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

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(First Reprint DECEMBER 2000)

IS : 3075 (Part 2) - 1986
(Reaffirmed 1996)

Machine Tools, Machine Tool Elements and Woodworking Machines Sectional Committee, EDC 11; Machine Tools Elements Subcommittee, EDC 11 : 1;
Ad hoc Panel for Circlips, EDC 11/AP-1 [Ref : Doc : EDC 11 (4398)]

Indian Standard

SPECIFICATION FOR CIRCLIPS

PART 2 FOR BORES

(First Revision)

1. Scope

1.1 Covers the requirement of circlips for bores of nominal diameter range 8 to 300 mm in normal type and 20 to 100 mm in heavy type.

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

2. Symbols

2.1 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 — bore diameter
d_2 — groove diameter
d_3 — external diameter of the circlip not under tension
d_4 — minimum 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 200 N/mm² (*see* **A-1.1**)
F_R — load-bearing capacity of circlip with sharp-edged abutment of the pressure 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 surface abutting against the circlip
h — distance between the plates when testing conical deformation
m — groove width
n — edge margin
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.

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

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

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

All dimensions in millimetres.

Bore 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}	Nom. Size of Pliers‖
	Size	Tolerance	Size	Tolerance	Max	≈	Min	Size	Tolerance	H13		Min		(kN)	(kN)		(kN)	
8	0·8	± 0·03	8·7		2·4	1·1	1	8·4	+ 0·09 0 (H11)	0·9	0·2	0·6	3	0·86	2·00	0·5	1·50	
9	0·8		9·8		2·5	1·3	1	9·4		0·9	0·2	0·6	3·7	0·96	2·00	0·5	1·50	
10	1		10·8		3·2	1·4	1·2	10·4		1·1	0·2	0·6	3·3	1·08	4·00	0·5	2·20	
11	1		11·8		3·3	1·5	1·2	11·4		1·1	0·2	0·6	4·1	1·17	4·00	0·5	2·30	
12	1		13	+ 0·36 − 0·10	3·4	1·7	1·5	12·5		1·1	0·25	0·8	4·9	1·60	4·00	0·5	2·30	
13	1		14·1		3·6	1·8	1·5	13·6	+ 0·11 0 (H11)	1·1	0·3	0·9	5·4	2·10	4·20	0·5	2·30	8
14	1		15·1		3·7	1·9	1·7	14·6		1·1	0·3	0·9	6·2	2·25	4·50	0·5	2·30	
15	1		16·2		3·7	2	1·7	15·7		1·1	0·35	1·1	7·2	2·80	5·00	0·5	2·30	
16	1		17·3		3.8	2	1·7	16·8		1·1	0·4	1·2	8	3·40	5·50	1	2·60	
17	1		18·3		3·9	2·1	1·7	17·8		1·1	0·4	1·2	8·8	3·60	6·00	1	2·50	
18	1		19·5		4·1	2·2	2	19		1·1	0·5	1·5	9·4	4·80	6·50	1	2·60	
19	1		20·5		4·1	2·2	2	20	+ 0·13 0 (H11)	1·1	0·5	1·5	10·4	5·10	6·80	1	2·50	
20	1		21·5	+ 0·42 − 0·13	4·2	2·3	2	21		1·1	0·5	1·5	11·2	5·40	7·20	1	2·50	
21	1		22·5		4·2	2·4	2	22		1·1	0·5	1·5	12·2	5·70	7·60	1	2·60	
22	1	± 0·04	23·5		4·2	2·5	2	23		1·1	0·5	1·5	13·2	5·90	8·00	1	2·70	
24	1·2		25·9		4·4	2·6	2	25·2		1·3	0·6	1·8	14·8	7·70	13·9	1	4·60	
25	1·2		26·9	+ 0·42 − 0·21	4·5	2·7	2	26·2	+ 0·21 0 (H12)	1·3	0·6	1·8	15·5	8·00	14·6	1	4·70	
26	1·2		27·9		4·7	2·8	2	27·2		1·3	0·6	1·8	16·1	8·40	13·85	1	4·60	
28	1·2		30·1		4·8	2·9	2	29·4		1·3	0·7	2·1	17·9	10·5	13·3	1	4·50	19
30	1·2		32·1		4·8	3	2	31·4		1·3	0·7	2·1	19·9	11·3	13·7	1	4·60	
31	1·2		33·4		5·2	3.2	2·5	32·7		1·3	0·85	2·6	20	14·1	13·8	1	4·70	
32	1·2		34·4		5.4	3·2	2·5	33·7		1·3	0·85	2·6	20·6	14·6	13·8	1	4·70	
34	1·5		36·5	+ 0·5 − 0·25	5·4	3·3	2·5	35·7		1·6	0·85	2·6	22·6	15·4	26·2	1·5	6·30	
35	1·5		37·8		5·4	3·4	2·5	37		1·6	1	3	23·6	18·8	26·9	1·5	6·40	
36	1·5		38·8		5·4	3·5	2·5	38	+ 0·25 0 (H12)	1·6	1	3	24·6	19·4	26·4	1·5	6·40	
37	1·5		39·8		5·5	3·6	2·5	39		1·6	1	3	25 4	19·8	27·1	1·5	6·50	
38	1·5		40·8		5·5	3·7	2·5	40		1·6	1	3	26·4	22·5	28·2	1·5	6·70	
40	1·75		43·5		5·8	3·9	2·5	42·5		1·85	1·25	3·8	27·8	27·0	44·6	2	8·30	
42	1·75	± 0·05	45·5	+ 0·9 − 0·39	5·9	4·1	2·5	44·5		1·85	1·25	3·8	29·6	28·4	44·7	2	8·40	
45	1·75		48·5		6·2	4·3	2·5	47·5		1·85	1·25	3·8	32	30·2	43·1	2	8·20	
47	1·75		50·5		6·4	4·4	2·5	49·5		1·85	1·25	3·8	33·5	31·4	43·5	2	8·30	
48	1·75		51·5		6·4	4·5	2·5	50·5		1·85	1·25	3·8	34·5	32·0	43·2	2	8·40	
50	2		54·2		6·5	4·6	2·5	53		2·15	1·5	4·5	36·3	40·5	60·8	2	12·1	
52	2		56·2		6·7	4·7	2·5	55		2·15	1·5	4·5	37·9	42·0	60·25	2	12·0	
55	2		59·2		6·8	5	2·5	58		2·15	1·5	4·5	40·7	44·4	60·3	2	12·5	
56	2		60·2		6·8	5·1	2·5	59		2·15	1·5	4·5	41·7	45·2	60·3	2	12·6	40
58	2		62·2		6·9	5·2	2·5	61		2·15	1·5	4·5	43·5	46·7	60·8	2	12·7	
60	2		64·2	+ 1·1 − 0·46	7·3	5·4	2·5	63		2·15	1·5	4·5	44.7	48·3	61·0	2	13·0	
62	2		66·2		7·3	5·5	2·5	65	+ 0·30 0 (H12)	2·15	1·5	4·5	46·7	49·8	60·9	2	13·0	
63	2	± 0·06	67·2		7·3	5·6	2·5	66		2·15	1·5	4·5	47·7	50·6	60·8	2	13·0	
65	2·5		69·2		7·6	5·8	3	68		2.65	1·5	4·5	49	51·8	121	2·5	20·8	
68	2·5		72·5		7·8	6·1	3	71		2·65	1·5	4·5	51·6	54·5	121·5	2·5	21·2	
70	2·5		74·5		7·8	6·2	3	73		2·65	1·5	4·5	53·6	56·2	119	2·5	21·0	
72	2·5		76·5		7·8	6·4	3	75		2·65	1·5	4·5	55·6	58·0	119·2	2·5	21·0	
75	2·5		79·5		7·8	6·6	3	78		2·65	1·5	4·5	58·6	60·0	118	2·5	21·0	

(*Continued*)

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

(First Revision)

(*Page* 6, *clause* 4.2) — Substitute the following table for the existing:

Nominal Diameter of Circlips		Hardness
Over	Up to and 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)*'.		

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

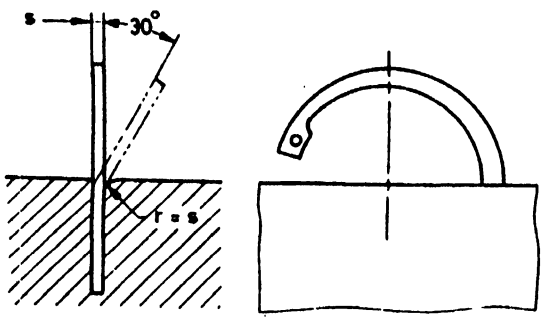
'7.2 Bend Test and Twist Test

'7.2.1 ***Bend test***

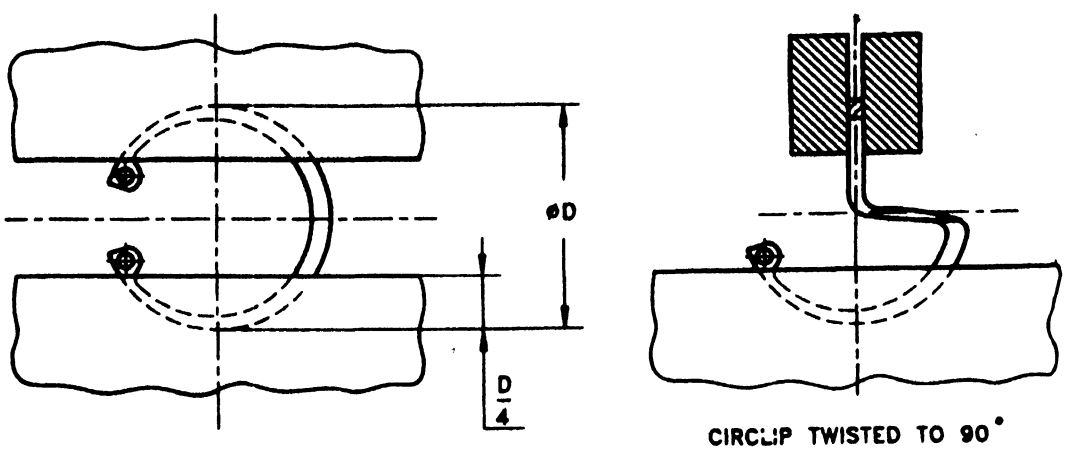
The circlip shall be clamped between two jaws, of which one has a radius equal to the thickness of the circlip as shown in Figure 2A. The circlip is bent through 30° by repeated light hammer blows or with a lever, following which there shall be no fracture or cracks in the circlip. The circlip is then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



2A



2B

FIG. 2 BEND TEST AND FRACTURE TEST

(*Page* 6, *Fig.* 2) — Delete.

(PE 02)

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

All dimensions in millimetres.

Bore Dia, d_1 Nom Size	Circlip							Groove					Design Data§					Nom Size of Pliers‖
	s		d_2		a	b*	d_5	d_3†		m‡	t	n	d_4	F_N	F_R	g	F_{Rg}	
	Size	Tolerance	Size	Tolerance	Max	≈	Min	Size	Tolerance	H13		Min		(kN)	(kN)		(kN)	
78	2·5	± 0·06	82·5	+ 1·3 − 0·54	8·5	6·8	3	81	+ 0·35 0 (H12)	2·85	1·5	4·5	60·1	62·3	122·5	2·5	21·8	
80	2·5		85·5		8·5	7	3	83·5		2·65	1·75	5·3	62·1	74·6	120·9	2·5	21·8	40
82	2·5		87·5		8·5	7	3	85·5		2·65	1·75	5·3	64·1	76·6	119	2·5	21·4	
85	3	± 0·07	90·5		8·6	7·2	3·5	88·5		3·15	1·75	5·3	66·9	79·5	201·4	3	31·2	
88	3		93·5		8·6	7·4	3·5	91·5		3·15	1·75	5·3	69·9	82·1	209·4	3	32·7	
90	3		95·5		8·6	7·6	3·5	93·5		3·15	1·75	5·3	71·9	84·0	199	3	31·4	
92	3		97·5		8·7	7·8	3·5	95·5		3·15	1·75	5·3	73·7	85·8	201	3	32·0	
95	3		100·5		8·8	8·1	3·5	98·5		3·15	1·75	5·3	76·5	88·6	195	3	31·4	
98	3		103·5		9	8·3	3·5	101·5		3·15	1·75	5·3	79	91·3	191	3	31·0	
100	3		105·5		9·2	8·4	3·5	103·5		3·15	1·75	5·3	80·6	93·1	188	3	30·8	
102	4	± 0·08	108		9·5	8·5	3·5	106	+ 0·54 0 (H13)	4·15	2	6	82	108·8	439	3	72·6	85
105	4		112		9·5	8·7	3·5	109		4·15	2	6	85	112	436	3	73·0	
108	4		115		9·5	8·9	3·5	112		4·15	2	6	88	115	419	3	71·0	
110	4		117		10·4	9	3·5	114		4·15	2	6	88·2	117	415	3	71·0	
112	4		119		10·5	9·1	3·5	116		4·15	2	6	90	119	418	3	72·0	
115	4		122		10·5	9·3	3·5	119		4·15	2	6	93	122	409	3	71·2	
120	4		127		11	9·7	3·5	124		4·15	2	6	96·9	127	396	3	70·0	
125	4		132		11	10	4	129		4·15	2	6	101·9	132	385	3	70·0	
130	4		137		11	10·2	4	134		4·15	2	6	106·9	138	374	3	69·0	
135	4		142		11·2	10·5	4	139		4·15	2	6	111·5	143	358	3	67·0	
140	4		147	+ 1·5 − 0·63	11·2	10·7	4	144		4·15	2	6	116·5	148	350	3	66·5	
145	4		152		11·4	10·9	4	149		4·15	2	6	121	153	336	3	65·0	
150	4		158		12	11·2	4	155	+ 0·63 0 (H13)	4·15	2·5	7·5	124·8	191	326	3	64·0	
155	4		164		12	11·4	4	160		4·15	2·5	7·5	129·8	206	324	3·5	55·0	
160	4		169		13	11·6	4	165		4·15	2·5	7·5	132·7	212	321	3·5	54·5	
165	4		174·5		13	11·8	4	170		4·15	2·5	7·5	137·7	219	319	3·5	54·0	
170	4		179·5		13·5	12·2	4	175		4·15	2·5	7·5	141·6	225	349	3·5	59·0	
175	4		184·5		13·5	12·7	4	180		4·15	2·5	7·5	146·6	232	351	3·5	59·0	
180	4		189·5		14·2	13·2	4	185		4·15	2·5	7·5	150·2	238	347	3·5	58·5	125
185	4		194·5		14·2	13·7	4	190		4·15	2·5	7·5	155·2	245	349	3·5	59·0	
190	4		199·5	+ 1·70 − 0·72	14·2	13·8	4	195	+ 0·72 0 (H13)	4·15	2·5	7·5	160·2	251	340	3·5	57·5	
195	4		204·5		14·2	13·8	4	200		4·15	2·5	7·5	165·2	258	330	3·5	55·5	
200	4		209·5		14·2	14	4	205		4·15	2·5	7·5	170·2	265	325	3·5	55·0	
210	5	± 0·09	222		14·2	14	4	216		5·15	3	9	180·2	333	601	4	89·5	
220	5		232		14·2	14	4	226		5·15	3	9	190·2	349	574	4	85·0	
230	5		242		14·2	14	4	236		5·15	3	9	200·2	365	549	4	81·0	
240	5		252		14·2	14	4	246		5·15	3	9	210·2	380	525	4	77·5	
250	5		262		14·2	14	4	256		5·15	3	9	220·2	396	504	4	75·0	
260	5		275		16·2	16	5	268	+ 0·81 0 (H13)	5·15	4	12	226	553	538	4	80·0	
270	5		285	+ 2·0 − 0·81	16·2	16	5	278		5·15	4	12	236	573	518	4	77·0	
280	5		295		16·2	16	5	288		5·15	4	12	246	593	499	4	74·0	
290	5		305		16·2	16	5	298		5·15	4	12	256	615	482	4	71·5	
300	5		315		16·2	16	5	308		5·15	4	12	266	636	466	4	69·0	

*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 'Specification for cold rolled steel strip for springs (*first revision*)', d_4 is calculated from $d_4 = d_1 - 2{\cdot}1\ a$.

‖Pliers conforming to IS : 7989-1976 'Specification for pliers for internal circlips'.

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

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

All dimensions in millimetres.

Bore 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}	Nom Size of Pliers‖
	Size	Tolerance	Size	Tolerance	Max	≈	Min	Size	Tolerance	H13		Min		(kN)	(kN)		(kN)	
20	1·5	± 0·05	21·5	+0·42 −0·21	4·5	2·4	2	21	+0·13 0 (H 11)	1·6	0·5	1·5	10·5	5·40	16·0	1	5·60	19
22	1·5		23·5		4·7	2·8	2	23		1·6	0·5	1·5	12·1	5·90	18·0	1	6·10	
24	1·5		25·9		4·9	3	2	25·2		1·6	0·6	1·8	13·7	7·70	21·7	1	7 ·2 0	
25	1·5		26·9		5	3·1	2	26·2	+0·21 0 (H 12)	1·6	0·6	1·8	14·5	8·00	22·8	1	7·30	
26	1·5		27·9		5·1	3·1	2	27·2		1·6	0·6	1·8	15·3	8·40	21·6	1	7·20	
28	1·5		30·1	+0·50 −0·25	5·3	3·2	2	29·4		1·6	0·7	2·1	16·9	10·5	20·8	1	7·00	
30	1·5		32·1		5·5	3·3	2	31·4		1·6	0·7	2·1	18·4	11·3	21·4	1	7·20	
32	1·5		34·4		5·7	3·4	2	33·7		1·6	0·85	2·6	20	14·6	21·4	1	7·30	
34	1·75		36·5		5·9	3·7	2·5	35·7		1·85	0·85	2·6	21·6	15·4	35·6	1·5	8·60	
35	1·75		37·8		6	3·8	2·5	37	+ 0·25 0 (H 12)	1·85	1	3	22·4	18·8	36·6	1·5	8·70	
37	1·75		39·8		6·2	3·9	2·5	39		1·85	1	3	24	19·8	36·8	1·5	8·80	
38	1·75		40·8		6·3	3·9	2·5	40		1·85	1	3	24·7	22·5	38·3	1·5	9·10	
40	2	± 0·06	43·5	+0·90 −0·39	6·5	3·9	2·5	42·5		2·15	1·25	3·8	26·3	27·0	58·4	2	10·9	40
42	2		45·5		6·7	4·1	2·5	44·5		2·15	1·25	3·8	27·9	28·4	58·5	2	11·0	
45	2		48·5		7	4·3	2·5	47·5		2·15	1·25	3·8	30·3	30·2	56·5	2	10·7	
47	2		50·5	+1·10 −0·46	7·2	4·4	2·5	49·5		2·15	1·25	3·8	31·9	31·4	57·0	2	10·8	
50	2·5		54·2		7·5	4·6	2·5	53		2·65	1·5	4·5	34·2	40·5	95·5	2	19·0	
52	2·5		56·2		7·7	4·7	2·5	55		2·65	1·5	4·5	35·8	42·0	94·6	2	18·8	
55	2·5		59·2		8	5	2·5	58		2·65	1·5	4·5	38·2	44·4	94·7	2	19·6	
60	3	± 0·07	64·2		8·5	5·4	2·5	63	+0·30 0 (H 12)	3·15	1·5	4·5	42·1	48·3	137	2	29·2	
62	3		66·2		8·6	5·5	2·5	65		3·15	1·5	4·5	43·9	49·8	137	2	29·2	
65	3		69·2		8·7	5·8	3	68		3·15	1·5	4·5	46·7	51·8	174	2·5	30·0	
68	3		72·5		8·8	6·1	3	71		3·15	1·5	4·5	49·5	54·5	174·5	2·5	30·6	
70	3		74·5		9	6·2	3	73		3·15	1·5	4·5	51·1	56·2	171	2·5	30·3	
72	3		76·5		9·2	6·4	3	75		3·15	1·5	4·5	52·7	58·0	172	2·5	30·3	
75	3		79·5		9·3	6·6	3	78		3·15	1·5	4·5	55·5	60·0	170	2·5	30·3	
80	4	± 0·08	85·5	+1·30 −0·54	9·5	7	3	83·5	+ 0·35 0 (H 12)	4·15	1·75	5·3	60	74·6	308	2·5	56·0	85
85	4		90·5		9·7	7·2	3·5	88·5		4·15	1·75	5·3	64·6	79 5	358	3	55·0	
90	4		95·5		10	7·6	3·5	93·5		4·15	1·75	5·3	69	84·0	354	3	56·0	
95	4		100·5		10·3	8·1	3·5	98·5		4·15	1·75	5·3	73·4	88·6	347	3	56·0	
100	4		105·5		10·5	8·4	3·5	103·5		4·15	1·75	5·3	78	93·1	335	3	55·0	

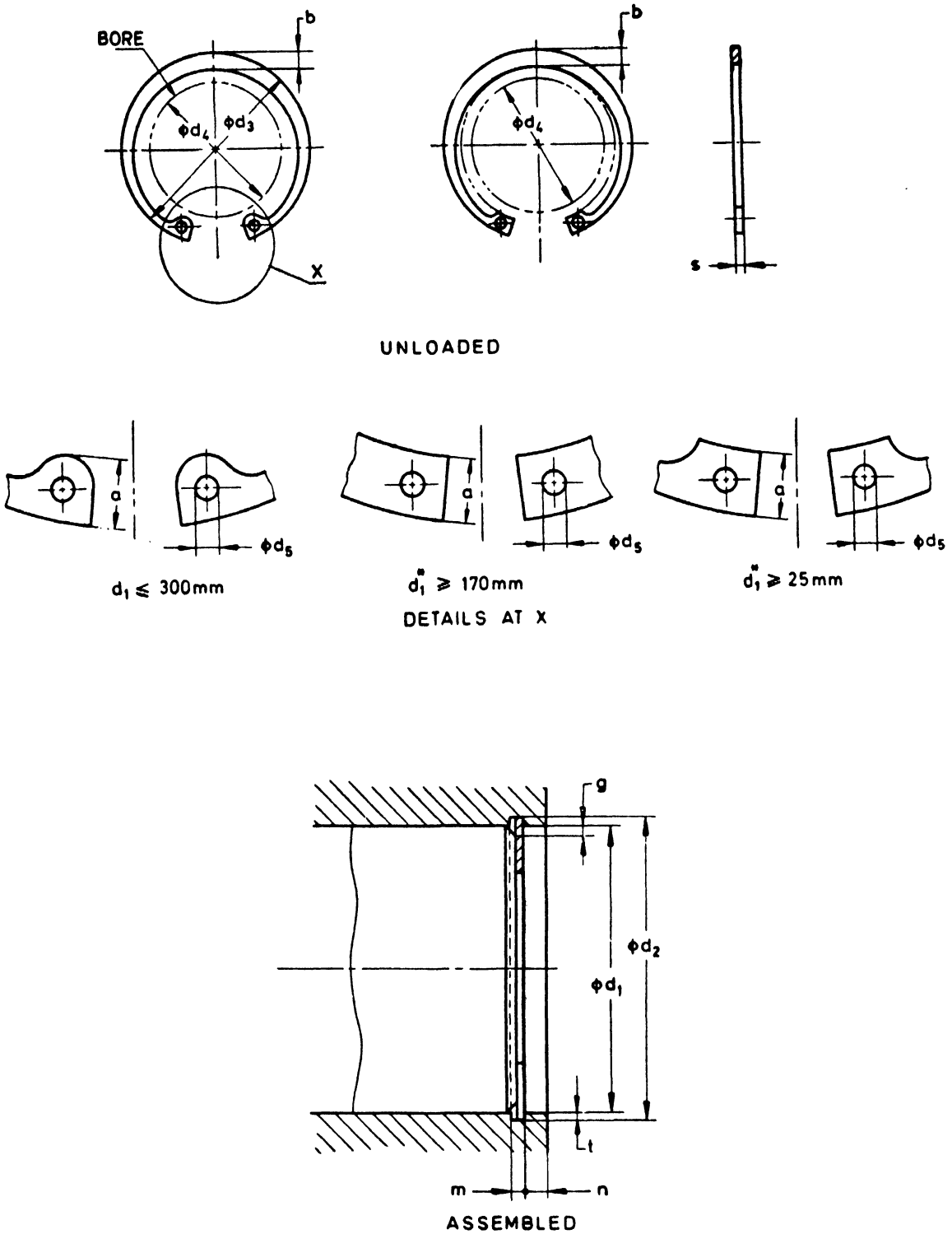
*Dimension b shall not exceed dimension a *Max*.

†*See* **A-3.1.**

‡*See* **A-3.2.**

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

‖Pliers conforming to IS : 7989-1976.



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 BORES

4. Material and Hardness

4.1 The circlips shall be manufactured from spring steel of Grade 70C6 or 75C6 as per IS : 2507-975.

4.2 Hardness of the 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 530 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 in accordance with IS : 4258-1982 'Hardness conversion tables for metallic materials (*first revision*)'.

5. Designation

5.1 A circlip for bore 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 2)

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

Circlip 40 × 2 H IS : 3075 (Part 2)

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 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 'Pnosphate treatment of iron and steel for protection against corrosion '. These coated circlips shall be subjected to appropriate treatment to avoid hydrogen embrittlement.

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

7. Tests

7.1 *Testing the Material*

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

7.1.2 Rockwell hardness test in accordance with IS : 1586-1968 'Methods of Rockwell hardness test (B and C scales) for steel (*first revision*)'. In case of doubt, the Vickers hardness test applies. 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 ductility shall be carried out in accordance with Fig. 2.

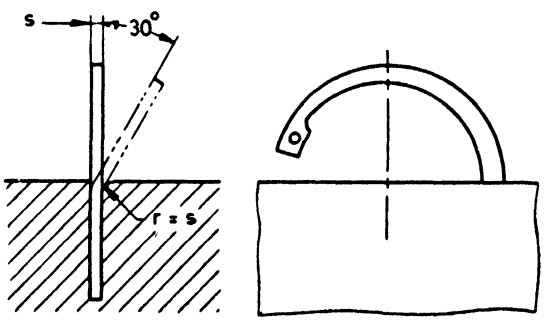


FIG. 2 BEND TEST AND FRACTURE TEST

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 fractures 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 as given in Table 3.

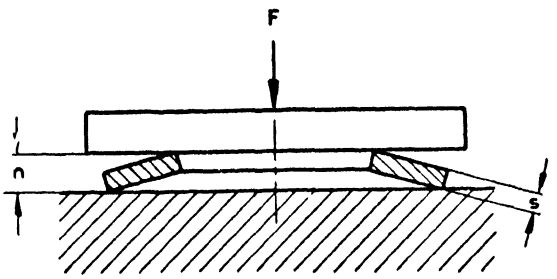


FIG. 3 TESTING CONICAL DEFORMATION

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	Upto	Normal Type	Heavy Type	
—	22	30	60	$b \times 0{\cdot}03$
22	38	40	80	
38	82	60	120	
82	150	80	160	$b \times 0{\cdot}02$
150	300	150	300	

7.3.2 *Testing the spiral flatness* — The circlip shall fall through two parallel planes with a clearance of c as given in table below read with Fig. 4.

Nominal Diameter of Circlips		c
Over	Up to	
—	100	$1{\cdot}5 \times s$
100	—	$1{\cdot}8 \times s$

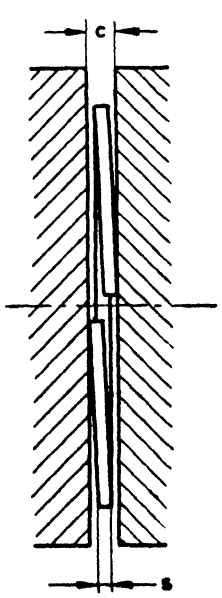


FIG. 4 TESTING THE SPIRAL FLATNESS

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

The circlip shall be inserted five times into a conical bore with a diameter of 0·99 d_1, in accordance with Fig. 12 (*see* A-3), and then be fitted into a bore with maximum groove diameter d_2 where it shall be held under its own height.

7.5 *Acceptance Testing*

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

TABLE 4 FEATURES FOR ACCEPTANCE TEST

Features
Circlip thickness, s
Circlip 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 to 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 Unless otherwise specified the circlips shall be packed in cartons of 100, 500, and 1 000 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 of the manufacturer's name or trade-mark.

9.2 *Certification Marking* — Details available with the Bureau of Indian Standards.

APPENDIX A

(*Clause* 1.2)

ADDITIONAL INFORMATION FOR LOAD-BEARING CAPACITY, SHAPE OF GROOVE AND FITTING OF CIRCLIP

A-1. Load-BearingCapacity — A circlip connectionr equires 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 load nor against fatigue fracture under fluctuating load. There shall be at least twice the level of safety against fracture under static load.

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 bore 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 bore 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 point:

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

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).

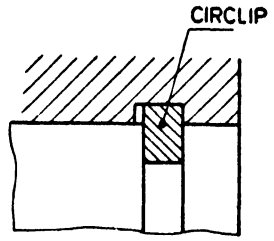


FIG. 5 SHARP-EDGED ABUTMENT

The values F_{Rg} apply to an abutment with an edge chamfering distance g (*see* Fig. 6).

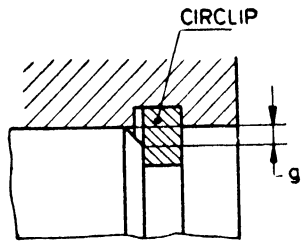


FIG. 6 ABUTMENT WITH EDGE CHAMFERING DISTANCE (CHAMFERING OR ROUNDING)

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.

$$F'_R = F_R \cdot \frac{E'}{210\,000}$$

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

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:

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

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 and edge chamfering distance, cannot be accommodated, then a sharp-edged abutment shall be created by means of a supporting ring (*see* Fig. 7).

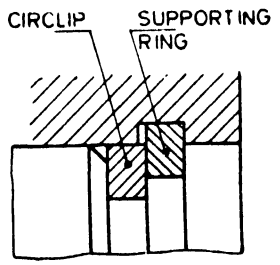


FIG. 7 SHARP-EDGED ABUTMENT WITH SUPPORTING RING

A-2. Shape of Groove

A-2.1 *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 — Larger groove diameters are possible if pretension can be dispensed with the upper limit is:

$$d_2\ Max = d_3\ Min.$$

A-2.2 *Groove Width*, m — As a rule, for the groove widths specified in Tables 1 and 2, the tolerance zone H13 applies. With unilateral power transmission, and 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. Groove shapes and groove widths specified in-house are therefore possible. If the circlip 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 tolerance, be matched to the circlip thickness *s* (for groove shape, *see* Fig. 8 to 11):

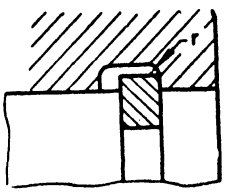


FIG. 8 Groove Shape

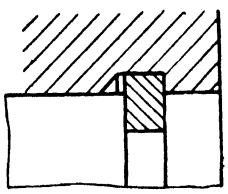


FIG. 9 Groove Shape

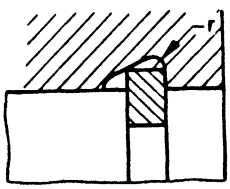


FIG. 10 Groove Shape

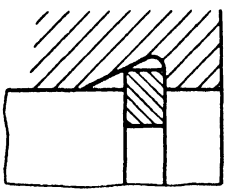


FIG. 11 Groove Shape

A-2.3 *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-3. Fitting the Circlip

A-3.1 Pliers in accordance with IS : 7989-1976 shall preferably be used for fitting the circlips.

A-3.1.1 When fitting, make absolutely sure that the circlips are not overstrained, that is, arenot squeezed further together than is necessary for insertion into the bore. If necessary, pliers with closing restriction (set screw) shall be used. The safest protection against overstretching is fitting with the aid of cones (*see* Fig. 12).

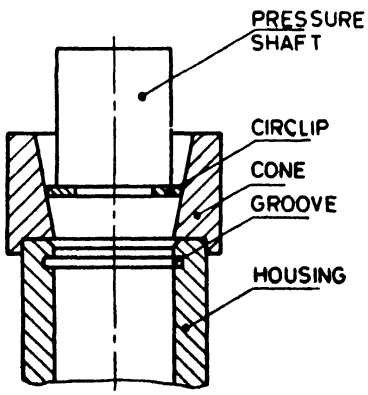


FIG. 12 FITTING WITH CONES

EXPLANATORY NOTE

This standard was issued in 1965 as part of comprehensive standard which was based on Draft DIN 472-1963 for dimensions. Subsequently, DIN standard was revised completely with the inclusion of testing and acceptance requirements. However, the sizes and range remain the same as that of earlier DIN version.

The committee, responsible for formulation of this standard, decided to revise the same 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 ring 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 chamfered 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 transferring 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 groove wall.

IS : 3075-1965 'Dimensions of circlips' 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 relevant DIN standards. Testing, acceptance ciriteria, packaging and Certification Marking clauses have also been included.

This Part 2 of the standard, which covers requirements of circlips to be assembled inside bores, is generally based on DIN 472-1981 'Circlips (retaining rings) for bores—normal type and heavy type'.

The other two parts of the standard in this series are:

Part 1 Specification for circlips for shafts (based on DIN 471-1981); and

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

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