Withworth Threads - Taps and Drill Sizes

Taps and drill sizes used for Whitworth - ISO 7 and ISO 228 threads

British Standard Whitworth (BSW) is an imperial-unit-based screw thread used for ISO 7-1 and ISO 228 threads (formerly BS-2779).

Size Taps *(inches)*	TPI	Drill Size *(inches)*		Size Taps *(inches)*	TPI	Drill Size *(inches)*
1/8	28	5/16		2	11	2 3/16
1/4	19	7/16		2 1/4	11	2 13/32
3/8	19	9/16		2 1/2	11	2 25/32
1/2	14	23/32		2 3/4	11	3 1/32
5/8	14	25/32		3	11	3 9/32
3/4	14	29/32		3 1/4	11	3 1/2
7/8	14	1 1/16		3 1/2	11	3 3/4
1	11	1 5/32		3 3/4	11	4
1 1/4	11	1 1/2		4	11	4 1/4
1 1/2	11	1 23/32		2	11	2 3/16
1 3/4	11	1 31/32		2 1/4	11	2 13/32

ISO 28741 - Spark Plugs Metric Threads

Metric threads spark plugs according ISO 28741

ISO 28741 Road vehicles — Spark-plugs and their cylinder head housings

Size	Major Diameter *(mm)*	Minor Diameter[1)] (mm) Tolerance class 6H.	Pitch *(mm)*	Tap Drill *(mm)*	Depth *(mm)*
M10 x 1.0	10.0	9.153 - 8.917	1.00	9.20	65
M12 x 1.25	12.0	10.912 - 10.647	1.25	10.9	72
M14 x 1.25	14.0	12.912 - 12.647	1.25	12.90	72
M18 x 1.5	18.0	16.676 - 16.376	1.50	16.75	68

ISO 724 - Metric Threads

ISO 724 specifies basic dimensions of metric threads in accordance with ISO 261. Dimensions refer to the basic profile in accordance with ISO 68.

There are three kinds of ISO metric threads:

- coarse
- fine
- extra fine

The thread angle is 60°. The thread depth is 0.614 x pitch.

Metric Threads - Coarse Thread Pitches

Size - Nominal Diameter *(mm)*	**Pitch[1)]** *(mm)*	**Clearance Drill** *(mm)*	**Tap Drill** *(mm)*	**Tensile Stress Area** *(mm)*
M 1.6	0.35	1.8	1.25	
M 2	0.40	2.4	1.60	
M 2.5	0.45	2.90	2.00	
M 3	0.50	3.40	2.50	
M 3.5	0.60	3.90	2.90	
M 4	0.70	4.50	3.30	8.78
M 5	0.80	5.50	4.20	14.2
M 6	1.00	6.60	5.00	20.1
M 8	1.25	9.00	6.80	36.6
M 10	1.50	12.00	8.50	58.0
M 12	1.75	14.00	10.20	84.3
M 14	2.00	16.00	12.00	
M 16	2.00	18.00	14.00	157
M 20	2.50	22.00	17.50	245
M 22	2.50	25.00	19.50	
M 24	3.00	27.00	21.00	353
M 27	3.00	30.00	24.00	
M 30	3.50	33.00	26.50	561
M 36	4.00	40.00	32.00	817
M 42	4.50	46.00	37.50	1120
M 48	5.00	53.00	43.00	1470
M 56	5.50	62.00	50.50	2030
M 64	6.00	70.00	58.00	2680
M 68	6.00	74.00	62.00	

[1)] For metric threads pitch is the distance between threads.

- *1 mm = 0.039 inches*
- Metric Bolts - Proof Loads

Metric Threads - Fine Thread Pitches

It is common to designate metric fine threads with the capital M plus an indication to their nominal outer diameter and their pitch:

M size x pitch Example: M 10 x 1.5

Size - Nominal Diameter *(mm)*	Pitch[1)] *(mm)*	Tap Drill *(mm)*	Tensile Stress Area *(mm)*
M 1.0 x 0.2	0.20	0.80	
M 1.1 x 0.2	0.20	0.90	
M 1.2 x 0.2	0.20	1.00	
M 1.4 x 0.2	0.20	1.20	
M 1.6 x 0.2	0.20	1.40	
M 1.8 x 0.2	0.20	1.60	
M 2 x 0.25	0.25	1.75	
M 2.2 x 0.25	0.25	1.95	
M 2.5 x 0.35	0.35	2.10	
M 3 x 0.35	0.35	2.60	
M 3.5 x 0.35	0.35	3.10	
M 4 x 0.5	0.50	3.50	
M 4.5 x 0.5	0.50	4.00	
M 5 x 0.5	0.50	4.50	
M 5.5 x 0.5	0.50	5.00	
M 6 x 0.75	0.75	5.20	20.1
M 7 x 0.75	0.75	6.20	
M 8 x 0.75	0.75	7.20	
M 8 x 1.0	1.00	7.00	39.2
M 9 x 0.75	0.75	8.20	
M 9 x 1	1.00	8.00	
M 10 x 0.75	0.75	9.20	
M 10 x 1	1.00	9.00	64.5
M 10 x 1.25	1.25	8.80	61.2
M 11 x 0.75	0.75	10.20	
M 11 x 1	1.00	10.00	
M 12 x 1	1.00	11.00	
M 12 x 1.25	1.25	10.80	92.1
M 12 x 1.5	1.50	10.50	88.1
M 14 x 1.0	1.00	13.00	
M 14 x 1.25	1.25	12.80	
M 14 x 1.5	1.50	12.50	
M 15 x 1	1.00	14.00	
M 15 x 1.5	1.50	13.50	
M 16 x 1	1.00	15.00	178
M 16 x 1.5	1.50	14.50	167

UNC and UNF - Unified Inch Screw Threads

ANSI/ASME B1.1 Unified National Thread - UNC Coarse and Fine series

- UNC – Unified National Coarse Thread - comparable with the ISO metric thread
- UNF – Unified National Fine Thread

- Female and Male UNC/UNF threads are both parallel
- The UNC/UNF flank angle is 60°

Unified threads comes in three different classes:

1. for applications where a liberal tolerance is required to permit easy assembly even with slightly nicked threads
2. most commonly used class for general applications
3. for applications where closeness of fit and/or accuracy of thread elements are important

UNC - Unified Coarse Threads

Major Diameter *(in)*	TPI	Major Diameter *(in)*	Major Diameter *(mm)*	Tap Drill Size *(mm)*	Pitch *(mm)*
#1 - 64	64	0.073	1.854	1.50	0.397
#2 - 56	56	0.086	2.184	1.80	0.453
#3 - 48	48	0.099	2.515	2.10	0.529
#4 - 40	40	0.112	2.845	2.35	0.635
#5 - 40	40	0.125	3.175	2.65	0.635
#6 - 32	32	0.138	3.505	2.85	0.794
#8 - 32	32	0.164	4.166	3.50	0.794
#10 - 24	24	0.190	4.826	4.00	1.058
#12 - 24	24	0.216	5.486	4.65	1.058
1/4" - 20	20	0.250	6.350	5.35	1.270
5/16" - 18	18	0.313	7.938	6.80	1.411
3/8" - 16	16	0.375	9.525	8.25	1.587
7/16" - 14	14	0.438	11.112	9.65	1.814
1/2" - 13	13	0.500	12.700	11.15	1.954
9/16" - 12	12	0.563	14.288	12.60	2.117
5/8" - 11	11	0.625	15.875	14.05	2.309
3/4" - 10	10	0.750	19.050	17.00	2.540
7/8" - 9	9	0.875	22.225	20.00	2.822
1" - 8	8	1.000	25.400	22.85	3.175
1 1/8" - 7	7	1.125	28.575	25.65	3.628
1 1/4" - 7	7	1.250	31.750	28.85	3.628
1 3/8" - 6	6	1.375	34.925	31.55	4.233
1 1/2" - 6	6	1.500	38.100	34.70	4.233
1 3/4" - 5	5	1.750	44.450	40.40	5.080
2" - 4 1/2	4 1/2	2.000	50.800	46.30	5.644
2 1/4" - 4 1/2	4 1/2	2.250	57.150	52.65	5.644
2 1/2" - 4	4	2.500	63.500	58.50	6.350
2 3/4" - 4	4	2.750	69.850	64.75	6.350

Major Diameter *(in)*	TPI	Major Diameter *(in)*	Major Diameter *(mm)*	Tap Drill Size *(mm)*	Pitch *(mm)*
3" - 4	4	3.000	76.200	71.10	6.350
3 1/4" - 4	4	3.250	82.550	77.45	6.350
3 1/2" - 4	4	3.500	88.900	83.80	6.350
3 3/4" - 4	4	3.750	95.250	90.15	6.350
4" - 4	4	4.000	101.600	96.50	6.350

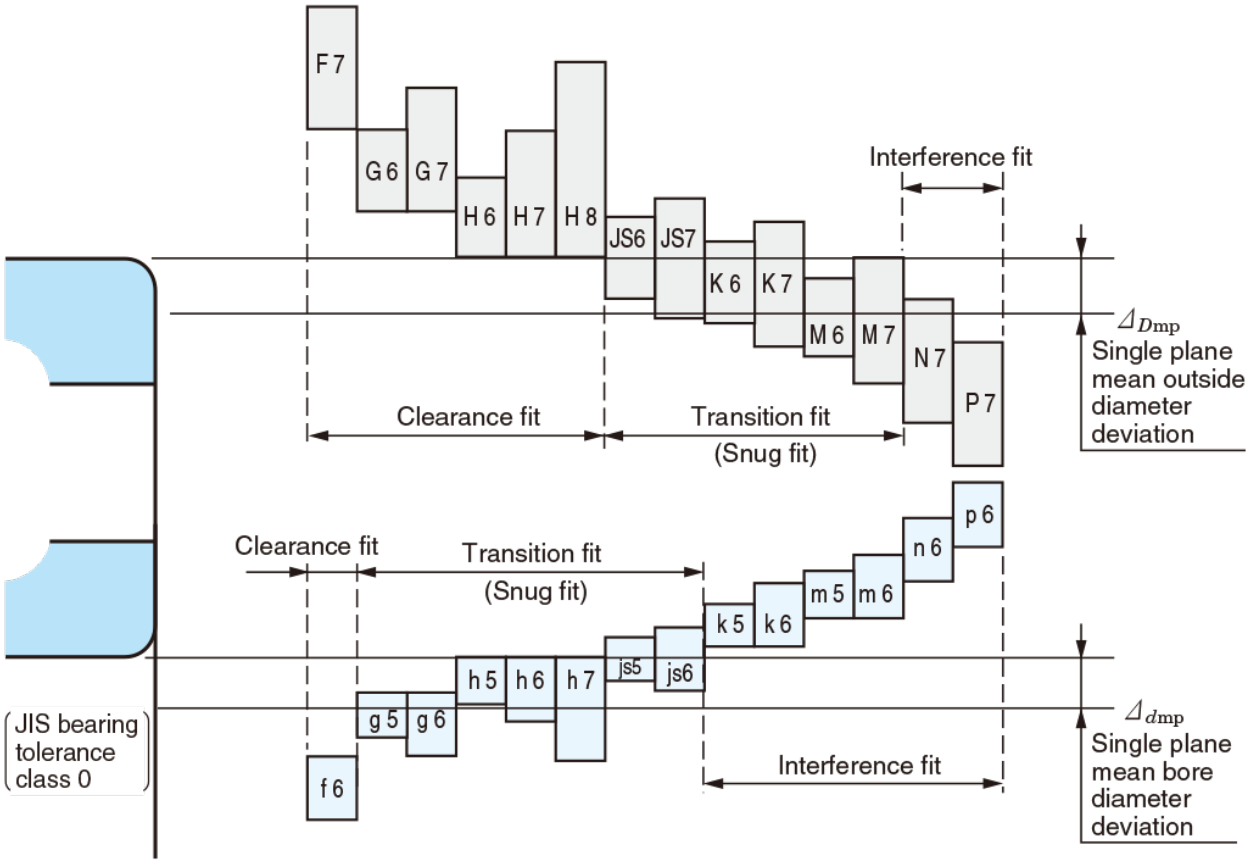
Example - Typical designation of an UNC thread

- 1/4” x 20 UNC
- 1/2” x 13 UNC

UNF - Unified National Fine Threads

Major Diameter *(in)*	TPI	Major Diameter *(in)*	Major Diameter *(mm)*	Tap Drill Size *(mm)*	Pitch *(mm)*
#0 - 80	80	0.060	1.524	1.25	0.317
#1 - 72	72	0.073	1.854	1.55	0.353
#2 - 64	64	0.086	2.184	1.90	0.397
#3 - 56	56	0.099	2.515	2.15	0.453
#4 - 48	48	0.112	2.845	2.40	0.529
#5 - 44	44	0.125	3.175	2.70	0.577
#6 - 40	40	0.138	3.505	2.95	0.635
#8 - 36	36	0.164	4.166	3.50	0.705
#10 - 32	32	0.190	4.826	4.10	0.794
#12 - 28	28	0.216	5.486	4.70	0.907
1/4" - 28	28	0.250	6.350	5.50	0.907
5/16" - 24	24	0.313	7.938	6.90	1.058
3/8" - 24	24	0.375	9.525	8.50	1.058
7/16" - 20	20	0.438	11.112	9.90	1.270
1/2" - 20	20	0.500	12.700	11.50	1.270
9/16" - 18	18	0.563	14.288	12.90	1.411
5/8" - 18	18	0.625	15.875	14.50	1.411
3/4" - 16	16	0.750	19.050	17.50	1.587
7/8" - 14	14	0.875	22.225	20.40	1.814
1" - 12	12	1.000	25.400	23.25	2.117
1 1/8" - 12	12	1.125	28.575	26.50	2.117
1 1/4" - 12	12	1.250	31.750	29.50	2.117
1 3/8" - 12	12	1.375	34.925	32.75	2.117
1 1/2" - 12	12	1.500	38.100	36.00	2.117

Example - Typical designation of an UNF thread 1/4” x 28 UNF, 1/2” x 20 UNF



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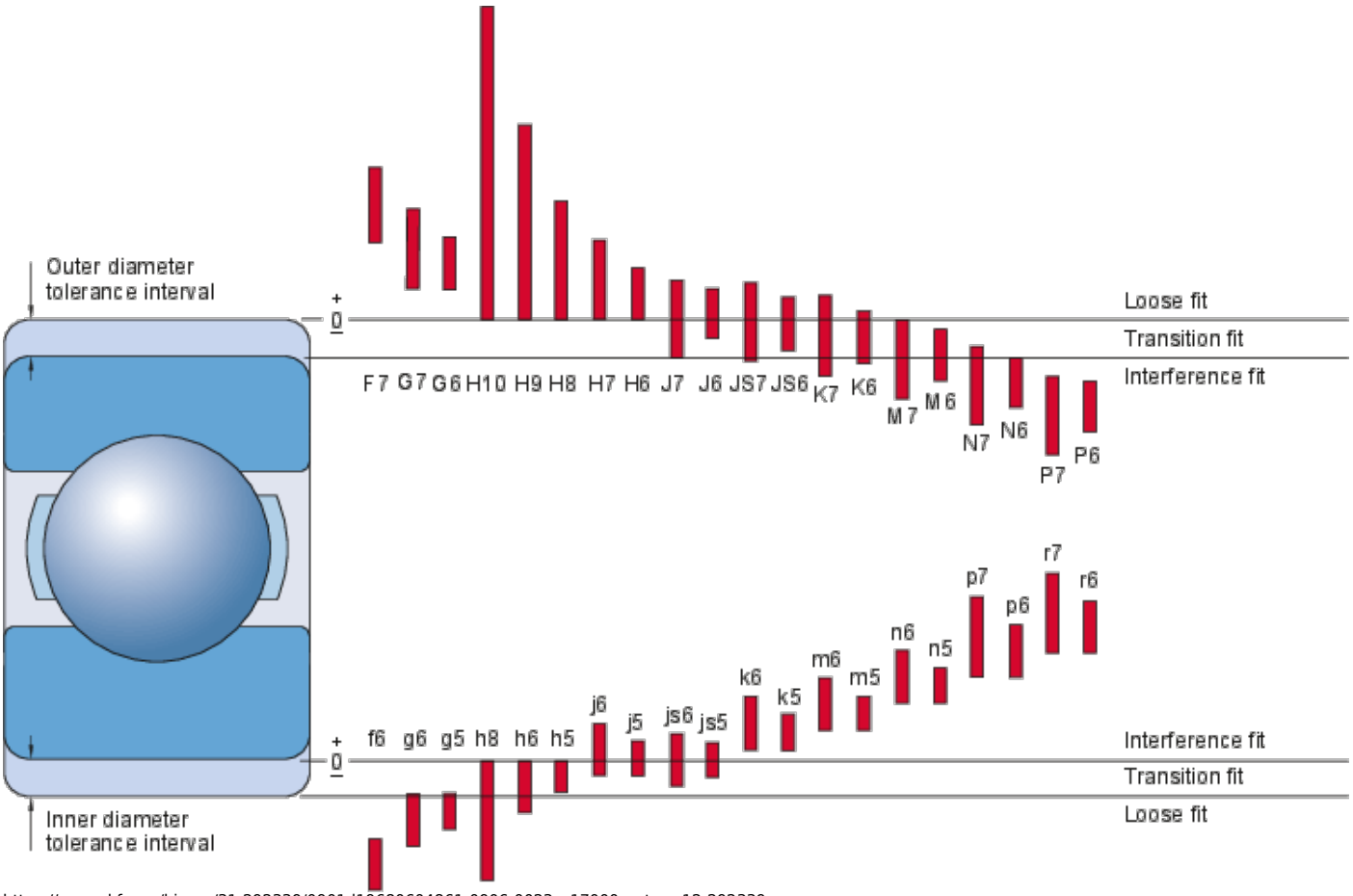

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Bicycle Chain **Width**

Internal

Chains come in 3⁄32 in (2.4 mm), 1⁄8 in (3.2 mm), 5⁄32 in (4.0 mm), or 3⁄16 in (4.8 mm) roller widths, the internal width between the inner plates.

1⁄8 in (3.2 mm) chains are typically used on bikes with a single rear sprocket: those with coaster brakes, hub gears, fixed gears such as track bicycles, or BMX bikes.

3⁄32 in (2.4 mm) wide rollers are generally used on bikes with derailleurs such as racing, touring, and mountain bikes. Fixed sprockets and freewheels are also available in 3⁄32 in (2.4 mm) widths so fixed-gear and single-speed bikes can be set up to use the narrower and lighter 3⁄32 in chain.

5⁄32 in (4.0 mm) wide rollers are used on freight bicycles and tricycles.

External

With derailleur equipped bicycles, the external width of the chain (measured at the connecting rivet) also matters, because chains must not be too wide for the cogset or they will rub on the next larger sprocket, or too narrow that they might fall between two sprockets. Chains can also be identified by the number of rear sprockets they can support, anywhere from 3 to 12, and the list below enables measuring a chain of unknown origin to determine its suitability.

•5 speed – 8mm ?

•6 speed – 7.8 mm (9⁄32 in) (Shimano HG), 7.1 mm (9⁄32 in) (SRAM, Shimano IG)
•7 speed – 7.3 mm (9⁄32 in) (Shimano HG), 7.1 mm (9⁄32 in) (SRAM, Shimano IG)
•8 speed – 7.1 mm (9⁄32 in) (Shimano HG), 7.1 mm (9⁄32 in) (SRAM, Shimano IG)

•9 speed – 6.5 to 6.8 mm

•10 speed – 6.0 to 7.0 mm (1⁄4 to 9⁄32 in) (Shimano, Campagnolo)
•10 speed (Narrow) – 5.88 mm (7⁄32 in) (Campagnolo, KMC)
•10 speed (Narrow, Direction) – 5.88 mm (7⁄32 in) (Shimano CN-5700, CN-6700, CN-7900)

•11 speed – 5.5 to 5.62 mm (7⁄32 in) (Campagnolo, KMC, Shimano CN-9000)

•12 speed – 5.25 to 5.3 mm (13⁄64 in) (SRAM and Shimano)

Shimano uses the same chain types on 6, 7,and 8 speed designs.

Wrench Conversion Chart

Standard SAE US ***(inches)***	**Metric Size** ***(mm)***		**Standard SAE US** ***(inches)***	**Metric Size** ***(mm)***
1/8	3.18		29/32	23.02
5/32	3.97		15/16	23.81
	4			24
3/16	4.76		31/32	24.61
	5			25
13/64	5.16		1	25.40
7/32	5.56			26
15/64	6.05		1 1/16	26.99
	6			27
1/4	6.35			28
17/64	6.75		1 1/8	28.58
	7			29
9/32	7.14			30
5/16	7.94		1 3/16	30.16
	8			31
11/32	8.73		1 1/4	31.75
	9			32
3/8	9.53			33
	10		1 5/16	33.34
	11			34
7/16	11.11		1 3/8	34.93
15/32	11.91			35
	12			36
1/2	12.7		1 7/16	36.51
	13			38
17/32	13.49		1 1/2	38.10
	14			39
9/16	14.29		1 9/16	39.69
	15			40
19/32	15.08			41
5/8	15.88		1 5/8	41.28
	16		1 11/16	42.86
21/32	16.67		1 3/4	44.45
	17			46
11/16	17.46		1 13/16	46.04
	18		1 7/8	47.63
	19		1 15/16	49.21
3/4	19.05			50
25/32	19.84		2	50.80
	20			51
13/16	20.64		2 1/8	53.96
	21			54
	22		2 1/4	57.15
7/8	22.23		2 3/8	60.33
	23		2 1/2	63.5

Fractional Inches to Decimal Inches to Millimetres

Inches		Metric
Fractional	Decimal	mm
.	0.0039	0.1
.	0.0079	0.2
.	0.0118	0.3
1/64	0.0156	0.3969
.	0.0157	0.4
.	0.0197	0.5
.	0.0236	0.6
.	0.0276	0.7
1/32	0.0313	0.7938
.	0.0315	0.8
.	0.0354	0.9
.	0.0394	1
.	0.0433	1.1
3/64	0.0469	1.1906
.	0.0472	1.2
.	0.0512	1.3
.	0.0551	1.4
.	0.0591	1.5
1/16	0.0625	1.5875
.	0.063	1.6
.	0.0669	1.7
.	0.0709	1.8
.	0.0748	1.9
5/64	0.0781	1.9844
.	0.0787	2
.	0.0827	2.1
.	0.0866	2.2
.	0.0906	2.3
3/32	0.0938	2.3813
.	0.0945	2.4
.	0.0984	2.5
7/64	0.1094	2.7781
.	0.1181	3
1/8	0.125	3.175
.	0.1378	3.5
9/64	0.1406	3.5719
5/32	0.1563	3.9688
.	0.1575	4
11/64	0.1719	4.3656
.	0.1772	4.5
3/16	0.1875	4.7625
.	0.1969	5
13/64	0.2031	5.1594
.	0.2165	5.5
7/32	0.2188	5.5563
15/64	0.2344	5.9531
.	0.2362	6
1 / 4	0.25	6.35
.	0.2559	6.5
17/64	0.2656	6.7469
.	0.2756	7
9/32	0.2813	7.1438
.	0.2953	7.5
19/64	0.2969	7.5406
5/16	0.3125	7.9375
.	0.315	8
21/64	0.3281	8.3344
.	0.3346	8.5
11/32	0.3438	8.7313
.	0.3543	9
23/64	0.3594	9.1281
.	0.374	9.5

Inches		Metric
Fractional	Decimal	mm
3 / 8	0.375	9.525
25/64	0.3906	9.9219
.	0.3937	10
13/32	0.4063	10.3188
.	0.4134	10.5
27/64	0.4219	10.7156
.	0.4331	11
7/16	0.4375	11.1125
.	0.4528	11.5
29/64	0.4531	11.5094
15/32	0.4688	11.9063
.	0.4724	12
31/64	0.4844	12.3031
.	0.4921	12.5
1 / 2	0.5	12.7
.	0.5118	13
33/64	0.5156	13.0969
17/32	0.5313	13.4938
.	0.5315	13.5
35/64	0.5469	13.8906
.	0.5512	14
9/16	0.5625	14.2875
.	0.5709	14.5
37/64	0.5781	14.6844
.	0.5906	15
19/32	0.5938	15.0813
39/64	0.6094	15.4781
.	0.6102	15.5
5 / 8	0.625	15.875
.	0.6299	16
41/64	0.6406	16.2719
.	0.6496	16.5
21/32	0.6563	16.6688
.	0.6693	17
43/64	0.6719	17.0656
11/16	0.6875	17.4625
.	0.689	17.5
45/64	0.7031	17.8594
.	0.7087	18
23/32	0.7188	18.2563
.	0.7283	18.5
47/64	0.7344	18.6531
.	0.748	19
3 / 4	0.75	19.05
49/64	0.7656	19.4469
.	0.7677	19.5
25/32	0.7813	19.8438
.	0.7874	20
51/64	0.7969	20.2406
.	0.8071	20.5
13/16	0.8125	20.6375
.	0.8268	21
53/64	0.8281	21.0344
27/32	0.8438	21.4313
.	0.8465	21.5
55/64	0.8594	21.8281
.	0.8661	22
7 / 8	0.875	22.225
.	0.8858	22.5
57/64	0.89063	22.6219
.	0.9055	23
29/32	0.90625	23.0188

Inches		Metric
Fractional	Decimal	mm
59/64	0.92188	23.4156
.	0.9252	23.5
15/16	0.9375	23.8125
.	0.9449	24
61/64	0.95313	24.2094
.	0.9646	24.5
31/32	0.96875	24.6063
.	0.9843	25
63/64	0.98438	25.0031
1 inch	1	25.4
.	1.0039	25.5
.	1.0236	26
.	1.0433	26.5
.	1.063	27
.	1.0827	27.5
.	1.1024	28
.	1.122	28.5
.	1.1417	29
.	1.1614	29.5
.	1.1811	30
.	1.2205	31
1 1 / 4	1.25	31.75
.	1.2598	32
.	1.2992	33
.	1.3386	34
.	1.378	35
.	1.4173	36
.	1.4567	37
.	1.4961	38
1 1 / 2	1.5	38.1
.	1.5354	39
.	1.5748	40
.	1.6142	41
.	1.6535	42
.	1.6929	43
.	1.7323	44
1 3 / 4	1.75	44.45
.	1.7717	45
.	1.811	46
.	1.8504	47
.	1.8898	48
.	1.9291	49
.	1.9685	50
2	2	50.8
.	2.0079	51
.	2.0472	52
.	2.0866	53
.	2.126	54
.	2.1654	55
.	2.2047	56
.	2.2441	57
2 1 / 4	2.25	57.15
.	2.2835	58
.	2.3228	59
.	2.3622	60
.	2.4016	61
.	2.4409	62
.	2.4803	63
2 1 / 2	2.5	63.5
.	2.5197	64
.	2.5591	65
.	2.5984	66

Inches		Metric
Fractional	Decimal	mm
.	2.6378	67
.	2.6772	68
.	2.7165	69
2 3 / 4	2.75	69.85
.	2.7559	70
.	2.7953	71
.	2.8346	72
.	2.874	73
.	2.9134	74
.	2.9528	75
.	2.9921	76
3	3	76.2
.	3.0315	77
.	3.0709	78
.	3.1102	79
.	3.1496	80
.	3.189	81
.	3.2283	82
.	3.2677	83
.	3.3071	84
.	3.3465	85
.	3.3858	86
.	3.4252	87
.	3.4646	88
3 1 / 2	3.5	88.9
.	3.5039	89
.	3.5433	90
.	3.5827	91
.	3.622	92
.	3.6614	93
.	3.7008	94
.	3.7402	95
.	3.7795	96
.	3.8189	97
.	3.8583	98
.	3.8976	99
.	3.937	100
4	4	101.6
.	4.3307	110
4 1 / 2	4.5	114.3
.	4.7244	120
5	5	127
.	5.1181	130
.	5.5118	140
.	5.9055	150
6	6	152.4
.	6.2992	160
.	6.6929	170
.	7.0866	180
.	7.4803	190
.	7.874	200
8	8	203.2
.	9.8425	250
10	10	254
20	20	508
30	30	762
40	40	1016
60	60	1524
80	80	2032
100	100	2540

Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)	Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)	Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)
104		0.0031	0.079	54		0.055	1.397	11		0.191	4.851
103		0.0035	0.089	53		0.0595	1.511	10		0.194	4.915
102		0.0039	0.099		1/16	0.0625	1.587	9		0.196	4.978
101		0.0043	0.109	52		0.0635	1.613	8		0.199	5.055
100		0.0047	0.119	51		0.067	1.702	7		0.201	5.105
99		0.0051	0.13	50		0.07	1.778		13/64	0.2031	5.159
98		0.0055	0.14	49		0.073	1.854	6		0.204	5.182
97		0.0059	0.15	48		0.076	1.93	5		0.206	5.22
96		0.0063	0.16		5/64	0.0781	1.984	4		0.209	5.309
95		0.0067	0.17	47		0.0785	1.994	3		0.213	5.41
94		0.0071	0.18	46		0.081	2.057		7/32	0.2188	5.556
93		0.0075	0.191	45		0.082	2.083	2		0.221	5.613
92		0.0079	0.201	44		0.086	2.184	1		0.228	5.791
91		0.0083	0.211	43		0.089	2.261	A		0.234	5.944
90		0.0087	0.221	42		0.0935	2.375		15/64	0.2344	5.953
89		0.0091	0.231		3/32	0.0938	2.381	B		0.238	6.045
88		0.0095	0.241	41		0.096	2.438	C		0.242	6.147
87		0.01	0.254	40		0.098	2.489	D		0.246	6.248
86		0.0105	0.267	39		0.0995	2.527	E		01/04/20	0.25
85		0.011	0.279	38		0.102	2.578	F		0.257	6.528
84		0.0115	0.292	37		0.104	2.642	G		0.261	6.629
83		0.012	0.305	36		0.107	2.705		17/64	0.2656	6.747
82		0.0125	0.318		7/64	0.1094	2.778	H		0.266	6.756
81		0.013	0.33	35		0.11	2.794	I		0.272	6.909
80		0.0135	0.343	34		0.111	2.819	J		0.277	7.036
79		0.0145	0.368	33		0.113	2.87	K		0.281	7.137
78		0.016	0.406	32		0.116	2.946		9/32	0.2813	7.144
77		0.018	0.457	31		0.12	3.048	L		0.29	7.366
76		0.02	0.508		1 / 8	0.125	3.175	M		0.295	7.493
75		0.021	0.533	30		0.129	3.264		19/64	0.2969	7.541
74		0.0225	0.572	29		0.136	3.454	N		0.302	7.671
73		0.024	0.61	28		0.141	3.569		5/16	0.315	8
72		0.025	0.635		9/64	0.1406	3.572	O		0.316	8.026
71		0.026	0.66	27		0.144	3.658	P		0.323	8.204
70		0.028	0.711	26		0.147	3.734		21/64	0.3281	8.334
69		0.0292	0.742	25		0.15	3.797	Q		0.332	8.433
68		0.031	0.787	24		0.152	3.861	R		0.339	8.611
	1/32	0.0313	0.794	23		0.154	3.912		11/32	0.3438	8.731
67		0.032	0.813		5/32	0.1563	3.969	S		0.348	8.839
66		0.033	0.838	22		0.157	3.988	T		0.358	9.093
65		0.035	0.889	21		0.159	4.039		23/64	0.3594	9.128
64		0.036	0.914	20		0.161	4.089	U		0.368	9.347
63		0.037	0.94	19		0.166	4.216		3 / 8	0.375	9.525
62		0.038	0.965	18		0.17	4.305	V		0.377	9.576
61		0.039	0.991		11/64	0.1719	4.366	W		0.386	9.804
60		0.04	1.016	17		0.173	4.394		25/64	0.3906	9.922
59		0.041	1.041	16		0.177	4.496	X		0.397	10.08
58		0.042	1.067	15		0.18	4.572	Y		0.404	10.26
57		0.043	1.092	14		0.182	4.623		13/32	0.4063	10.319
56		0.0465	1.181	13		0.185	4.699	Z		0.413	10.49
	3/64	0.0469	1.191		3/16	0.1875	4.762				
55		0.052	1.321	12		0.189	4.801				
Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)	Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)	Gauge (no.)	Fractional (inches)	Decimal (inches)	(mm)

Decimal System Prefixes

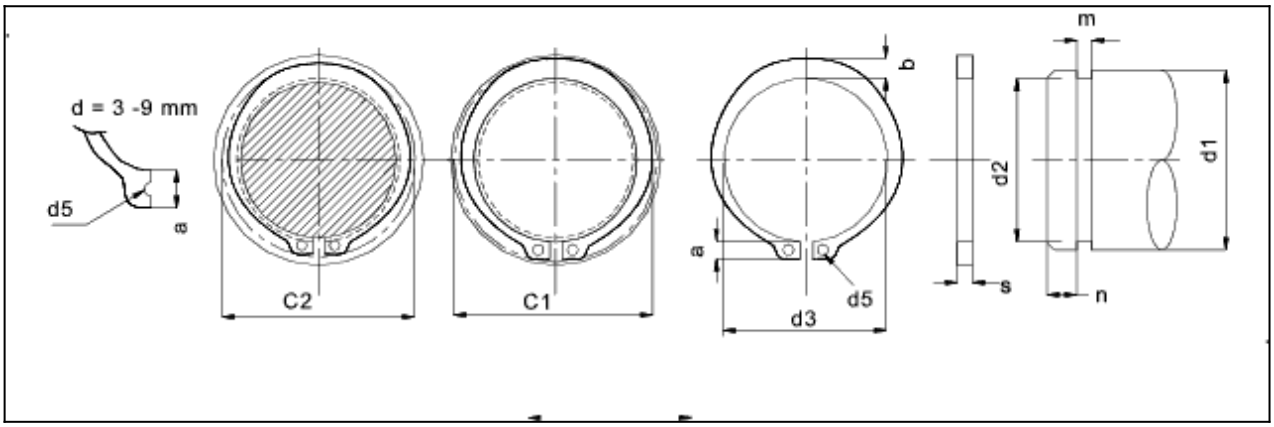
Prefix names of multiples and divisors of units

Decimal multiples of units:

Prefix	Measure	Decimal equivalent	Exponential expression
y - yocto		0.000 000 000 000 000 000 000 001	E^{-24}
z - zepto		0.000 000 000 000 000 000 001	E^{-21}
a - atto	one-quintillionth	0.000 000 000 000 000 001	E^{-18}
f - femto	one-quadrillionth	0.000 000 000 000 001	E^{-15}
p - pico	one-trillionth	0.000 000 000 001	E^{-12}
n - nano	one-billionth	0.000 000 001	E^{-9}
µ - micro	one-millionth	0.000 001	E^{-6}
m - milli	one-thousandth	0.001	E^{-3}
c - centi	one-hundredth	0.01	E^{-2}
d - deci	one-tenth	0.1	E^{-1}
Uni	one	1	E^{0}
d - deka	ten	10	E^{1}
h - hecto	one hundred	100	E^{2}
k - kilo	one thousand	1 000	E^{3}
M - mega	one million	1 000 000	E^{6}
G - giga	one billion	1 000 000 000	E^{9}
T - tera	one trillion	1 000 000 000 000	E^{12}
P - peta		1 000 000 000 000 000	E^{15}
E - exa		1 000 000 000 000 000 000	E^{18}
Z - zetta		1 000 000 000 000 000 000 000	E^{21}
Y - yotta		1 000 000 000 000 000 000 000 000	E^{24}

Circlips – External, Dimensions

Circlips generally to dimensions according to DIN 471



Nom size (mm)	External Circlip Dimensions (mm)									Groove Dimensions (mm)					Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
3	0.40	-0.05	2.7	+0.04 -0.15	1.9	0.8	1.0	7.0	6.6	2.8	-0.04	0.50	0.10	0.3	0.1	0.47
4	0.40	-0.05	3.7	+0.04 -0.15	2.2	0.9	1.0	8.6	8.2	3.8	-0.04	0.50	0.10	0.3	0.2	0.50
5	0.60	-0.05	4.7	+0.04 -0.15	2.5	1.1	1.0	10.3	9.8	4.8	-0.04	0.70	0.10	0.3	0.2	1.0
6	0.70	-0.05	5.6	+0.04 -0.15	2.7	1.3	1.2	11.7	11.1	5.7	-0.04	0.80	0.15	0.5	0.4	1.45
7	0.80	-0.05	6.5	+0.06 -0.18	3.1	1.4	1.2	13.5	12.9	6.7	-0.06	0.90	0.15	0.5	0.5	2.6
8	0.80	-0.05	7.4	+0.06 -0.18	3.2	1.5	1.2	14.7	14.0	7.6	-0.06	0.90	0.20	0.6	0.8	3.0
9	1.00	-0.06	8.4	+0.06 -0.18	3.3	1.7	1.2	16.0	15.2	8.6	-0.06	1.10	0.2	0.6	0.9	3.5
10	1.00	-0.06	9.3	+0.10 -0.36	3.3	1.8	1.5	17.0	16.2	9.6	-0.11	1.10	0.2	0.6	1.0	4.0
11	1.00	-0.06	10.2	+0.10 -0.37	3.3	1.8	1.5	18.0	17.1	10.5	-0.11	1.10	0.25	0.8	1.4	4.5
12	1.00	-0.06	11.0	+0.10 -0.38	3.3	1.8	1.7	19.0	18.1	11.5	-0.11	1.10	0.25	0.8	1.5	5.0
13	1.00	-0.06	11.9	+0.10 -0.39	3.4	2.0	1.7	20.2	19.2	12.4	-0.11	1.10	0.3	0.9	2.0	5.8
14	1.00	-0.06	12.9	+0.10 -0.40	3.5	2.1	1.7	21.4	20.4	13.4	-0.11	1.10	0.3	0.9	2.1	6.4
15	1.00	-0.06	13.8	+0.10 -0.41	3.6	2.2	1.7	22.6	21.5	14.3	-0.11	1.10	0.35	1.1	2.6	6.9
16	1.00	-0.06	14.7	+0.10 -0.42	3.7	2.2	1.7	23.8	22.6	15.2	-0.11	1.10	0.40	1.2	3.2	7.4
17	1.00	-0.06	15.7	+0.10 -0.43	3.8	2.3	1.7	25.0	23.8	16.2	-0.11	1.10	0.40	1.2	3.4	8.0
18	1.20	-0.06	16.5	+0.10 -0.44	3.9	2.4	2.0	26.2	24.8	17.0	-0.11	1.30	0.50	1.5	4.5	17.00
19	1.20	-0.06	17.5	+0.10 -0.45	3.9	2.5	2.0	27.2	25.8	18.0	-0.11	1.30	0.50	1.5	4.8	17.00
20	1.20	-0.06	18.5	+0.13 -0.42	4.0	2.6	2.0	28.4	27.0	19.0	-0.13	1.30	0.50	1.5	5.0	17.10
21	1.20	-0.06	19.5	+0.13 -0.42	4.1	2.7	2.0	29.6	28.2	20.0	-0.13	1.30	0.50	1.5	5.3	16.80
22	1.20	-0.06	20.5	+0.13 -0.42	4.2	2.8	2.0	30.8	29.4	21.0	-0.13	1.30	0.50	1.5	5.6	16.90
23	1.20	-0.06	21.5	+0.13 -0.42	4.3	2.9	2.0	32.0	30.6	22.0	-0.15	1.30	0.50	1.5	5.9	16.60
24	1.20	-0.06	22.2	+0.21 -0.42	4.4	3.0	2.0	33.2	31.7	22.9	-0.21	1.30	0.55	1.7	6.7	16.10
25	1.20	-0.06	23.2	+0.21 -0.42	4.4	3.0	2.0	34.2	32.7	23.9	-0.21	1.30	0.55	1.7	7.0	16.20
26	1.20	-0.06	24.2	+0.21 -0.42	4.5	3.1	2.0	35.5	33.9	24.9	-0.21	1.30	0.55	1.7	7.3	16.10
27	1.20	-0.06	24.9	+0.21 -0.42	4.6	3.1	2.0	36.7	34.8	25.6	-0.21	1.30	0.70	2.1	9.6	16.40
28	1.50	-0.06	25.9	+0.21 -0.42	4.7	3.2	2.0	37.9	36.0	26.6	-0.21	1.60	0.70	2.1	10.0	32.10
29	1.50	-0.06	26.9	+0.21	4.8	3.4	2.0	39.1	37.2	27.6	-0.21	1.60	0.70	2.1	10.3	31.80

Nom size (mm)	External Circlip Dimensions (mm)									Groove Dimensions (mm)					Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
30	1.50	-0.06	27.9	-0.42 +0.21 -0.42	5.0	3.5	2.0	40.5	38.6	28.6	-0.21	1.60	0.70	2.1	10.7	32.10
31	1.50	-0.06	28.6	+0.21 -0.42	5.1	3.5	2.5	41.7	40.9	29.3	-0.21	1.60	0.85	2.6	13.4	31.50
32	1.50	-0.06	29.6	+0.21 -0.42	5.2	3.6	2.5	43.0	40.7	30.3	-0.25	1.60	0.85	2.6	13.8	31.20
33	1.50	-0.06	30.5	+0.25 -0.50	5.2	3.7	2.5	44.0	41.7	31.3	-0.25	1.60	0.85	2.6	14.3	31.60
34	1.50	-0.06	31.5	+0.25 -0.50	5.4	3.8	2.5	45.4	43.1	32.3	-0.25	1.60	0.85	2.6	14.7	31.30
35	1.50	-0.06	32.2	+0.25 -0.50	5.6	3.9	2.5	46.8	44.2	33.0	-0.25	1.60	1.00	3.0	17.8	30.80
36	1.75	-0.06	33.2	+0.25 -0.50	5.6	4.0	2.5	47.8	45.2	34.0	-0.25	1.85	1.00	3.0	18.3	49.40
37	1.75	-0.06	34.2	+0.25 -0.50	5.7	4.1	2.5	49.0	47.0	35.0	-0.25	1.85	1.00	3.0	18.8	50.00
38	1.75	-0.06	35.2	+0.25 -0.50	5.8	4.2	2.5	50.2	47.6	36.0	-0.25	1.85	1.00	3.0	19.3	49.50
39	1.75	-0.06	36.0	+0.25 -0.50	5.9	4.3	2.5	51.4	48.5	37.0	-0.25	1.85	1.00	3.0	19.9	49.80
40	1.75	-0.06	36.5	+0.25 -0.50	6.0	4.4	2.5	52.6	49.5	37.5	-0.25	1.85	1.25	3.8	25.3	51.0
41	1.75	-0.06	37.5	+0.39 -0.90	6.2	4.5	2.5	54.0	51.5	38.5	-0.25	1.85	1.25	3.8	26.0	50.1
42	1.75	-0.06	38.5	+0.39 -0.90	6.5	4.5	2.5	55.7	52.5	39.5	-0.25	1.85	1.25	3.8	26.7	50.0
44	1.75	-0.06	40.5	+0.39 -0.90	6.6	4.6	2.5	57.9	55.4	41.5	-0.25	1.85	1.25	3.8	28.0	48.5
45	1.75	-0.06	41.5	+0.39 -0.90	6.7	4.7	2.5	59.1	55.9	42.5	-0.25	1.85	1.25	3.8	28.6	49.0
46	1.75	-0.06	42.5	+0.39 -0.90	6.7	4.8	2.5	60.1	56.9	43.5	-0.25	1.85	1.25	3.8	29.4	48.9
47	1.75	-0.06	43.5	+0.39 -0.90	6.8	4.9	2.5	61.3	58.1	44.5	-0.25	1.85	1.25	3.8	30.0	49.5
48	1.75	-0.06	44.5	+0.39 -0.90	6.9	5.0	2.5	62.5	59.3	45.5	-0.25	1.85	1.25	3.8	30.7	49.4
50	2.00	-0.07	45.8	+0.39 -0.90	6.9	5.1	2.5	64.5	60.8	47.0	-0.25	2.15	1.50	4.5	38.0	73.3
52	2.00	-0.07	47.8	+0.39 -0.90	7.0	5.2	2.5	66.7	63.0	49.0	-0.25	2.15	1.50	4.5	39.7	73.1
54	2.00	-0.07	49.8	+0.39 -0.90	7.1	5.3	2.5	69.0	65.2	51.0	-0.30	2.15	1.50	4.5	41.2	71.2
55	2.00	-0.07	50.8	+0.46 -1.10	7.2	5.4	2.5	70.2	66.4	52.0	-0.30	2.15	1.50	4.5	42.0	71.4
56	2.00	-0.07	51.8	+0.46 -1.10	7.3	5.5	2.5	71.6	67.6	53.0	-0.30	2.15	1.50	4.5	42.8	70.8
57	2.00	-0.07	52.8	+0.46 -1.10	7.3	5.5	2.5	72.3	69.3	54.0	-0.30	2.15	1.50	4.5	43.7	70.9
58	2.00	-0.07	53.8	+0.46 -1.10	7.3	5.6	2.5	73.6	69.6	55.0	-0.30	2.15	1.50	4.5	44.3	71.1
60	2.00	-0.07	55.8	+0.46 -1.10	7.4	5.8	2.5	75.6	71.8	57.0	-0.30	2.15	1.50	4.5	46.0	69.2
62	2.00	-0.07	57.8	+0.46 -1.10	7.5	6.0	2.5	77.8	74.0	59.0	-0.30	2.15	1.50	4.5	47.5	69.3
63	2.00	-0.07	58.8	+0.46 -1.10	7.6	6.2	2.5	79.0	75.2	60.0	-0.30	2.15	1.50	4.5	48.3	70.2
65	2.50	-0.07	60.8	+0.46 -1.10	7.8	6.3	3.0	81.4	77.6	62.0	-0.30	2.65	1.50	4.5	49.8	135.0
67	2.50	-0.07	62.5	+0.46 -1.10	7.9	6.4	3.0	83.6	79.8	64.0	-0.30	2.65	1.50	4.5	51.3	136.0
68	2.50	-0.07	63.5	+0.46 -1.10	8.0	6.5	3.0	84.4	81.0	65.0	-0.30	2.65	1.50	4.5	52.2	135.0
70	2.50	-0.07	65.5	+0.46 -1.10	8.1	6.6	3.0	87.0	83.2	67.0	-0.30	2.65	1.50	4.5	53.8	134.0
72	2.50	-0.07	67.5	+0.46 -1.10	8.2	6.8	3.0	89.2	85.4	69.0	-0.30	2.65	1.50	4.5	55.3	131.0
75	2.50	-0.07	70.5	+0.46 -1.10	8.4	7.0	3.0	92.7	88.8	72.0	-0.30	2.65	1.50	4.5	57.6	130.0
77	2.50	-0.07	72.5	+0.46 -1.10	8.5	7.2	3.0	94.9	91.0	74.0	-0.30	2.65	1.50	4.5	59.3	131.0
78	2.50	-0.07	73.5	+0.46 -1.10	8.6	7.3	3.0	96.1	92.2	75.0	-0.30	2.65	1.50	4.5	60.0	131.0
80	2.50	-0.07	74.5	+0.46 -1.10	8.6	7.4	3.0	98.1	93.7	76.5	-0.30	2.65	1.75	5.3	71.6	128.0
82	2.50	-0.07	76.5	+0.46 -1.10	8.7	7.6	3.0	100.3	95.9	78.5	-0.30	2.65	1.75	5.3	73.5	128.0

Nom size (mm)	External Circlip Dimensions (mm)									Groove Dimensions (mm)					Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
85	3.00	-0.08	79.5	+0.46 -1.10	8.7	7.8	3.5	103.3	98.9	81.5	-0.35	3.15	1.75	5.3	76.2	215.0
87	3.00	-0.08	81.5	+0.54 -1.30	8.8	7.9	3.5	105.5	100.9	83.5	-0.35	3.15	1.75	5.3	78.2	222.0
88	3.00	-0.08	82.5	+0.54 -1.30	8.8	8.0	3.5	106.5	102.0	84.5	-0.35	3.15	1.75	5.3	79.0	221.0
90	3.00	-0.08	84.5	+0.54 -1.30	8.8	8.2	3.5	108.5	104.0	86.5	-0.35	3.15	1.75	5.3	80.0	217.0
92	3.00	-0.08	86.5	+0.54 -1.30	9.0	8.4	3.5	110.9	107.4	88.5	-0.35	3.15	1.75	5.3	82.0	217.0
95	3.00	-0.08	89.5	+0.54 -1.30	9.4	8.6	3.5	114.8	111.0	91.5	-0.35	3.15	1.75	5.3	85.0	212.0
97	3.00	-0.08	91.5	+0.54 -1.30	9.4	8.8	3.5	116.7	113.2	93.5	-0.35	3.15	1.75	5.3	87.0	211.0
98	3.00	-0.08	91.5	+0.54 -1.30	9.4	8.8	3.5	118.6	114.0	94.5	-0.35	3.15	1.75	5.3	88.0	208.0
100	3.00	-0.08	94.5	+0.54 -1.30	9.6	9.0	3.5	120.2	116.0	96.5	-0.35	3.15	1.75	5.3	90.0	206.0
102	4.00	-0.10	95.0	+0.54 -1.30	9.7	9.2	3.5	122.4	118.0	98.0	-0.54	4.15	2.00	6.0	104.0	482.0
105	4.00	-0.10	98.0	+0.54 -1.30	9.9	9.3	3.5	126.2	122.0	101.0	-0.54	4.15	2.00	6.0	107.0	471.0
107	4.00	-0.10	100.0	+0.54 -1.30	10.0	9.5	3.5	128..0	124.0	103.0	-0.54	4.15	2.00	6.0	110.0	465.0
108	4.00	-0.10	100.0	+0.54 -1.30	10.0	9.5	3.5	129.0	124.0	104.0	-0.54	4.15	2.00	6.0	111.0	459.0
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
Nom size (mm)	External Circlip Dimensions (mm)									Groove Dimensions (mm)					Groove Strength	Circlip Strength

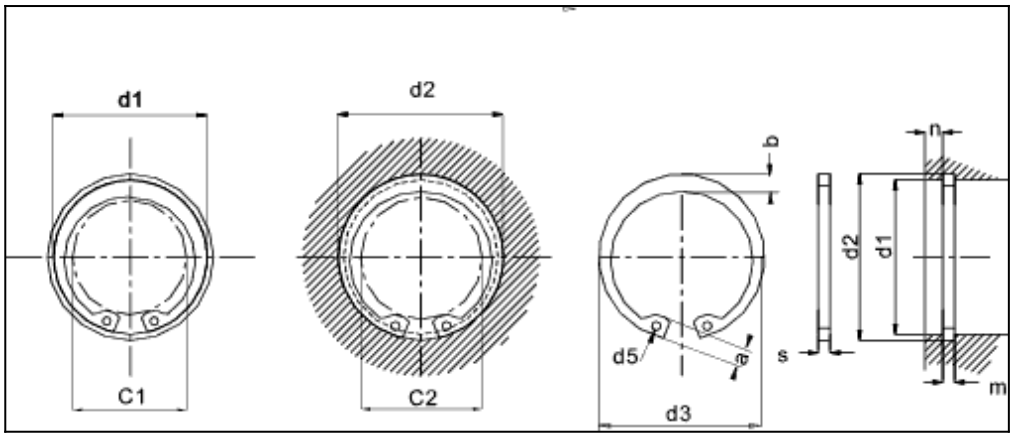
Notes: The load capacities shown are for first estimate values for initial design evaluations.

They include only for sharp edges of stressed surfaces in contact with the circlips... If the hole or shaft includes chamfers and radii significant strength reductions are required - see manufactures literature.
The groove strength is based on approximate yield stength of 200 N/mm2 with no safety factor and no allowance for stress concentration factors or notch sensitivities.

The circlip strength is based on manufacturers standard spring steel material.

Circlips – Internal, Dimensions

Circlips generally to dimensions according to DIN 471



Nom size	Internal Circlip Dimensions									Groove Dimensions					Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
8	0.8	-0.05	8.7	+0.36 -0.10	2.4	1.1	1.0	3.0	3.6	8.4	+0.09	0.9	0.2	0.6	0.86	2.0
9	0.8	-0.05	9.8	+0.36 -0.10	2.5	1.3	1.0	3.7	4.4	9.4	+0.09	0.9	0.2	0.6	0.96	2.0
10	1.0	-0.06	10.8	+0.36 -0.10	3.2	1.4	1.2	3.3	4.0	10.4	+0.11	1.1	0.2	0.6	1.08	4.0
11	1.0	-0.06	11.8	+0.36 -0.10	3.3	1.5	1.2	4.1	4.8	11.4	+0.11	1.1	0.2	0.6	1.17	4.0
12	1.0	-0.06	13.0	+0.36 -0.10	3.4	1.7	1.5	4.9	5.7	12.5	+0.11	1.1	0.25	0.8	1.60	4.0
13	1.0	-0.06	14.1	+0.36 -0.10	3.6	1.8	1.5	5.4	6.4	13.6	+0.11	1.1	0.3	0.9	2.10	4.2
14	1.0	-0.06	15.	+0.36 -0.10	3.7	1.8	1.7	6.2	7.2	14.6	+0.11	1.1	0.3	0.9	2.10	4.5
15	1.0	-0.06	16.2	+0.36 -0.10	3.7	2.0	1.7	7.2	8.3	15.7	+0.11	1.1	0.35	1.1	2.80	5.0
16	1.0	-0.06	17.3	+0.36 -0.10	3.8	2.0	1.7	8.0	9.2	16.8	+0.11	1.1	0.4	1.2	3.40	5.5
17	1.0	-0.06	18.3	+0.42 -0.13	3.9	2.1	1.7	8.8	10.0	17.8	+0.11	1.1	0.4	1.2	3.60	6.0
18	1.0	-0.06	19.5	+0.42 -0.13	4.1	2.2	2.0	9.4	10.8	19.0	+0.13	1.1	0.5	1.5	4.80	6.5
19	1.0	-0.06	20.5	+0.42 -0.13	4.1	2.2	2.0	10.4	11.8	20.0	+0.13	1.1	0.5	1.5	5.10	6.8
20	1.0	-0.06	21.5	+0.42 -0.13	4.1	2.3	2.0	11.2	12.6	21.0	+0.13	1.1	0.5	1.5	5.40	7.2
21	1.0	-0.06	22.5	+0.42 -0.13	4.2	2.4	2.0	12.2	13.6	22.0	+0.13	1.1	0.5	1.5	5.70	7.6
22	1.00	-0.06	23.5	+0.42 -0.13	4.2	2.5	2.0	13.2	14.6	23.0	+0.13	1.10	0.50	1.5	5.90	8.0
23	1.20	-0.06	24.6	+0.42 -0.13	4.2	2.5	2.0	14.2	15.7	24.1	+0.13	1.30	0.55	1.7	6.80	8.0
24	1.20	-0.06	25.9	+0.42 -0.21	4.3	2.6	2.0	14.8	16.4	25.2	+0.21	1.30	0.60	1.8	7.70	13.9
25	1.20	-0.06	26.9	+0.42 -0.21	4.5	2.7	2.0	15.5	17.2	26.2	+0.21	1.30	0.60	1.8	8.00	14.6
26	1.20	-0.06	27.9	+0.42 -0.21	4.7	2.8	2.0	16.1	17.8	27.2	+0.21	1.30	0.60	1.8	8.40	13.8
27	1.20	-0.06	29.1	+0.42 -0.21	4.7	2.9	2.0	17.1	19.0	28.4	+0.21	1.30	0.70	2.1	10.10	13.3
28	1.20	-0.06	30.1	+0.50 -0.25	4.8	2.9	2.0	17.9	19.8	29.4	+0.21	1.30	0.70	2.1	10.50	13.3
29	1.20	-0.06	31.1	+0.50 -0.25	4.8	3.0	2.0	18.9	20.8	30.4	+0.25	1.30	0.70	2.1	10.90	13.6
30	1.20	-0.06	32.1	+0.50 -0.25	4.8	3.0	2.0	19.9	21.8	31.4	+0.25	1.30	0.70	2.1	11.30	13.7
31	1.20	-0.06	33.4	+0.50 -0.25	5.2	3.1	2.5	20.0	22.3	32.7	+0.25	1.30	0.85	2.6	14.10	13.8
32	1.20	-0.06	34.4	+0.50 -0.25	5.4	3.2	2.5	20.6	22.9	33.7	+0.25	1.30	0.85	2.6	14.60	13.8
33	1.20	-0.06	35.5	+0.50 -0.25	5.4	3.3	2.5	21.6	23.9	34.7	+0.25	1.30	0.85	2.6	15.00	14.3
34	1.50	-0.06	36.5	+0.50 -0.25	5.4	3.3	2.5	22.6	24.9	35.7	+0.25	1.60	0.85	2.6	15.40	26.2
35	1.50	-0.06	37.8	+0.50 -0.25	5.4	3.4	2.5	23.6	26.2	37.0	+0.25	1.60	1.00	3.0	18.80	26.9

Nom size	Internal Circlip Dimensions									Groove Dimensions					Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
36	1.50	-0.06	38.8	+0.50 -0.25	5.4	3.5	2.5	24.6	27.2	38.0	+0.25	1.60	1.00	3.0	19.40	26.4
37	1.50	-0.06	39.8	+0.50 -0.25	5.5	3.6	2.5	25.4	28.0	39.0	+0.25	1.60	1.00	3.0	19.80	27.1
38	1.50	-0.06	40.8	+0.50 -0.25	5.5	3.7	2.5	26.4	29.0	40.0	+0.25	1.60	1.00	3.0	22.50	28.2
39	1.50	-0.06	42.0	+0.90 -0.39	5.6	3.8	2.5	27.3	29.8	41.0	+0.25	1.60	1.00	3.0	26.00	28.8
40	1.75	-0.06	43.5	+0.90 -0.39	5.8	3.9	2.5	27.8	30.9	42.5	+0.25	1.85	1.25	3.8	27.00	44.6
41	1.75	-0.06	44.5	+0.90 -0.39	5.9	4.0	2.5	28.6	31.7	43.5	+0.25	1.85	1.25	3.8	27.60	45.0
42	1.75	-0.06	45.5	+0.90 -0.39	5.9	4.1	2.5	29.6	32.7	44.5	+0.25	1.85	1.25	3.8	28.40	44.7
43	1.75	-0.06	46.5	+0.90 -0.39	5.9	4.2	2.5	30.6	33.7	45.5	+0.25	1.85	1.25	3.8	28.80	44.5
44	1.75	-0.06	47.5	+0.90 -0.39	6.0	4.2	2.5	31.4	34.5	46.5	+0.25	1.85	1.25	3.8	29.50	43.3
45	1.75	-0.06	48.5	+0.90 -0.39	6.2	4.3	2.5	32.0	35.1	47.5	+0.25	1.85	1.25	3.8	30.20	43.1
46	1.75	-0.06	49.5	+0.90 -0.39	6.3	4.4	2.5	32.8	35.9	48.5	+0.25	1.85	1.25	3.8	30.80	42.9
47	1.75	-0.06	50.5	+1.10 -0.46	6.4	4.4	2.5	33.5	36.7	49.5	+0.25	1.85	1.25	3.8	31.40	43.5
48	2.00	-0.06	51.5	+1.10 -0.46	6.4	4.5	2.5	34.5	37.7	50.5	+0.30	1.85	1.25	3.8	32.00	43.2
50	2.00	-0.07	54.2	+1.10 -0.46	6.5	4.6	2.5	36.3	40.0	53.0	+0.30	2.15	1.50	4.5	40.50	60.8
51	2.00	-0.07	55.2	+1.10 -0.46	6.5	4.7	2.5	37.3	41.0	54.0	+0.30	2.15	1.50	4.5	41.20	60.2
52	2.00	-0.07	56.2	+1.10 -0.46	6.7	4.7	2.5	37.9	41.6	55.0	+0.30	2.15	1.50	4.5	42.00	60.2
53	2.00	-0.07	57.2	+1.10 -0.46	6.7	4.9	2.5	39.00	42.6	56.0	+0.30	2.15	1.50	4.5	42.90	60.7
54	2.00	-0.07	58.2	+1.10 -0.46	6.7	5.0	2.5	40.00	43.6	57.0	+0.30	2.15	1.50	4.5	43.60	60.4
55	2.00	-0.07	59.2	+1.10 -0.46	6.8	5.0	2.5	40.7	44.4	58.0	+0.30	2.15	1.50	4.5	44.40	60.3
56	2.00	-0.07	60.2	+1.10 -0.46	6.8	5.1	2.5	41.7	45.4	59.0	+0.30	2.15	1.50	4.5	45.20	60.3
57	2.00	-0.07	61.2	+1.10 -0.46	6.8	5.1	2.5	42.7	46.4	60.0	+0.30	2.15	1.50	4.5	46.00	60.8
58	2.00	-0.07	62.2	+1.10 -0.46	6.9	5.2	2.5	43.5	47.2	61.0	+0.30	2.15	1.50	4.5	46.70	60.8
60	2.00	-0.07	64.2	+1.10 -0.46	7.3	5.4	2.5	44.7	48.4	63.0	+0.30	2.15	1.50	4.5	48.30	61.0
62	2.00	-0.07	66.2	+1.10 -0.46	7.3	5.5	2.5	46.7	50.4	65.0	+0.30	2.15	1.50	4.5	49.80	60.9
62	2.00	-0.07	67.2	+1.10 -0.46	7.3	5.6	2.5	47.7	51.4	66.0	+0.30	2.15	1.50	4.5	50.60	60.8
64	2.00	-0.07	68.2	+1.10 -0.46	7.4	5.7	2.5	48.7	52.4	67.0	+0.30	2.15	1.50	4.5	51.40	60.6
65	2.50	-0.07	69.2	+1.10 -0.46	7.6	5.8	3.0	49.00	52.8	68.0	+0.30	2.65	1.50	4.5	51.80	121.0
67	2.50	-0.07	71.5	+1.10 -0.46	7.7	6.0	3.0	50.8	54.6	70.0	+0.30	2.65	1.50	4.5	53.80	121.0
68	2.50	-0.07	72.5	+1.10 -0.46	7.8	6.1	3.0	51.6	55.4	71.0	+0.30	2.65	1.50	4.5	56.20	119.0
70	2.50	-0.07	74.5	+1.10 -0.46	7.8	6.2	3.0	53.6	57.4	73.0	+0.30	2.65	1.50	4.5	56.20	119.0
72	2.50	-0.07	76.5	+1.10 -0.46	7.8	6.4	3.0	55.6	59.4	75.0	+0.30	2.65	1.50	4.5	58.00	119.0
75	2.50	-0.07	79.5	+1.10 -0.46	7.8	6.6	3.0	58.6	62.4	78.0	+0.30	2.65	1.50	4.5	60.00	118.0
77	2.50	-0.07	82.5	+1.30 -0.54	8.5	6.8	3.0	59.2	63.0	80.0	+0.30	2.65	1.50	4.5	61.60	121.0
78	2.5	-0.07	82.5	+1.30 -0.54	8.5	6.8	3.0	60.1	64.00	81.0	+0.35	2.65	1.50	4.5	62.30	122.0
80	2.50	-0.07	85.5	+1.30 -0.54	8.5	7.0	3.0	62.1	66.5	83.5	+0.35	2.65	1.75	5.3	74.60	120.0
81	2.50	-0.07	86.5	+1.30 -0.54	8.5	7.0	3.0	62.2		84.5	+0.35	2.65	1.75	5.3	75.80	119.0
82	2.50	-0.07	87.5	+1.30 -0.54	8.5	7.0	3.0	64.1	68.5	85.5	+0.35	2.65	1.75	5.3	76.60	119.0
83	2.50	-0.07	88.5	+1.30 -0.54	8.5	7.0	3.0	65.2	69.5	86.5	+0.35	2.65	1.75	5.3	77.50	118.0
85	3.00	-0.08	90.5	+1.30	8.6	7.2	3.5	66.9	71.3	88.5	+0.35	3.15	1.75	5.3	79.50	201.0

Nom size	Internal Circlip Dimensions									Groove Dimensions				Groove Strength	Circlip Strength
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
87	3.00	-0.08	93.5	-0.54 +1.30 -0.54	8.6	7.4	3.5	69.0	73.3	90.5	+0.35	3.15	1.75	5.3	81.30	204.0
88	3.00	-0.08	93.5	+1.30 -0.54	8.6	7.4	3.5	69.9	74.3	91.5	+0.35	3.15	1.75	5.3	82.00	209.0
90	3.00	-0.08	95.5	+1.30 -0.54	8.6	7.6	3.5	71.9	76.3	93.5	+0.35	3.15	1.75	5.3	84.00	199.0
92	3.00	-0.08	97.5	+1.30 -0.54	8.7	7.8	3.5	73.7	78.1	95.5	+0.35	3.15	1.75	5.3	85.0	201
95	3.00	-0.08	100.5	+1.30 -0.54	8.8	8.1	3.5	76.5	80.9	98.5	+0.35	3.15	1.75	5.3	88.00	195
d1	s	s (tol)	d 3	d 3 (tol)	a max	b	d 5min	C1	C2	d 2	d 2 (tol)	m min	t	n	F n(kN)	F r(kN)
Nom size (mm)	Internal Circlip Dimensions (mm)									Groove Dimensions (mm)					Groove Strength	Circlip Strength