 0,51	0.030 0.020
R_1	0,89 0,64	0.035 0.025
R_2	0,64 0,38	0.025 0.015
R_3	0,76 0,51	0.030 0.020
R_4	0,76 0,51	0.030 0.020
U	7,75 7,49	0.305 0.295
V	1,27 1,02	0.050 0.040
W	4,95 4,70	0.195 0.185
X	12,7 min.	0.500 min.
Y	10,16 min.	0.400 min.
Z	2,54 min.	0.100 min.

TABLE 1c)

Geometric tolerance	mm	in
T_1	0,051	0.002
T_2	0,025	0.001
ϕT_3	0,3	0.012
T_4	0,051	0.002
ϕT_5	0.076	0.003

TABLE 1d)

Surface texture CLA	μm	μin
S_1	0,8	32
S_2	1,6	63

TABLE 1e)

Spigot ref.	Toroidal sealing ring size[1)]
150	217
200	223
250	227

1) In accordance with ISO/R 1078.

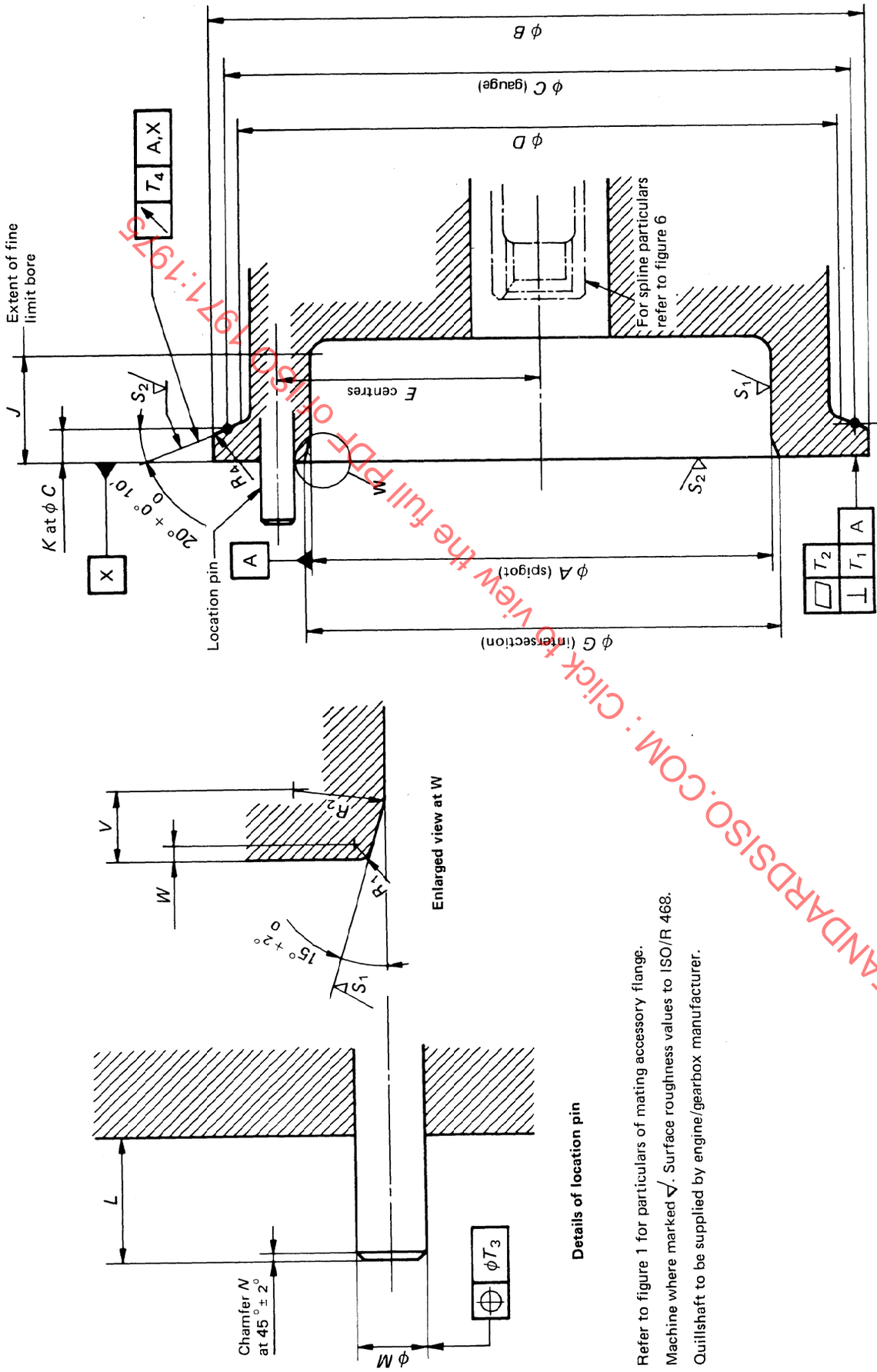


FIGURE 2 — **Engine/gearbox pads (up to spigot reference 250)**

Refer to figure 1 for particulars of mating accessory flange.

Machine where marked ∇. Surface roughness values to ISO/R 468.

Quillshaft to be supplied by engine/gearbox manufacturer.

TABLES 2a) to 2d) — **Dimensions for engine/gearbox pads (up to spigot reference 250)**

TABLE 2a)

Spigot ref.	ϕA		ϕB		ϕC		ϕD max.		E		ϕG	
	mm	in (H8)	mm	in	mm	in	mm	in	mm	in	mm	in
150	38,141 38,100	1.500	65,02 64,52	2.560 2.540	60,96	2.400	57,15	2.250	23,495	0.925	40,26 40,00	1.585 1.575
200	50,846 50,800	2.000	77,72 77,22	3.060 3.040	73,66	2.900	69,85	2.750	29,845	1.175	52,96 52,70	2.085 2.075
250	63,546 63,500	2.500	90,42 89,92	3.560 3.540	86,36	3.400	82,55	3.250	36,195	1.425	65,66 65,40	2.585 2.575

TABLE 2b)

Dimension	mm	in
J	14,6 min.	0.575 min.
K	4,572 4,521	0.180 0.178
L	8,64 8,00	0.340 0.315
ϕM	4,775 4,648	0.188 0.183
N	0,635 0,508	0.025 0.020
R_1	1,52 1,27	0.060 0.050
R_2	6,35 5,08	0.250 0.200
R_4	0,76 0,51	0.030 0.020
V	4,88 max.	0.192 max.
W	1,27 1,02	0.050 0.040

TABLE 2c)

Geometric tolerance	mm	in
T_1	0,051	0.002
T_2	0,025	0.001
ϕT_3	0,3	0.012
T_4	0,051	0.002

TABLE 2d)

Surface texture CLA	μm	μin
S_1	0,8	32
S_2	1,6	63

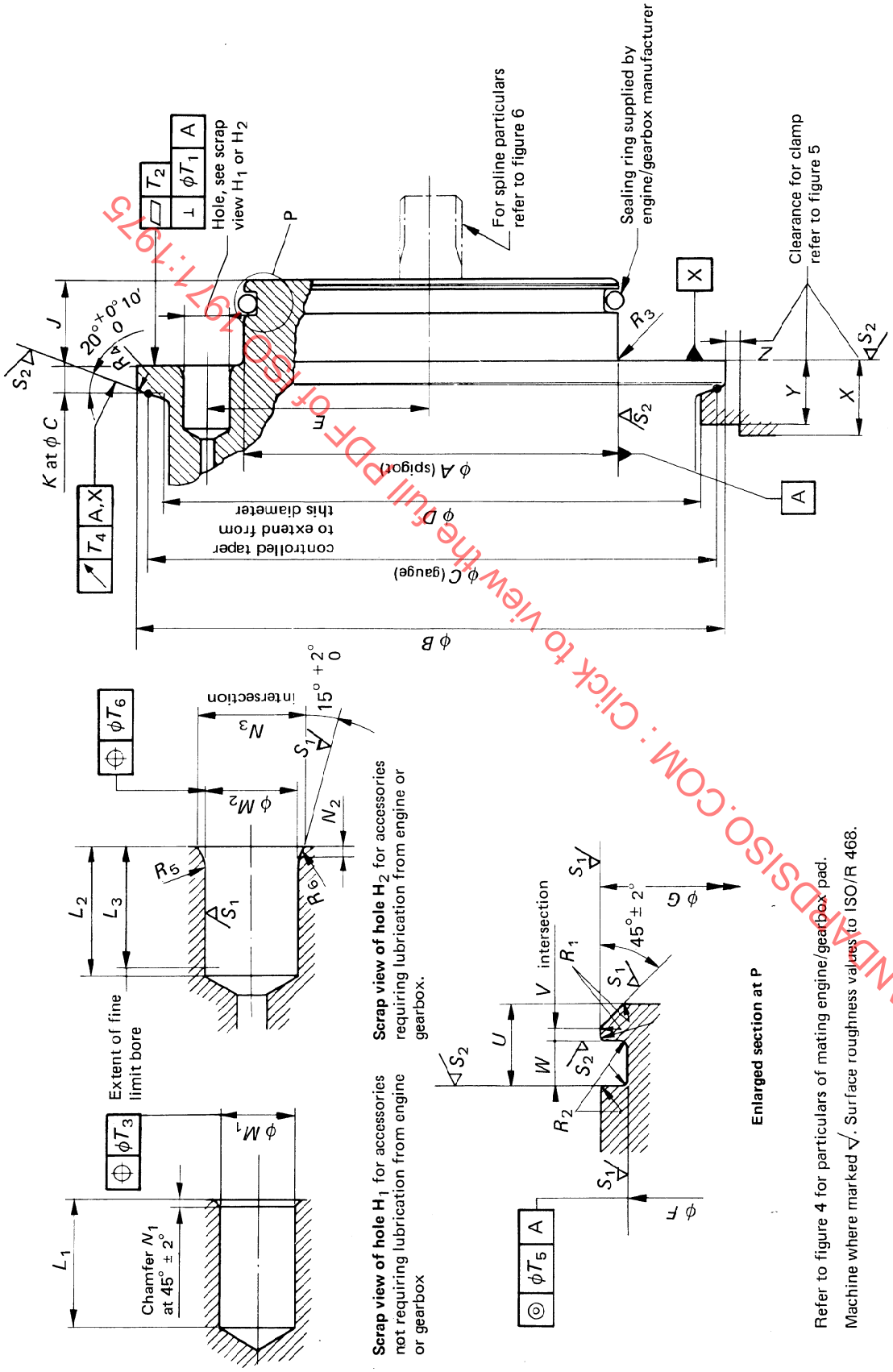


FIGURE 3 – **Accessory flanges (above spigot reference 250)**

TABLES 3a) to 3e) — **Dimensions for accessory flanges (above spigot reference 250)**

TABLE 3a)

Spigot ref.	ϕA		ϕB		ϕC		ϕD max.		E		ϕF		ϕG	
	mm	in (f7)	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
300	76,170 76,139	3.000	119,63 119,13	4.710 4.690	115,57	4.550	109,22	4.300	45,72	1.800	70,485 70,409	2.775 2.772	75,946 75,819	2.990 2.985
350	88,864 88,829	3.500	132,33 131,83	5.210 5.190	128,27	5.050	121,92	4.800	52,07	2.050	83,185 83,109	3.275 3.272	88,646 88,519	3.490 3.485
412	104,739 104,704	4.125	148,21 147,70	5.835 5.815	144,145	5.675	137,8	5.425	59,944	2.360	99,060 98,984	3.900 3.897	104,521 104,394	4.115 4.110
475	120,609 120,569	4.750	164,08 163,58	6.460 6.440	160,02	6.300	153,67	6.050	67,945	2.675	114,935 114,859	4.525 4.522	120,396 120,269	4.740 4.735
550	139,659 139,619	5.500	183,13 182,63	7.210 7.190	179,07	7.050	172,72	6.800	77,47	3.050	133,985 133,909	5.275 5.272	139,446 139,319	5.490 5.485
650	165,059 165,019	6.500	208,53 208,03	8.120 8.190	204,47	8.050	198,12	7.800	90,17	3.550	159,385 159,309	6.275 6.272	164,846 164,719	6.490 6.485
750	190,449 190,403	7.500	233,93 233,43	9,210 9.190	229,87	9.050	223,52	8.800	102,87	4.050	184,785 184,709	7.275 7.272	190,246 190,119	7.490 7.485
900	228,549 228,503	9.000	272,03 271,53	10.710 10.690	267,97	10.550	261,62	10.300	121,92	4.800	222,885 222,809	8,775 8.772	228,346 228,219	8.990 8.985
1 050	266,644 266,593	10.500	310,13 309,63	12.210 12.190	306,07	12.050	299,72	11.800	140,97	5.550	260,985 260,909	10.275 10.272	266,446 266,319	10.490 10.485

TABLE 3b)

Dimension	mm	in
J	16,76 16,26	0.660 0.640
K	5,461 5,410	0.215 0.213
L_1	12,95 min.	0.510 min.
L_2	13,21 12,95	0.520 0.510
L_3	12,06 min.	0.475 min.
M_1	8,19 7,89	0.322 5 0.310 5
M_2	9,581 9,525	0.375 H10
N_1	0,89 0,64	0.035 0.025
N_2	1,27 1,02	0.050 0.040
N_3	11,05 10,80	0.435 0.425
R_1	0,89 0,64	0.035 0.025
R_2	0,64 0,38	0.025 0.015
R_3	1,27 1,02	0.050 0.040
R_4	0,76 0,51	0.030 0.020
R_5	6,35 5,08	0.250 0.200
R_6	1,52 1,27	0.060 0.050
U	8,64 8,38	0.340 0.330
V	1,27 1.02	0.050 0.040
W	4,95 4,70	0.195 0.185
X	15,88 min.	0.625 min.
Y	12,7 min.	0.500 min.
Z	2,54 min.	0.100 min.

TABLE 3c)

Geometric tolerance	mm	in
T_1	0,051	0.002
T_2	0,025	0.001
ϕT_3	0,3	0.012
T_4	0,051	0.002
ϕT_5	0,076	0.003
ϕT_6	0,051	0.002

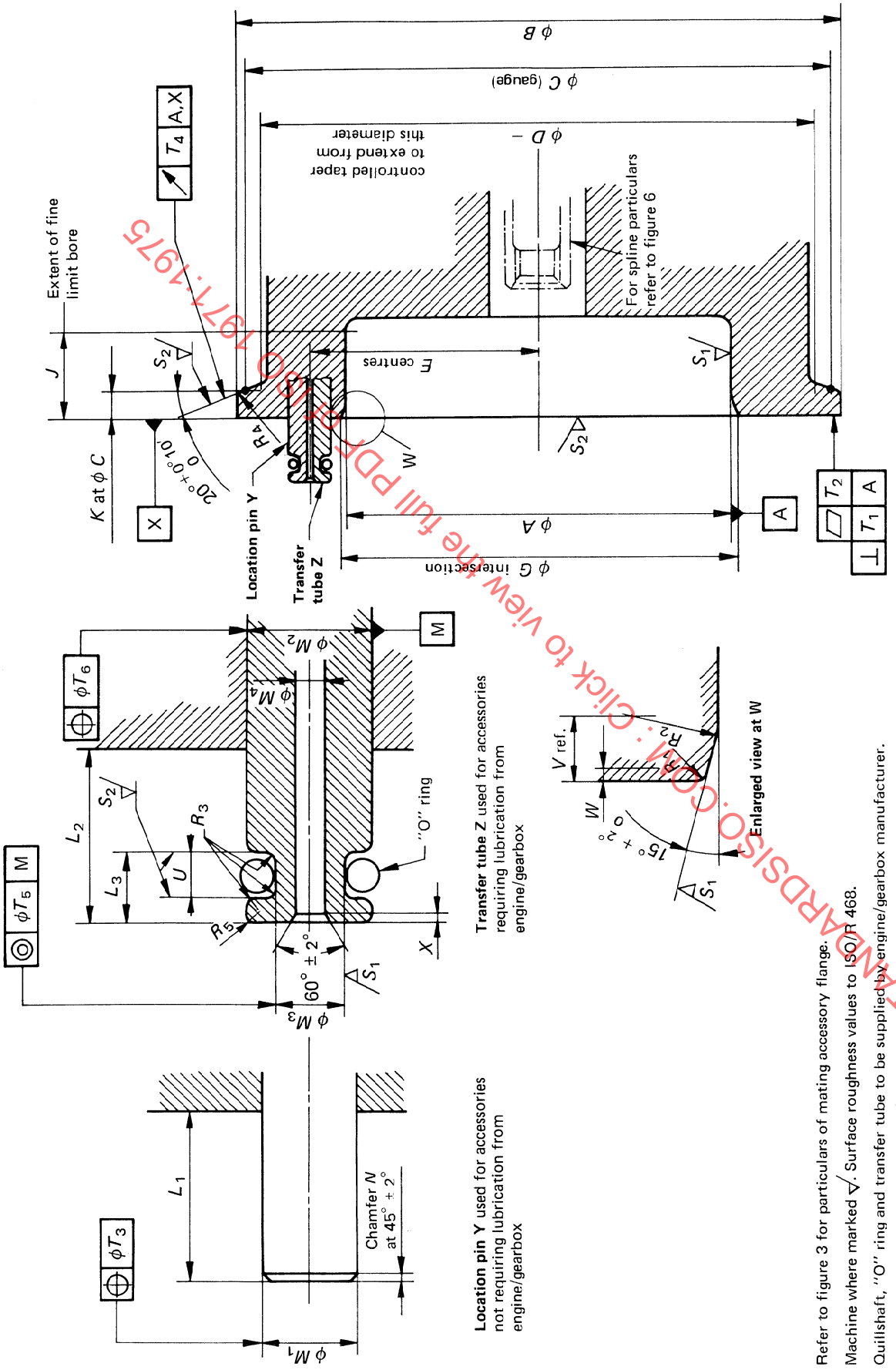
TABLE 3d)

Surface texture CLA	μm	μin
S_1	0,8	32
S_2	1,6	63

TABLE 3e)

Spigot ref.	Toroidal sealing ring size [1]
300	231
350	235
412	240
475	245
550	251
650	258
750	262
900	268
1 050	273

1) In accordance with ISO/R 1078.



Refer to figure 3 for particulars of mating accessory flange.

Machine where marked ▽. Surface roughness values to ISO/R 468.

Quillshaft, "O" ring and transfer tube to be supplied by engine/gearbox manufacturer.

FIGURE 4 – **Engine/gearbox pads (above spigot reference 250)**

TABLES 4a) to 4e) — **Dimensions of engine/gearbox pads (above spigot reference 250)**

TABLE 4a)

Spigot ref.	ϕA		ϕB		ϕC nom.		ϕD max.		E		ϕG	
	mm	in (H8)	mm	in	mm	in	mm	in	mm	in	mm	in
300	76,246 76,200	3.000	119,63 119,13	4.170 4.690	115,57	4.550	109,22	4.300	45,72	1.800	78,36 78,10	3.085 3.075
350	88,956 88,900	3.500	132,33 131,83	5.210 5.190	128,27	5.050	121,92	4.800	52,07	2.050	91,06 90,80	3.585 3.575
412	104,831 104,775	4.125	148,21 147,70	5.835 5.815	144,145	5.675	137,8	5.425	59,944	2.360	106,93 106,68	4.210 4.200
475	120,714 120,650	4.750	164,08 163,58	6.460 6.440	160,02	6.300	153,67	6.050	67,945	2.675	122,81 122,56	4.835 4.825
550	139,764 139,700	5.500	183,13 182,63	7,210 7.190	179,07	7.050	172,72	6.800	77,47	3.050	141,86 141,60	5.585 5.575
650	165,164 165,100	6.500	208,53 208,03	8.210 8.190	204,47	8.050	198,12	7.800	90,17	3.550	167,26 167,00	6.585 6.575
750	190,571 190,500	7.500	233,93 233,43	9.210 9.190	229,87	9.050	223,52	8.800	102,87	4.050	192,66 192,40	7.585 7.575
900	228,671 228,600	9.000	272,03 271,53	10.710 10.690	267,97	10.550	261,62	10.300	121,92	4.800	230,76 230,50	9.085 9.075
1 050	266,776 266,700	10.500	310,13 309,63	12.210 12.190	306,07	12.050	229,72	11.800	140,97	5.550	268,86 268,60	10.585 10.575

TABLE 4b)

Dimension	mm	in
J	17,14 min.	0.675 min.
K	5,461 5,410	0.215 0.213
L_1	12,70 12,06	0.500 0.475
L_2	12,70 12,45	0.500 0.490
L_3	5,33 5,08	0,210 0.200
M_1	7,163 7,036	0.282 0.277
M_2	9,484 9,449	0.375 d9
M_3	5,105 5,029	0.201 0.198
M_4	2,62 2,31	0.103 0.091
N	0,89 0,64	0.035 0.025
R_1	1,52 1,27	0.060 0.050
R_2	6,35 5,08	0.250 0.200
R_3	0,64 0,38	0.025 0.015
R_4	0,76 0,51	0.030 0.020
R_5	0,89 0,64	0.035 0.025
U	3,68 3,43	0.145 0.135
V	4,88 max.	0.192 max.
W	1,27 1,02	0.050 0.040
X	0,89 0,38	0.035 0.015

TABLE 4c)

Geometric tolerance	mm	in
T_1	0,051	0.002
T_2	0,025	0.001
ϕT_3	0,3	0.012
T_4	0,051	0.002
ϕT_5	0,076	0.003
ϕT_6	0,051	0.002

TABLE 4d)

Surface texture CLA	μm	μin
S_1	0,8	32
S_2	1,6	63

TABLE 4e) — **Toroidal sealing ring size 106**

Dimension	mm	in
Section diameter	2,692 2,540	0.106 0.100
Inside diameter	4,57 4,32	0.180 0.170

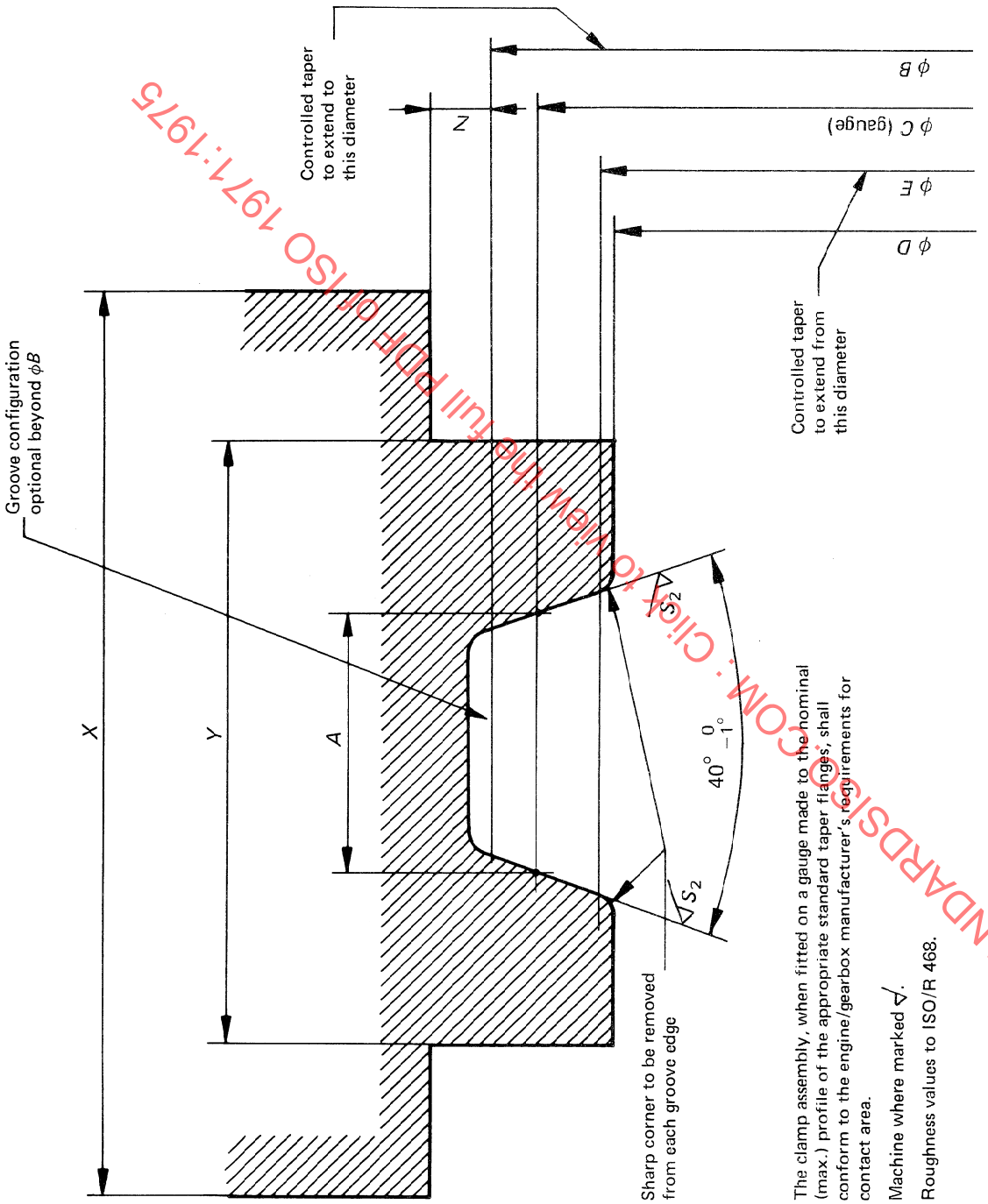


FIGURE 5 — **Coupling clamp**

TABLES 5a) and 5b) — **Dimensions of coupling clamp profile**

TABLE 5a)

Spigot ref.	*A*		*φB* min.		*φC*		*φD* min.		*φE* max.		*X*[1] max.		*Y* max.		*Z* min.	
	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in
150	9,246 9,144	0.364 0.360	65,329	2.572	60,96	2.400	57,71	2.272	58,725	2.312	24,13	0.950	19,05	0.750	3,18	0.125
200	9,246 9,144	0.364 0.360	78,029	3.072	73,66	2.900	70,41	2.772	71,425	2.812	24,13	0.950	19,05	0.750	3,18	0.125
250	9,246 9,144	0.364 0.360	90,729	3.572	86,36	3.400	83,11	3.272	84,125	3.312	24,13	0.950	19,05	0.750	3,18	0.125
300	11,024 10,922	0.434 0.430	119,939	4.722	115,57	4.550	109,78	4.322	110,795	4.362	30,48	1.200	24,13	0.950	3,18	0.125
350	11,024 10,922	0.434 0.430	132,639	5.222	128,27	5.050	122,48	4.822	123,495	4.862	30,48	1.200	24,13	0.950	3,18	0.125
412	11,024 10,922	0.434 0.430	148,514	5.847	144,145	5.675	138,35	5.447	139,37	5.487	30,48	1.200	24,13	0.950	3,18	0.125
475	11,024 10,922	0.434 0.430	164,389	6.472	160,02	6.300	154,23	6.072	155,245	6.112	30,48	1.200	24,13	0.950	3,18	0.125
550	11,024 10,922	0.434 0.430	183,439	7.222	179,07	7.050	173,28	6.822	174,295	6.862	30,48	1.200	24,13	0.950	3,18	0.125
650	11,024 10,922	0.434 0.430	208,839	8.222	204,47	8.050	198,68	7.822	199,695	7.862	30,48	1.200	24,13	0.950	3,18	0.125
750	11,024 10,922	0.434 0.430	234,239	9.222	229,87	9.050	224,08	8.822	225,095	8.862	30,48	1.200	24,13	0.950	3,18	0.125
900	11,024 10,922	0.434 0.430	272,339	10.722	267,97	10.550	262,18	10.322	263,195	10.362	30,48	1.200	24,13	0.950	3,18	0.125
1 050	11,024 10,922	0.434 0.430	310,439	12.222	306,07	12.050	300,28	11.822	301,295	11.862	30,48	1.200	24,13	0.950	3,18	0.125

1) Dimension *X* applies to the general profile. It may be necessary to exceed this in the fastening area.

TABLE 5b)

Surface texture CLA	μm	μin
S_2	1,6	63

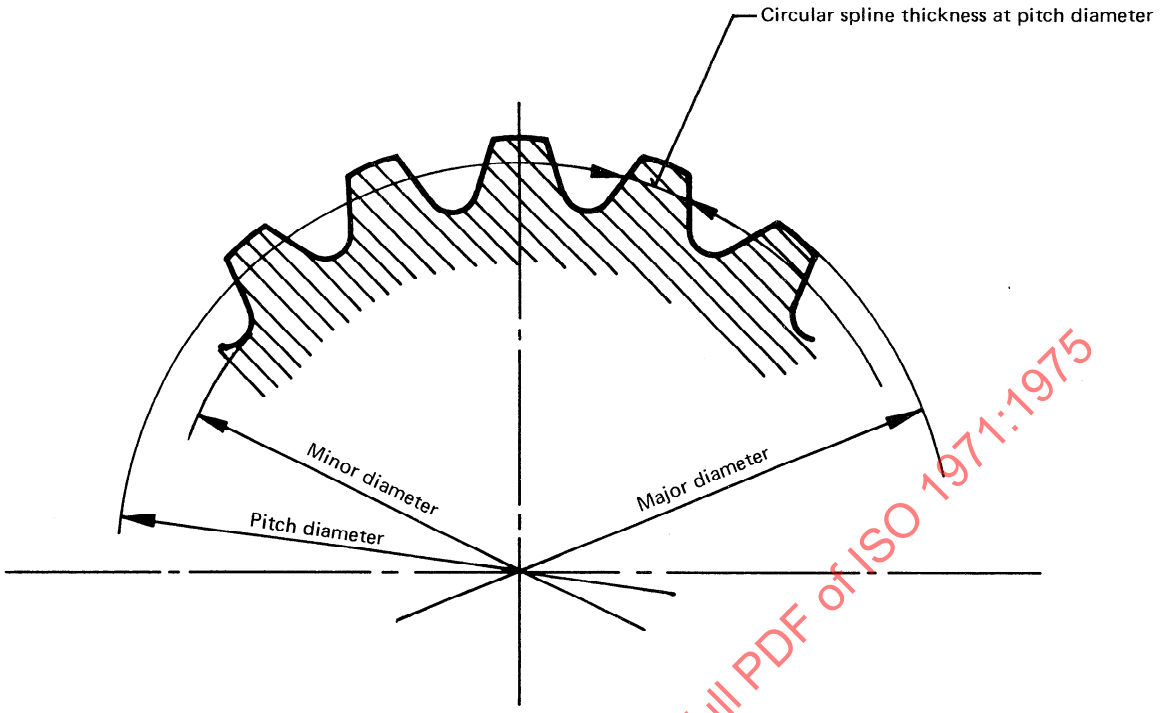


FIGURE 6 — **Involute splines**

NOTES

1 30° pressure angle, fillet root side fitting involute splines to ISO . . ., modified to provide increased circumferential clearance (backlash).

2 The minor diameter has been reduced accordingly to allow the splines to be produced with standard cutters.

3 Method of calculating clearance :

Effective min. = (min. effective space width) minus (max. effective spline thickness).

Theoretical max.= (max. actual space width) minus (min. actual spline thickness).

4 For all information not shown in table 6a) or 6b), refer to ISO . . .[1)].

5 For hole particulars refer to ISO . . .[1)], fillet root side fit.

6 For flange particulars refer to figures 1 and 2, or 3 and 4.

7 For dimensions of modifications to spline shafts refer to table 6a) or 6b).

1) In preparation.