IS 3075-1 (1986): circlips, Part 1: For shafts [PGD 2: Machine Tool Elements and Holding Devices]

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UDC 621·887·6 : 621·824

(Second Reprint DECEMBER 2000)

IS : 3075 (Part 1) - 1986
(Reaffirmed 1996)

Indian Standard

SPECIFICATION FOR CIRCLIPS

PART 1 FOR SHAFTS

(First Revision)

1. Scope

1.1 Covers the requirement of circlips for shafts of nominal diameter range 3 to 300 mm in normal type and 15 to 100 mm in heavy type.

1.2 Additional information like load-bearing capacity, detachment speed, shape of groove and fitting of circlip have been given in Appendix A.

2. Symbols — For the purpose of this standard, the following letter symbols shall apply:

- a radial width of the lug
- b beam (radial width of circlip opposite the aperture)
- c distance between measuring plates for testing spiral flatness
- d_1 shaft diameter
- d_2 groove diameter
- d_3 internal diameter of circlip not under tension
- d_4 maximum symmetrical diameter of bore during fitting
- d_5 diameter of the lug holes
- E modulus of elasticity
- F_N load-bearing capacity of groove at a yield point of the grooved material of 200N/mm^2 (*see* **A-1.1**)
- F_R load-bearing capacity of circlip with sharp-edged abutment of the pressing part (*see* **A-1.2**)
- F_{Rg} load-bearing capacity of circlip for abutment with edge chamfering distance g (*see* **A-1.2**)
- R_{eL} yield point
- g edge chamfering distance of the abutment surface to the circlip
- h distance between the plates when testing conical deformation
- m groove width
- n edge margin
- N_{ds} detachment speed of the circlip (*see* **A-2**)
- r curvature in the groove base or test jaws
- s thickness of the circlip
- t groove depth with nominal sizes of d_1 and d_2

3. Dimensions, Tolerances and Design Data

3.1 Dimensions, tolerances and design data for circlips, normal type shall be as given in Table 1, read with Fig. 1.

Machine Tools, Machine Tool Elements and Woodworking Machines Sectional Committee, EDC 11; Machine Tool Elements Subcommittee, EDC 11 : 1; *and* Ad-hoc Panel for Circlips, EDC 11/AP-1 [Ref : Doc : EDC 11 (4397)]

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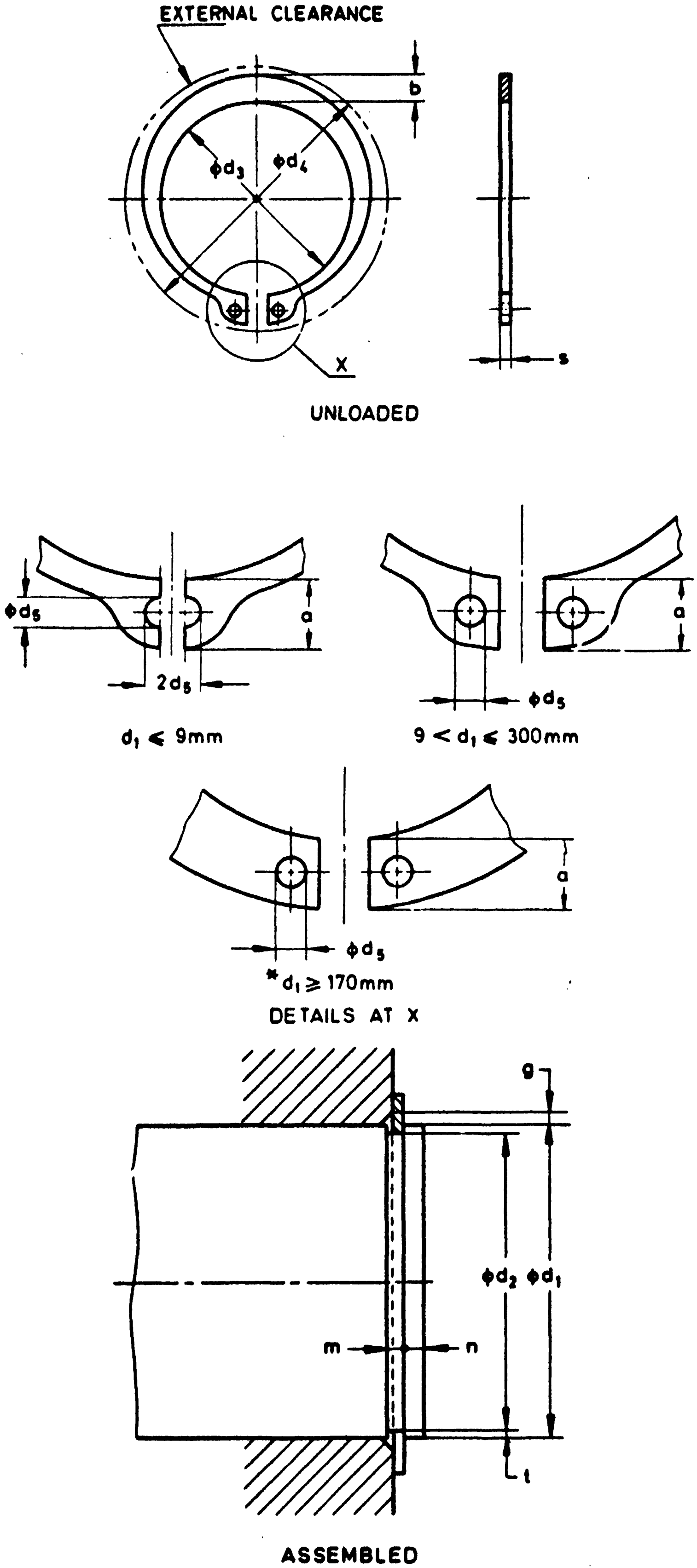
3.2 Dimensions, tolerances and design data for circlips, heavy type shall be as given in Table 2, read with Fig. 1.



Note 1 — Location of the lug hole shall be such that it leaves uniform material all round.
Note 2 — Unloaded shape of ring at manufacturer's discretion.

*At manufacturer's discretion.

FIG. 1 DIMENSIONS FOR CIRCLIPS — FOR SHAFTS

AMENDMENT NO. 1 JUNE 1991
TO
IS 3075 (Part 1) : 1986 SPECIFICATION FOR CIRCLIPS

PART 1 FOR SHAFTS

(First Revision)

(*Page* 3, *Table* 1, *Tolerance on s for Sizes* 5 *to* 8) — Substitute '± 0.03' for the existing.

(*Page* 3, *Table* 1, *Tolerance on* d_3 *for Nominal Sizes* 24 *to* 32) — Substitute '$^{+0.21}_{-0.42}$' for the existing.

(*Page* 3, *Table* 1, *Dimension a for Nominal Size* 45) — Substitute '6.7' for the existing.

(*Page* 3, *Table* 1, *Dimension* d_5 *for Nominal Size* 42) — Substitute '2.5' for the existing

(*Page* 4, *Table* 1, *Tolerance on s for Sizes* 72 *to* 82) — Substitute '± 0.06' for the existing.

(*Page* 6, *clause* 4.2, *first line in Hardness column for Sizes Over* 48 *and Up to* 200) — *Replace* '435 by 350' *with* '435 to 550'.

(PE 02)

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AMENDMENT NO. 2 NOVEMBER 1997
TO
IS 3075 (PART 1) : 1986 SPECIFICATION FOR CIRCLIPS
PART 1 FOR SHAFTS
(First Revision)

[*Page 6, clause 4.2 (see also Amendment No.* 1)] — Substitute the following table for the existing:

Nominal Diameter of Circlips		Hardness
Over	Up to Including	
—	48	480 to 560 HV (corresponding to 48 to 52 HRC)
48	200	440 to 510 HV (corresponding to 44 to 49 HRC)
200	300	390 to 450 HV (corresponding to 40 to 45 HRC)
NOTE — Hardness values converted as per IS 4258 : 1982 'Hardness conversion tables for metallic materials (*first revision*)'.		

(*Pages* 6 *and* 7, *clauses* 7.2 *to* 7.2.2) — Substitute the following for the existing clauses:

'7.2 Bend Test and Twist Test

7.2.1 ***Bend test***

The circlip shall be clamped between two jaws, of which one has a radius equal to the thickness of the circlip as shown in Figure 2A. The circlip is bent through 30° by repeated light hammer blows or with a lever, following which there shall be no fracture or cracks in the circlip. The circlip is then further bent until fracture occurs. The fracture surface shall reveal a fine- grained structure.

7.2.2 ***Twist test***

The circlip shall be clamped so that 3/4 of its diameter is free as shown in the Figure 2B. An equivalent section of the circlip shall be gripped and rotated through 90° following which there shall be no signs of fracture, cracks or similar defects. The circlips shall then be further twisted in the direction until fracture occurs, following which examination of the fracture shall reveal a uniform grain structure with no sign of lamination or other defects.

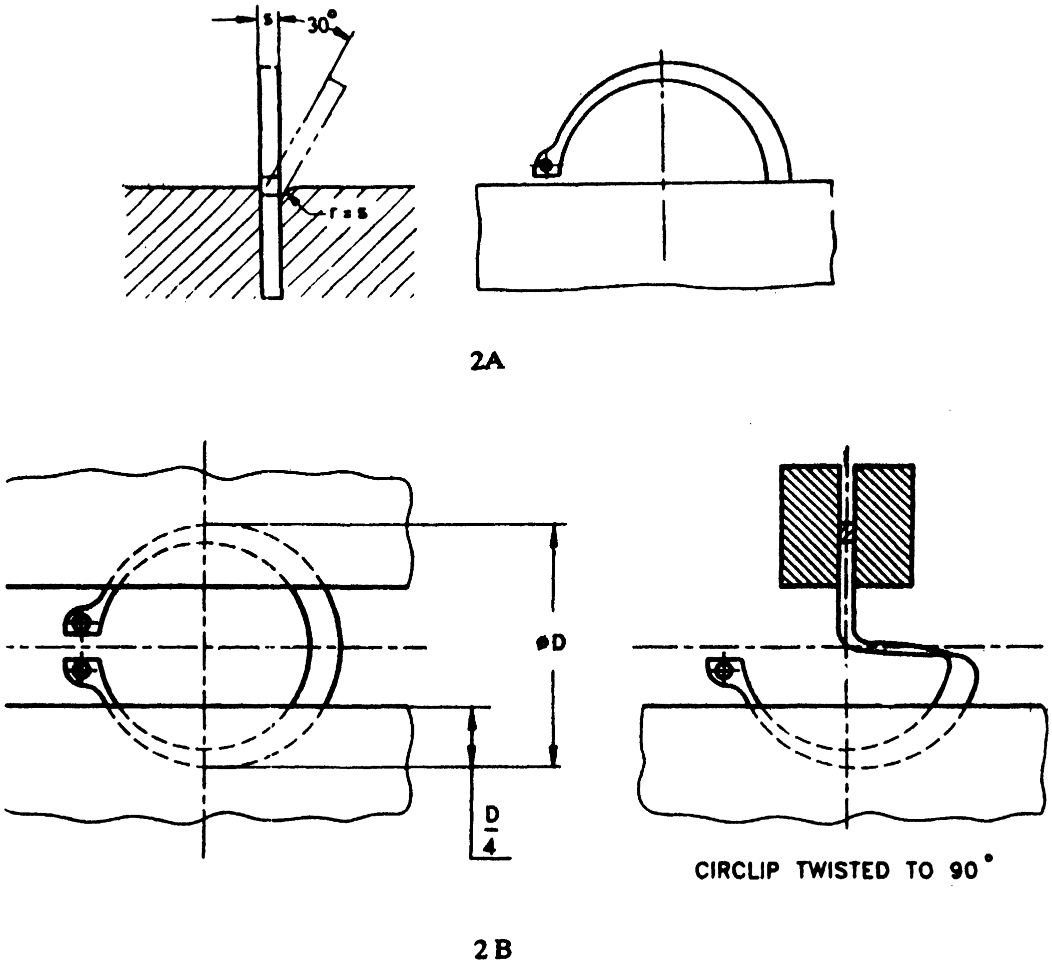

Fig. 2 Bend Test and Fracture Test

(*Page* 7, *Fig.* 2) — Delete.

(PE 02)

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TABLE 1 DIMENSIONS AND DESIGN DATA FOR CIRCLIPS FOR SHAFTS — NORMAL TYPE

(*Clause* 3.1; and *Fig.* 1)

All dimensions in millimetres.

Shaft Dia. d_1 Nom. Size	Circlip							Groove						Design Data§						Nom. Size of Plier
	s		d_3		a	b*	d_5	d_2†		m‡	t	n	d_4	F_N	F_R	g	F_{Rg}	N_{ds}		
	Size	Tolerance	Size	Tolerance	Max	≃	Min	Size	Tolerance	H13		Min		(kN)	(kN)		(kN)	Min^{-1}		
3	0·4	± 0·02	2·7	+ 0·04 − 0·15	1·9	0·8	1	2·8	0 − 0·04 (h10)	0·5	0·1	0·3	7	0·15	0·47	0·5	0·27	3 60 000		3
4	0·4		3·7		2·2	0·9	1	3·8	0 − 0·048 (h10)	0·5	0·1	0·3	8·6	0·20	0·50	0·5	0·30	2 11 000		
5	0·6	± 0·3	4·7		2·5	1·1	1	4·8		0·7	0·1	0·3	10 3	0·26	1·00	0·5	0·80	1 54 000		
6	0·7		5·6		2·7	1·3	1·2	5·7	0 − 0·06 (h10)	0·8	0 15	0·5	11·7	0·46	1·45	0·5	0·90	1 14 000		
7	0·8		6·5	+ 0·06 − 0·18	3·1	1·4	1 2	6·7		0·9	0·15	0·5	13·5	0·54	2·60	0·5	1·40	1 21 000		
8	0·8		7·4		3·2	1·5	1·2	7·6		0·9	0·2	0·6	14·7	0·81	3·00	0·5	2·00	96 000		
9	1	± 0·04	8·4		3·3	1·7	1·2	8·6		1 1	0·2	0·6	16	0·92	3·50	0·5	2·40	85 000		
10	1		9·3	+ 0·10 − 0·36	3·3	1·8	1·5	9·6	0 − 0·11 (h11)	1·1	0·2	0·6	17	1·01	4·00	1	2·40	84 000		10
11	1		10·2		3.3	1·8	1·5	10·5		1·1	0·25	0·8	18	1·40	4·50	1	2·40	70 000		
12	1		11		3·3	1·8	1·7	11·5		1·1	0·25	0·8	19	1·53	5·00	1	2·40	75 000		
13	1		11·9		3·4	2	1·7	12·4		1·1	0·3	0·9	20·2	2·00	5·80	1	2·40	66 000		
14	1		12·9		3 5	2·1	1·7	13·4		1·1	0·3	0·9	21·4	2·15	6·35	1	2·40	58 000		
15	1		13·8		3·6	2·2	1·7	14·3		1·1	0·35	1·1	22·6	2·66	6·90	1	2·40	50 000		
16	1		14·7		3·7	2·2	1·7	15·2		1·1	0·4	1·2	23·6	3 26	7·40	1	2·40	45 000		
17	1		15·7		3·8	2·3	1·7	16·2		1·1	0·4	1·2	25	3·46	8·00	1	2 40	41 000		
18	1·2		16·5		3·9	2·4	2	17		1·3	0·5	1·5	26 2	4·58	17·0	1·5	3·75	39 000		
19	1·2		17·5		3·9	2·5	2	18		1·3	0·5	1·5	27·2	4·84	17·0	1·5	3·80	35 000		
20	1·2		18·5	+ 0·13 − 0·42	4	2·6	2	19	0 − 0·13 (h11)	1·3	0·5	1·5	28·4	5·06	1 7·1	1·5	3·85	32 000		19
21	1·2		19·5		4·1	2·7	2	20		1·3	0·5	1·5	29·6	5·36	16·8	1·5	3·75	29 000		
22	1·2		20·5		4·2	2·8	2	21		1·3	0·5	1·5	30·8	5·65	16·9	1·5	3·80	27 000		
24	1.2		22·2	+ 0·41 − 0·42	4·4	3	2	22·9	0 − 0·21 (h12)	1·3	0 55	1·7	33·2	6·75	16·1	1·5	3·65	27 000		
25	1.2		23·2		4.4	3	2	23·9		1·3	0·55	1·7	34·2	7·05	16·2	1·5	3·70	25 000		
26	1.2		24·2		4·5	3·1	2	24·9		1·3	0·55	1·7	35·5	7·34	16·1	1·5	3·70	24 000		
28	1.5	± 0·05	25·9		4·7	3·2	2	26·6		1·6	0 7	2·1	37·9	10·00	32·1	1·5	7·50	21 200		
29	1.5		26·9		4·8	3·4	2	27·6		1·6	0·7	2·1	39 1	10·37	31·8	1·5	7·45	20 000		
30	1.5		27·9		5	3·5	2	28·6		1·6	0·7	2·1	40·5	10·73	32·1	1·5	7·65	18 900		
32	1.5		29·6		5·2	3·6	2·5	30·3	0 − 0·25 (h12)	1·6	0·85	2·6	43	13·85	31·2	2	5·55	16 900		
34	1.5		31·5	+ 0·25 − 0·5	5·4	3·8	2·5	31·3		1·6	0·85	2·6	45·4	14·72	31·3	2	5·60	16 100		
35	1.5		32·2		5·6	3·9	2·5	33		1·6	1	3	46·8	17·80	30 8	2	5·55	15 500		
36	1.75		33·2		5·6	4	2·5	34		1·85	1	3	47·8	18·33	49·4	2	9·00	14 500		
38	1.75		35·2		5·8	4·2	2·5	36		1·85	1	3	50·2	19·30	49·5	2	9·10	13 600		
40	1.75		36·5	+ 0·39 − 0·9	6	4·4	2·5	37·5		1·85	1·25	3·8	52·6	25·30	51·0	2	9·50	14 300		40
42	1.75		38·5		6·5	4·5	2	39·5		1·85	1·25	3·8	55·7	26·70	50·0	2	9·45	13 000		
45	1.75		41·5		5·7	4·7	2·5	42·5		1·85	1·25	3·8	59·1	28·60	49·0	2	9·35	11 400		
48	1.75		44·5		6·9	5	2·5	45·5		1·85	1·25	3·8	62·5	30·70	49·4	2	9·55	10 300		
50	2	± 0·06	45·8		6·9	5·1	2·5	47		2·15	1·5	4·5	64·5	38·00	73·3	2	14·4	10 500		
52	2		47·8		7	5·2	2·5	49	0 − 0·30 (h12)	2·15	1·5	4·5	66·7	39·70	73·1	2·5	11·5	9 850		
55	2		50·8	+ 0·46 − 1·1	7·2	5·4	2·5	52		2 15	1·5	4·5	70·2	42·00	71·4	2·5	11·4	8 960		
56	2		51·8		7·3	5·5	2·5	53		2·15	1·5	4 5	71·6	42·80	70·8	2·5	11·35	8 670		
58	2		53·8		7·3	5·6	2·5	55		2·15	1·5	4·5	73·6	44·30	71·1	2·5	11·5	8 200		
60	2		55·8		7.4	5·8	2·5	57		2.15	1·5	4·5	75·6	46·00	69·2	2·5	11·3	7 620		
62	2		57·8		7·5	6	2·5	59		2·15	1·5	4·5	77·8	47·50	69·3	2·5	11·45	7 240		
63	2		58·8		7·6	6·2	2·5	60		2·15	1·5	4·5	79	48·30	70·2	2·5	11·6	7 050		
65	2.5		60·8		7·8	6·3	3	62		2·65	1·5	4·5	81·4	49·80	135·6	2·5	22·7	6 640		
68	2.5		63·5		8	6·5	3	65		2·65	1·5	4·5	84·8	52·25	135·9	2·5	23·1	6 910		
70	2.5		65·5		8·1	6·6	3	67		2·65	1·5	4·5	87	53·80	134·2	2·5	23·0	6 530		

(*Continued*)

TABLE 1 DIMENSIONS AND DESIGN DATA FOR CIRCLIPS FOR SHAFTS — NORMAL TYPE — *Contd*

All dimensions in millimetres.

Shaft Dia, d_1 Nom. Size	Circlip s Size	Circlip s Tolerance	Circlip d_3 Size	Circlip d_3 Tolerance	Circlip a Max	Circlip b* ≃	Circlip d_5 Min	Groove d_2† Size	Groove d_2† Tolerance	Groove m‡ H13	Groove t	Groove n Min	Design Data§ d_4	Design Data§ F_N (kN)	Design Data§ F_R (kN)	Design Data§ g	Design Data§ F_{Rg} (kN)	Design Data§ Nd_3 Min^{-1}	Nom. Size of Pliers‖
72	2·5	± 0·06	67·5	+ 0·46 − 1·1	8·2	6·8	3	69	0 − 0·3 (h 12)	2·65	1·5	4·5	89·2	55·30	131·8	2·5	22·8	6 190	40
75	2·5		70·5		8·4	7	3	72		2·65	1·5	4·5	92·7	57·60	130·0	2·5	22·8	5 740	
78	2·5		73·5		8·6	7·3	3	75		2·65	1·5	4·5	96·1	60·00	131·3	3	19·75	5 450	
80	2·5		74·5		8·6	7·4	3	76·5		2·65	1·75	5·3	98·1	71·60	128·4	3	19·5	6 100	
82	2·5		76·5		8·7	7·6	3	78·5		2·65	1·75	5·3	100·3	73·50	128·0	3	19·6	5 860	
85	3	± 0·07	79·5		8·7	7·8	3·5	81·5	0 − 0·35 (h 12)	3·15	1·75	5·3	103·3	76·20	215·4	3	33·4	5 710	85
88	3		82·5	+ 0·54 − 1·3	8·8	8	3·5	84·5		3·15	1·75	5·3	106·5	79·00	221·8	3	34·85	5 200	
90	3		84·5		8·8	8·2	3·5	86·5		3·15	1·75	5·3	108·5	80·80	217·2	3	34·4	4 980	
95	3		89·5		9·4	8·6	3·5	91·5		3·15	1·75	5·3	114·8	85·50	212·2	3·5	29·25	4 550	
100	3		94·5		9·6	9	3·5	96·5		3·15	1·75	5·3	120·2	90·00	206·4	3·5	29·0	4 180	
105	4	± 0·08	98		9·9	9·3	3·5	101	0 − 0·54 (h 13)	4·15	2	6	125·8	107·6	471·8	3·5	67·7	4 740	
110	4		103		10·1	9·6	3·5	106		4·15	2	6	131·2	113·0	457·0	3 5	66·9	4 340	
115	4		108		10·6	9·8	3·5	111		4·15	2	6	137·3	118·2	438·6	3·5	65·5	3 970	
120	4		113		11	10·2	3·5	116		4·15	2	6	143·1	123·5	424·6	3·5	64·5	3 685	
125	4		118		11·4	10·4	4	121	0 − 0·63 (h 13)	4·15	2	6	149	128·7	411·5	4	56·5	3 420	125
130	4		123	+ 0·63 − 1·5	11·6	10·7	4	126		4·15	2	6	154·4	134·0	395·5	4	55·2	3 180	
135	4		128		11·8	11	4	131		4·15	2	6	159·8	139·2	389·5	4	55·4	2 950	
140	4		133		12	11·2	4	136		4·15	2	6	165·2	144·5	376·5	4	54·4	2 760	
145	4		138		12·2	11·5	4	141		4·15	2	6	170·6	149·6	367·0	4	53·8	2 600	
150	4		142		13	11·8	4	145		4·15	2·5	7·5	177·3	193·0	357·5	4	53·4	2 480	
155	4		146		13	12	4	150		4·15	2·5	7·5	182·3	199·6	352·9	4	52·6	2 710	
160	4		151		13·3	12·2	4	155		4·15	2·5	7·5	188	206·1	349·2	4	52·2	2 540	
165	4		155·5		13·5	12·5	4	160		4·15	2·5	7·5	193·4	212·5	345·3	5	41·4	2 520	
170	4		160·5		13·5	12·9	4	165		4·15	2·5	7·5	198·4	219·1	349·2	5	41·9	2 440	
175	4		165·5		13·5	12·9	4	170		4·15	2·5	7·5	203·4	225·5	340·1	5	40·7	2 300	
180	4		170·5		14·2	13·5	4	175		4·15	2·5	7·5	210	232·2	345·3	5	41·4	2 180	
185	4		175·5		14·2	13·5	4	180		4·15	2·5	7·5	215	238·6	336·7	5	40·4	2 070	
190	4		180·5	+ 0·72 − 1·7	14·2	14	4	185	0 − 0·72 (h 13)	4·15	2·5	7·5	220	245·1	333·8	5	40·0	1 970	
195	4		185·5		14·2	14	4	190		4·15	2·5	7·5	225	251·8	325·4	5	39·0	1 835	
200	4		190·5		14·2	14	4	195		4·15	2·5	7·5	230	258·3	319·2	5	38·3	1 770	
210	5	± 0·09	198		14·2	14	4	204		5·15	3	9	240	325·1	598·2	6	59·9	1 835	
220	5		208		14·2	14	4	214		5·15	3	9	250	340·8	572·4	6	57·3	1 620	
230	5		218		14·2	14	4	224		5·15	3	9	260	356·6	548·9	6	55·0	1 445	
240	5		228		14·2	14	4	234		5·15	3	9	270	372·6	530·3	6	53·0	1 305	
250	5		238		14·2	14	4	244		5·15	3	9	280	388·3	504·3	6	50·5	1 180	
260	5		245		16·2	16	5	252	0 − 0·81 (h 13)	5·15	4	12	294	535·8	540·6	6	54·6	1 320	
270	5		255	+ 0·8 − 2	16·2	16	5	262		5·15	4	12	304	556·6	525·3	6	52·5	1 215	
280	5		265		16·2	16	5	272		5·15	4	12	314	576·6	508·2	6	50·9	1 100	
290	5		275		16·2	16	5	282		5·15	4	12	324	599·1	490·8	6	49·2	1 005	
300	5		285		16·2	16	5	292		5·15	4	12	334	619·1	475·0	6	47·5	930	

*Dimension *b* shall not exceed dimension *a Max*.

†*See* **A-3.1**.

‡*See* **A-3.2**.

§The design data apply only to circlips of spring steel as per IS : 2507-1975 'Specification for cold rolled steel strips for spring (*first revision*)', d_4 is calculated from $d_4 = d_1 + 2{\cdot}1\,a$.

‖Pliers conforming to IS : 7990-1976 'Specification for pliers for external circlips'.

TABLE 2 DIMENSIONS AND DESIGN DATA FOR CIRCLIPS FOR SHAFTS — HEAVY TYPE

(*Clause* 3.2 and *Fig.* 1)

All dimensions in millimetres.

Shaft Dia, d_1 Nom. Size	Circlip							Groove					Design Data§						
	s		d_3		a	b*	d_5	d_2†		m‡	t	n	d_4	F_N	F_R	g	F_{Rg}	N_{ds}	Nom. Size of Pliers‖
	Size	Tolerance	Size	Tolerance	*Max*	≃	*Min*	Size	Tolerance	H13		*Min*		(kN)	(kN)		(kN)	*Min*$^{-1}$	
15	1·5	±0·05	13·8		4·8	2·4	2	14·3		1·6	0·35	1·1	25·1	2·66	15·5	1	6·40	57 000	10
16	1·5		14·7	+0·10 −0·36	5	2·5	2	15·2	0 −0·11 (h 11)	1·6	0·4	1·2	26·5	3·26	16·6	1	6·35	44 000	
17	1·5		15·7		5	2·6	2	16·2		1·6	0·4	1·2	27·5	3·46	18·0	1	6·70	46 000	
18	1·5		16·5		5·1	2·7	2	17		1·6	0·5	1·5	28·7	4·58	26·6	1·5	5·85	42 750	
20	1·75		18·5	+0·13 −0·42	5·5	3	2	19	0 −0·13 (h 11)	1·85	0·5	1·5	31·6	5·06	36·3	1·5	8·20	36 000	19
22	1·75		20·5		6	3·1	2	21		1·85	0·5	1·5	34·6	5·65	36·0	1·5	8·10	29 000	
24	1·75		22·2		6·3	3·2	2	22·9		1·85	0·55	1·7	37·3	6·75	34·2	1·5	7·60	29 200	
25	2	±0·06	23·2	+0·21 −0·42	6·4	3·4	2	23·9	0 −0·21 (h 12)	2·15	0·55	1·7	38·5	7·05	45·0	1·5	10·3	25 000	
28	2		25·9		6·5	3·5	2	26·6		2·15	0·7	2·1	41·7	10·0	57·0	1·5	13·4	22 200	
30	2		27·9		6·5	4·1	2	28·6		2·15	0·7	2·1	43·7	10·7	57·0	1·5	13·6	21 100	
32	2		29·6		6·5	4·1	2·5	30·3	0 −0·25 (h 12)	2·15	0·85	2·6	45·7	13·8	55·5	2	10·0	18 400	
34	2·5		31·5	+0·25 −0·5	6·6	4·2	2·5	32·3		2·65	0·85	2·6	47·9	14·7	87·0	2	15·6	17 800	
35	2·5		32·2		6·7	4·2	2·5	33		2·65	1	3	49·1	17·8	86·0	2	15·4	16 500	
38	2·5		35·2		6·8	4·3	2·5	36		2·65	1	3	52·3	19·3	101	2	18·6	14 500	
40	2·5		36·5	+0·39 −0·9	7	4·4	2·5	37·5		2·65	1·25	3·8	54·7	25·3	104	2	19·3	14 300	40
42	2·5		38·5		7·2	4·5	2·5	39·5		2·65	1·25	3·8	57·2	26·7	102	2	19·2	13 000	
45	2·5		41·5		7·5	4·7	2·5	42·5		2·65	1·25	3·8	60·8	28·6	100	2	19·1	11 400	
48	2·5		44·5		7·8	5	2·5	45·5		2·65	1·25	3·8	64·4	30·7	101	2	19·5	10 300	
50	3	±0·07	45·8		8	5·1	2·5	47		3·15	1·5	4·5	66·8	38·0	165	2	32·4	10 500	
52	3		47·8		8·2	5·2	2·5	49		3·15	1·5	4·5	69·3	39·7	165	2 5	26·0	9 850	
55	3		50·8	+0·46 −1·1	8·5	3·4	2·5	52	0 −0·30 (h 12)	3·15	1·5	4 5	72·9	42·0	161	2·5	25·6	8 960	
58	3		53·8		8·8	5·6	2·5	55		3 15	1·5	4·5	76·5	44·3	160	2 5	26·0	8 200	
60	3		55·8		9	5·8	2·5	57		3·15	1·5	4·5	78·9	46·0	156	2·5	25·4	7 620	
65	4	±0·08	60·8		9·3	6·3	3	62		4·15	1·5	4·5	84·5	49 8	346	2·5	58·0	6 640	
70	4		65·5		9·5	6·6	3	67		4·15	1·5	4·5	90	53·8	343	2·5	59·0	6 530	
75	4		70·5		9·7	7	3	72		4·15	1·5	4·5	95·4	57·6	333	2·5	58·0	5 740	
80	4		74·5		9·8	7·4	3	76·5		4·15	1·75	5·3	100·6	71 6	328	3	50·0	6 100	
85	4		79·5		10	7·8	3·5	81·5	0 −0·35 (h 12)	4·15	1·75	5·3	106	76·2	383	3	59·4	5 710	85
90	4		84·5	+0·54 −1·3	10·2	8·2	3·5	86·5		4·15	1·75	5·3	111·5	80·8	386	3	61·0	4 980	
100	4		94·5		10·5	9	3·5	96·5		4·15	1·75	5·3	122·1	90·0	368	3·5	51·6	4 180	

*Dimension *b* shall not exceed dimension *a Max*.

†*See* **A-3.1.**

‡*See* **A-3.2.**

§The design data apply to circlips of spring steel as per IS : 2507-1975, b_4 is calculated from $d_4 = d_1 + 2{\cdot}1\,a$.

‖Pliers conforming to IS : 7990-1976.

4. Material and Hardness

4.1 The circlips shall be manufactured from spring steel such as 70 C6 or 75 C6 as per IS : 2507-1975 'Specification for cold rolled steel strips for springs (*first revision*)'.

4.2 Hardness of circlips shall be as given below:

Nominal Diameter of Circlips		Hardness
Over	Up to	
—	48	470 to 580 Vickers hardness (corresponding to 47 to 54 Rockwell C hardness)
48	200	435 to 350 Vickers hardness (corresponding to 44 to 51 Rockwell C hardness)
200	300	390 to 470 Vickers hardness (corresponding to 40 to 47 Rockwell C hardness)

Note — Hardness values converted as per IS : 4258-1982 'Hardness conversion Table for metallic materials (*first revision*)'.

5. Designation

5.1 A circlip for shaft diameter (nominal size) d_1 = 40 mm and thickness 1·75 mm, normal type (N), shall be designated as:

Circlip 40 × 1·75 N IS : 3075 (Part 1)

5.2 A circlip for shaft diameter (nominal size) d_1 = 40 mm and thickness 2·5 mm, heavy type (H), shall be designated as:

Circlip 40 × 2·5 H IS : 3075 (Part 1)

6. Finish

6.1 All sharp edges shall be removed from the circlips. The circlips shall be free from burrs, cracks, laminations and other defects.

6.1.1 The maximum permissible deviation on the profile at engaging lip may also be mutually agreed upon between the manufacturer and the user in case of special application.

6.2 Unless any alternative finish is specified by the purchaser, the circlips shall be chemically and/or thermally blackened or phosphated to class A2 of IS : 3618-1966 'Phosphate treatment for iron and steel for protection against corrosion'. The coated circlips shall be subjected to appropriate treatment to avoid hydrogen embrittlement.

Note — In the case of circlips with electroplated surface protection, the upper limit of the circlips thickness *S* may be exceeded according to the film thickness of the plating required. This shall be taken into account in the design of the groove.

7. Tests

7.1 *Testing of Material*

7.1.1 Vickers hardness test in accordance with IS : 1501 (Part 1)-1984 'Method for Vickers hardness test for metallic materials: Part 1 HV 5 to HV 100 (*second revision*)'.

7.1.2 Rockwell hardness test in accordance with IS : 1586-1968 'Methods for Rockwell hardness test (B and C scales) for steels (*first revision*)'.

Note 1 — In case of doubt, the Vickers hardness test applies.

Note 2 — In case of circlips, the hardness test is regarded as a destructive test.

7.2 *Bend Test and Fracture Test*

7.2.1 The testing of the circlip for dutcility shall be carried out in accordance with Fig. 2.

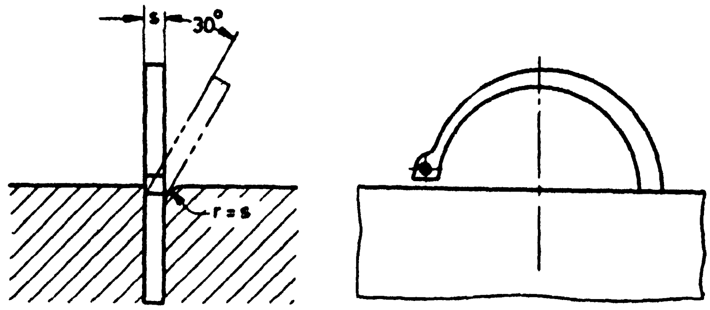


FIG. 2 BEND TEST AND FRACTURE TEST

7.2.2 One half of the circlip is clamped between two jaws, of which one has a radius equal to the thickness of the circlip. The circlip is bent through 30° by repeated light hammer blows or with a lever, following which there shall be no fracture or cracks in the circlip. The circlip is then further bent until fracture occurs. The fracture surface shall reveal a fine-grained structure.

7.3 *Deformation Test*

7.3.1 *Testing the conical deformation* — The circlip is placed between two parallel plates and loaded in accordance with Fig. 3. The distance $h - s$ measured under force F shall not exceed the maximum value stated as given in Table 3.

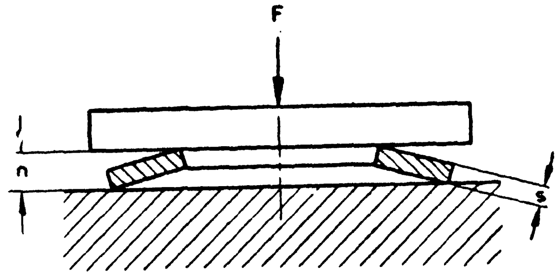


FIG. 3 TESTING CONICAL DEFORMATION

TABLE 3 TESTING THE CONICAL DEFORMATION

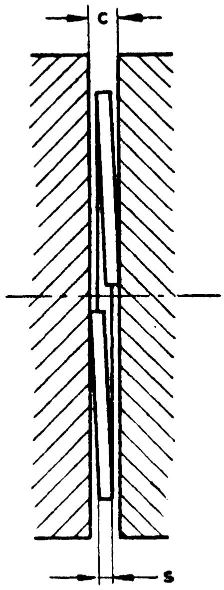
(*Clause* 7.3.1; and *Fig.* 3)

All dimensions in millimetres.

Nominal Diameter of Circlips		Force *F* in N ± 5%		*h − s* Max
Over	Up to	Normal Type	Heavy Type	
—	22	30	60	b × 0·03
22	38	40	80	
38	82	60	120	
82	150	80	160	b × 0·02
150	300	150	300	

7.3.2 *Testing the spiral flatness*

7.3.2.1 The circlip shall fall through two parallel planes with a clearance *c* as given in table below (read with Fig. 4):



Nominal Diameter of Circlips		c
Over	Up to	
—	100	1·5 × s
100	—	1·8 × s

FIG. 4 TESTING SPIRAL FLATNESS

7.4 *Testing the Function (Permanent Set and Grip Test)*

7.4.1 The circlip is passed five times over a cone with a diameter of 1·01 d_1 in accordance with Fig. 12 (*see* **A-4**) and then be fitted on to a shaft of minimum groove diameter d_2 where it shall remain under its own weight.

7.5 *Acceptance Testing*

7.5.1 Table 4 applies to features, while Table 5 applies for the acceptance quality level (AQL).

TABLE 4 FEATURES FOR ACCEPTANCE TESTS

Features
Circlips thickness, *s*
Circlips internal diameter, d_3
Conical deformation
Spiral flatness
Function (set and grip)

TABLE 5 ACCEPTABLE QUALITY LEVEL

Acceptable Quality Level, AQL*	
For Testing of Features	For Testing of Faulty Parts
1	1·5

*Refer IS : 2500 (Part 1)-1973 'Sampling inspection tables: Part 1 Inspection by attributes and by count of defects (*first revision*)'.

8. Preservation and Packing

8.1 A suitable anti-corrosive surface treatment shall be given to the circlips for protection during transit.

8.2 *Packing* — Unless otherwise specified, the circlips shall be packed in cartons of 100, 500 and 1000 or multiples thereof. Each carton shall contain circlips of one size only.

9. Marking

9.1 The label on the carton shall carry the designation, number of pieces and the manufacturer's name or trade-mark.

9.2 *Standard Mark* — Details available with Bureau of Indian Standards.

APPENDIX A

(*Clause* 1.2)

ADDITIONAL INFORMATION FOR LOAD BEARING CAPACITY, DETACHMENT SPEED, SHAPE OF GROOVE AND FITTING OF CIRCLIPS

A-1. Load-Bearing Capacity— A circlip connection requires separate calculations for the load bearing capacity of the groove F_N and for the load-bearing capacity of the circlip F_R. In each case the weaker part is that which applies. The load-bearing capacities (F_N, F_R, F_{Rg}) given in **3**, contain no safety, neither against yielding under static stress nor against fatigue fracture under fluctuating stress. There shall be at least twice the level of safety against fracture under static stress.

A-1.1 *Load-Bearing Capacity of Groove*, F_N — The load-bearing capacity of the groove F_N in **3**, applies for a yield point of the material in the region of the shaft groove of R_{eL} = 200 N/mm² as well as for the given nominal groove depths t and edge margins n.

The load-bearing capacity F'_N for deviating groove depths t' (resulting from deviating shaft diameters d_1 and/or deviating groove diameters d_2) and yield points R'_{eL} is directly proportional to the groove depth and the yield:

$$F'_N = F_N . \frac{t}{t} . \frac{R'_{eL}}{200}$$

A-1.2 *Load-Bearing Capacity of Circlip*, F_R — The load-bearing capacity of the circlip F_R in accordance with **3** applies to a sharp-edged abutment of the pressing machine part (*see* Fig. 5).

The values F_{Rg} apply to an abutment with an edge chamfering distance g (*see* Fig. 6). The two values F_R and F_{Rg} apply to circlip materials with a modulus of elasticity (E-modulus) of 210 000 N/mm². If circlips of a different material with a different E modulus E' are used, then, for conversion, the load-bearing capacity of the circlip is directly proportional to the modulus of elasticity:

$$F'_R = F_R . \frac{E'}{210\,000}, \text{ and}$$

$$F'_{Rg} = F_{Rg} . \frac{E'}{210\,000}$$

If the existing edge chamfering distance g' deviates from the values in **3**, then, for conversion, the load-bearing capacity of the circlip is indirectly proportional to the edge chamfering distance:

$$F'_{Rg} = F_{Rg} - \frac{g}{g'}$$

Note — If F'_{Rg} with small values of g' is greater than F_R, then F_R applies.

If the existing forces, because of too great an edge chamfering distance cannot be accommodated, then a sharp-edged abutment shall be created by means of a supporting ring (*see* Fig. 7).

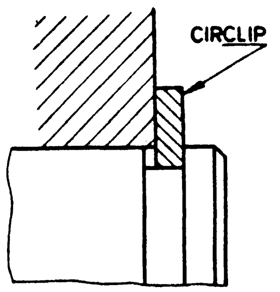


FIG. 5 SHARP EDGE ABUTMENT

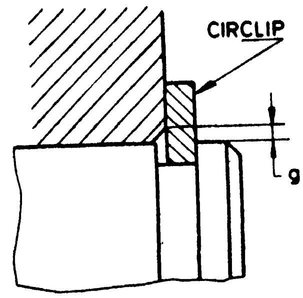


FIG. 6 ABUTMENT WITH EDGE CHAMFERING DISTANCE (CHAMFERING OR ROUNDING)

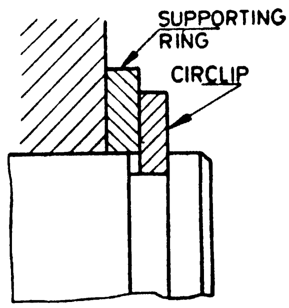


FIG. 7 SHARP EDGE ABUTMENT WITH SUPPORTING RING

A-2. Detachment Speed, N_{ds} — The application of circlips is limited by speeds at which pretension is relieved by centrifugal force and at which the circlip starts to lift from its seating in the groove base. In Table 1 and Table 2, detachment speed N_{ds} are given at which the circlips start to become detached from their seating in the groove (groove diameter = nominal diameter). Actual release of the circlip can be expected only after a further increase of speeds by 50%. The values apply to circlips made of spring steels as specified in **4.2.**

A-3. Shape of Groove

A-3.1 *Groove Diameter,* d_2 — The groove diameters d_2 specified in **3** are selected so that the circlips are seated in the groove with pretension.

Note — Smaller groove diameters are possible if pretension can be dispensed. The lower limit is:

$$d_2 \; Min = d_3 \; Max$$

A-3.2 *Groove Width, m* — As a rule, for the groove width specified in Tables 1 and 2, the tolerance zone H13 applies. With unilateral power transmission, the grooves can be widened and/ or chamfered towards the unloaded side. The groove width has no influence on the load-bearing capacity of the circlip connection. Intra-plant specified groove shapes and groove widths are therefore possible.

If the circlips is to be subjected to alternate power transmission on both groove edges, the groove width *m* shall as far as possible, for example also by reducing the tolerancê, be matched to the circlip thickness, *s* (for groove shapes, *see* Fig. 8 to 11).

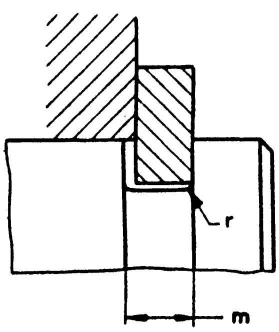


FIG. 8 GROOVE SHAPE

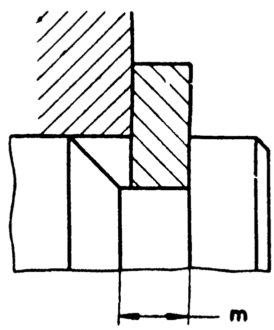


FIG. 9 GROOVE SHAPE

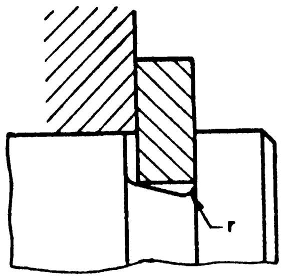


FIG 10. GROOVE SHAPE

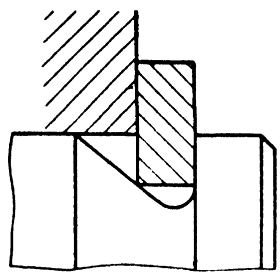


FIG. 11 GROOVE SHAPE

A-3.3 *Shape of Groove Base* — A square shape is the normal type of groove base (*see* Fig. 8). The radius *r* on the load side shall not exceed 0·1 *s*. Other successful shapes of groove are shown in Fig. 9 to 11. In the case of a sharp-edged square groove, the notch sensitivity of the material used produces a corresponding fatigue notch factor.

A-4. Fitting of Circlips

A-4.1 Pliers in accordance with IS : 7990-1976 shall preferably be used tor fitting the circlips.

A-4.1.1 When fitting, make absolutely sure that the circlips are not overspread, that is, are not opened further than is necessary for fitting over the shaft. If necessary, pliers with opening restriction (set screw) shall be used. The safest protection against overspreading is fitting with the aid of cones (*see* Fig. 12).

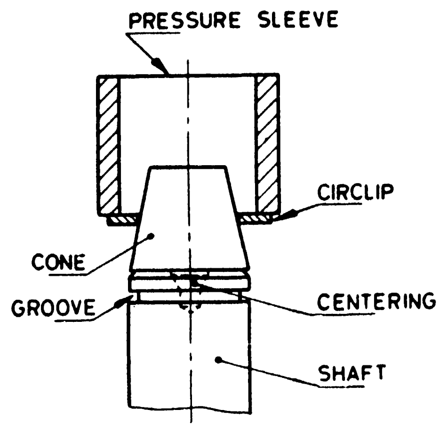


FIG. 12 FITTING WITH CONES

EXPLANATORY NOTE

This standard was issued in 1965, as a comprehensive standard based on draft DIN 471-1963 for dimensions. Subsequently in 1981 the DIN standard was revised completely incorporating testing and acceptance requirements, but sizes and range remained the same.

The committee responsible for formulation of this Indian standard decided to revise it to bring it in line with the relevant DIN standard.

Circlips made from carbon spring steel strips or bars serve as radial spring fasteners for positioning and retaining components in assembly. Normally, the circlips are axially assembled either over shafts or inside bores.

When the circlips are assembled, a portion of the circlip protrudes from the groove to form a shoulder to support the abutting part. The part to be retained may be a ground thrust washer having a full surface contact with the shoulder providing a sharp-cornered abutment; or a ball bearing with a radiused edge which will have contact with only a portion of the shoulder; or a gear wheel with a sharpened edge which will also have contact with only a portion of the shoulder. The large corner radius or chamfer will result in a different type of assembly from that of the sharp cornered abutment.

Thus the fastening system using circlips depends on three elements, namely the circlip, the groove and the retained part. In case of axial load transmission, the circlip serves as a means of transfering the load from the retained part to the groove wall. However, in cases of impact loading, the energy absorbing capacity of the circlip will be an important factor. The more energy absorbed, the less will be transferred to the grooved wall.

Earlier standard dealt with the dimensions and other requirements for all types of circlips. In the present revision, IS : 3075-1965 has been divided into three parts to bring it in line with latest DIN standards. Testing, acceptance criteria, packaging and Standard Mark clauses have also been included.

This standard is Part 1 which covers requirements of circlips to be assembled over shaft, generally based on DIN 471-1981 'Circlips (retaining rings) for shafts — normal type and heavy type'. In addition to this, the requirements for radially assembled type of circlips, commonly known as 'E' type circlips, used for smaller shafts have been covered in part 3 of this standard. Other two parts of the standard in this series are:

Part 2 : Specification for circlips for bores (based on DIN 472-1981); and

Part 3 : Specification for circlips, Type E for shafts (based on DIN 6799-1981).

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