

TECHNICAL INFORMATION (TI)



REM[®]
REYHER ENGINEERING MANAGEMENT

We have added many new developments to the technical information (TI) that may be helpful to you when dealing with fasteners. These changes result from many consultations, in which customers have been able to benefit from our expertise.

New in this issue of the catalogue are comprehensive pages of measurement data. Sorted by product groups, the data will be especially supportive in the development and design of new products.

We have also significantly expanded the tables with tightening torques and pre-stressing forces for the assembly of fasteners.

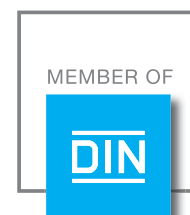
An overview of laws and directives affecting fasteners and fixing technology provides important orientation on product selection, especially for designers and buyers.

With this technical information we live up to our claim, to support your day-to-day work with the latest information and individual solutions.

Mechanical fasteners from REYHER are mass produced items used worldwide in all areas of technology. Availability and inter-changeability must be ensured by appropriate standardisation.

With our participation in this standardisation work we make a contribution to unification and market-driven execution of our products.

REYHER's cooperation in standardising bodies provides a forum for technological observation of the market and timely information on new technologies and customer-specific requirements.



Today, REYHER is helping to shape tomorrow's products!

DIN EN ISO	STANDARDS CONVERSION	4-11		
	Standards conversion DIN-EN-ISO/ISO-EN-DIN	4	Dimensions for pins	114
	Standards types, relations	5	- Linch pins/spring cotter/split pins	120
	Normative changes to screws	6	- Parallel pins/taper pins/grooved pins	114
	Normative changes to nuts	7	- Spring-type straight pins	119
	Normative changes to bolts and pins	10	Dimensions for handles	123
	Normative changes to threads and tapping screws	11	- Grips	123
			- Tommy screws/tommy nuts	125
	DIMENSIONS FOR FASTENERS	12-135	Dimensions for brackets, clamps and rope fixings	128
	Dimensions for screws and bolts	12	- Hose clamps/pipe clamps	128
	- Hexagon and hexalobular socket head cap screws	12	- Rope clips/thimble ropes/shackles	130
	- Hexagon head screws/bolts	15	- Stirrup bolts	128
	- Hooks/special bolts with wood screw thread	53	Dimensions for rivets	131
	- Locking screws	28	Dimensions for other products	133
	- Lubricating nipples	25	- Axle holders	134
	- Other screws with metric thread	29	- Cam segments and washers for diagonal pull tension	133
	- Screw plugs/pipe plugs	22	- Hooks	134
	- Set screws/grub screws	19	- Parallel keys	134
	- Slotted and cross recessed screws with metric thread	37		
	- Studs	18	Pi	PRODUCT INFORMATION
	- Tapping screws, thread rolling screws and thread cutting screws	41		136-152
	- Theft resistant screws	26	Cable ties and accessories	143
	- Wood screws/chipboard screws	51	Disc springs	142
	Dimensions for bolts, nuts and accessories for steel constructions	56	Head shapes, drive features and ends of externally threaded fasteners	141
	- Bolts, nuts and accessories, system HV	56	Lifting eye bolts and lifting eye nuts	148
	- Clamping lengths	59	Self tapping thread inserts	152
	Dimensions for nuts	60	Special materials	140
	- Hexagon nuts	60	Tolerances for screws, nuts and washers	136
	- Locking nuts	65	Tolerances, ISO deviations	139
	- Nuts for T-slots	69	Wire thread inserts	150
	- Special forms	70		
	- Square nuts	82	lindapter®	
	- Threaded plates	77	STEELWORK FASTENER AND FIXING SYSTEMS	154-157
	- Turnbuckles	80	Product overview: girder clamps, support fixings, cavity fixings and floor fixings	156
	- Welding nuts	69	Steelwork fixings – girder clamps	154
	Dimensions for washers and rings	84		
	- Adjusting rings	109		
	- Plain washers-round	84	PLUGS AND ANCHORS	158-161
	- Retaining lock washers and rings	88	Plugs and anchors: Selection and assembly aids	158
	- Sealing washer-plain	87		
	- Special forms	111		
	- Square washers/taper washers	86		

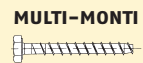
FISCHER – Plugs and anchors

- Cavity fixings	186
- Chemical fixings	162
- Electrical fixings	189
- General fixings	182
- High performance steel anchors	167
- Insulation supports	191
- Long-shaft anchors/frame fixings/adjustment fixings	177
- Scaffold fixings	190



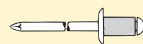
UPAT – Plugs and anchors

192-195



MULTI-MONTI screw-in anchors

196-198



BLIND RIVET SYSTEMS

199-208

Blind rivets and accessories	199
Blind rivet nuts and accessories	206



SCREW THREAD

209-213

Profile, types, threadability	209
Tolerances, thread pitches	211



CORROSION PROTECTION

214-219

Corrosion protection measures	215
Corrosion resistance	216
Electroplated coatings, maximum layer thicknesses	217
Hot dip galvanized coatings	219
General information, corrosion types, contact corrosion	214
Zinc flake coatings	218



PROPERTIES

220-227

Fasteners from corrosion-resistant stainless steel	224
Fasteners from non-ferrous materials	227
Fasteners with UN Thread	222
Steel screws, bolts, studs and nuts	220



ASSEMBLY OF SCREWED FASTENINGS

228-237

Assembly instructions for tapping screws	237
Assembly instructions, preloads and tightening torque for high-strength structural bolting (system HV)	234
General information, tightening methods, friction coefficients	228
Preloads and tightening torque for fasteners from BUMAX brass and polyamide	236
Preloads and tightening torque for fasteners from stainless steel	235
Preloads and tightening torque for fasteners of steel	230
Preloads and tightening torque for screwed fastenings with locking elements	233



INSPECTIONS, ACCEPTANCE TESTINGS, CERTIFICATES

238-240

Acceptance inspection according to ISO 3269	239
Certificates	239
Quality inspection	238
Test method: Hardness measurement, impact test	240



LOCKING OF SCREWED FASTENINGS

242-244

Form-fitting locking elements and adhesive coatings	243
General information, measures	242
Product overview of form-fitting locking elements and adhesive coatings	244



DIRECTIVES AND LEGISLATION

245-248

EC Directive 2000/53/EC on end-of-life vehicles	245
EC Directive 2002/95/EC on electrical and electronic equipment (ROHS directive)	245
EC Directive 2006/42/EC (Machinery directive)	247
EC Directive EC 2006/122/EC (PFOS)	246
EC Directive 97/23/EC (Pressure equipment directive)	247
EC Regulation of construction products	246
EC Regulation 1907/2006 – Chemicals regulation (REACH)	246
Fastener Quality Act (FQA)	248
HR 4040 – CPSIA	245
Product Safety Act (ProSG)	247
ZEK 01-08 PAK	245

Standards conversion DIN → ISO/EN

The conversion of some national DIN standards to ISO or EN standards is (was) done with the aim of deconstructing trade barriers in international goods exchange and harmonising the technical rules in the common single European market.

Table 1 shows the ISO/EN standards for product standards and the most important thread and basic standards according to the corresponding DIN in ascending order (as of: 01.2016).

Table 2 (next page) shows the EN and DIN standards according to the corresponding ISO in ascending order. The tables also include draft standards and withdrawn standards.

Table 1

Product standards				Product standards				Product standards				Product standards				Product standards				Basic/Functional standards			
DIN		ISO DIN ISO DIN EN ISO		DIN		ISO DIN ISO DIN EN ISO		DIN		ISO DIN ISO DIN EN ISO		DIN		ISO DIN ISO DIN EN ISO		DIN		ISO DIN ISO DIN EN ISO		DIN		ISO DIN ISO DIN EN ISO	
1	2339	911	2936	2509*	–	7337	15973–16585	58450	–	267–1	8992												
7	2338	912 (RG)	4762	2510–1...8	–	7338–7340	–	70613–70618	–	267–2	4759–1												
39	–	912 (FG)	12474	3015–3016	–	7341	1051	70851*	–	267–3	898–1												
84	1207	913	4026	3017	–	7343	8750	70852	–	267–4	898–2												
85	1580	914	4027	3220	–	7344	8748	70951*	–	267–5	3269 (16426)												
93*	–	915	4028	3319	–	7346	13337	70952	–	267–6	4759–1												
94	1234	916	4029	3404, 3405	–	7349	–	71412	–	267–7	898–1												
95, 96, 97	–	917	–	3567	–	7500–1	–	71752	–	267–8	898–2												
98, 99	–	920–927	–	3568*	–	7504	15480–15483	71802–71805	–	267–9	4042												
123.124	1051	928, 929	–	3570	–	7513	–	74361	–	267–10	10684												
125–1.2	7089, 7090	931–1	4014	3575	–	7516	–	80403	–	267–11	3506–1–4												
126	7091	931–2	–	3670	–	7603	–	80701	–	267–12	2702												
127*, 128*	–	933	4017	3870, 3872	–	7604	–	80704	–	267–13	–												
134*, 137*	–	934 RG	4032, 4033	4109	–	7642, 7643	–	80705	–	267–15	2320												
186, 188	–	934 FG	8673, 8674	5299	–	7964	–	81698	–	267–18	8839												
258	ISO 8737	935–1	–	5406	–	7965	–	82006–82010	–	267–19	6157–1, 3												
261	–	935–3	–	5417	–	7967*	–	82013	–	267–20	6157–2												
302	1051	936 RG/FG	(4035/8675)	5525, 5526	–	7968	–	82101	–	267–21	10484												
314–318	–	937	–	5586	–	7969	–	–	–	267–23	898–6												
319	–	938–940	–	5903, 5906	–	7971	1481	Thread standards				267–24	–										
338, 340	–	949–1.2	–	5914	–	7972	1482	13–1...11	724	267–25	898–7												
388, 390	–	950–959	–	6303	–	7973	1483	13–12	261	267–26–30	–												
404	–	960	8765	6304–6307	–	7976	1479	13–13	262, 965–2	475**	272 (EN 1660)												
417	7435	961	8676	6311	–	7977	8737	13–14, 15	965–1, 2	522	4759–3												
427	2342	963	2009	6319	–	7978	8736	13–16...18	1502	918	1891												
431	–	964	2010	6324	–	7979	8733, 8735	13–19	68–1	946	16047												
432*	–	965	7046–1, 2	6325	8734	7980*	–	13–20...26	–	962 (34803)	7378, 8991												
433–1.2	7092	966	7047	6330, 6331	–	7981	7049	13–27	965–3	969	–												
434–436	–	967, 968	–	6332	–	7982	7050	13–28	–	974	–												
438	7436	(970)	4032	6334*	–	7983	7051	13–50...52	–	2510–2, 8	–												
439–1	4036	(971–1.2)	8673, 8674	6335–6337	–	7984	–	14	–	7150–7152	286												
439–2 RG/FG	4035, 8675	(972)	4034	6340	–	7985	7045	103–1	2901	7154–7157	–												
440	7094	975	DIN 976	6378	–	7987*, 7988*	–	103–2	2902	7160, 7161	286												
442, 443	–	976–1.2	–	6379	–	7989–1.2	–	103–3	2903	7168	2768, 8015												
444	–	977	–	6791, 6792	1051	7990	–	103–4	2904	7172, 7182	286												
462, 463*	–	979	–	6796	–	7991	10642	103–5...9	–	7184	1101												
464, 465*	–	980 RG	7042 (7719)	6797*	–	7992	–	202	–	7337	14588–589												
466, 467	–	981	–	6798*	–	7993	–	2244	5408	7500–2/7504	–/10666												
468, 469	–	980 FG	10513	6799	–	7995–7997	–	2510–2	–	7962	4757												
470	–	982 RG	7040	6880	–	7999	EN 14399–8	7952	–	7970	1478												
471, 472	–	982 FG	10512	6881	–	8140	–	7970	1478	7998	–												
478–480	–	983	–	6883, 6884	2492	9021	7093–1,–2	7998	–	8140–1–3	–												
508	299	985	10511	6885–1, 2	–	9045*	–	8140, 8141	–	9830	–												
525, 529	–	986	–	6885–3	–	9841	7379	66	15065	18800	–												
546–548	–	987*	–	6886, 6887	–	11014	–	69	273	34803, 34804	–												
551	4766	988	–	6888	3912	11023, 11024	–	74	–	40080	2859–1–3												
553	7434	1052	–	6899	–	15058	–	76–1	3508, 4755	50049	EN 10204												
555	4034	1433–1436	–	6900	10644	15237	–	76–2	228–1	–	–												
557	–	1440	–	6901	10510	16903	–	78	4753	–	–												
558	4018	1441	–	6902–6908	10669, 10673	18182	–	101	1051	–	–												
561	–	1443	2340	6911	–	21346	–	–	–	–	–												
562	–	1444	2341	6912	–	21547	–	–	–	–	–												
564	–	1445	–	6913*	–	22424, 22425	–	–	–	–	–												
571	–	1469	–	6914–6915	EN 14399–4	25192	–	–	–	–	–												
580, 582	–	1470	8739	6916	EN 14399–6	25193	–	–	–	–	–												
601	4016	1471	8744	6917–6918	–	25195	–	–	–	–	–												
603	–	1472	8745	6921	EN 1665	25197*	–	–	–	–	–												
604–608	–	1473	8740	6922	EN 1665	25200–25203	–	–	–	–	–												
609, 610*	–	1474	8741	6923	EN 1661	26020	–	–	–	–	–												
653	–	1475	8742/8743	6924 (RG)	7040	28030	–	–	–	–	–												
660–662	1051	1476	8746	6924 (FG)	10512	28129	–	–	–	–	–												
674, 675	1051	1477	8747	6925 (RG)	7042	28152	–	–	–	–	–												
703*, 705	–	1478–1480	–	6925 (FG)	10513	32500, 32501	13918	–	–	–	–												
741	–	1481	8752	6926 (RG)	EN 1663	34800–34802	–	–	–	–	–												
787	299	1587	–	6926 (FG)	EN 1666	34803, 34804	–	–	–	–	–												
792	–	1592–1597	–	6927 (RG)	EN 1664	34810–34816	–	–	–	–	–												
797, 798*	–	1804	–	6927 (FG)	EN 1667	34817–34819	–	–	–	–	–												
830*	–	1816	–	6928 (RG)	7053	34820	–	–	–	–	–												
835	–	2093	–	6928 (FG)	10509	46258, 46320	–	–	–	–	–												
906–910	–	2507	(EN 1515)	7331	–	46288	–	–	–	–	–												

What you need to know about standardisation

Individual questions are answered quickly and competently



REYHER Engineering Management

Phone: +49 40 85363-999
Fax: +49 40 85363-602

– ISO/EN standard not yet known (as of 01.2016)

() Transitional standards (dimensions identical with ISO)

* withdrawn DIN standard without replacement, because, for example, technically reworked
(On issue of DIN EN-/DIN EN ISO standards the corresponding DIN/DIN ISO are/were withdrawn)

Legend for table 2

HV high strength steel
Csk. countersunk
Rcsk. raised countersunk
CT/FT coarse pitch thread/fine pitch thread
CH/TC/CD/CP with flat point/with cone point/with dog point/with cup point

What you need to know about standardisation

Individual questions are answered quickly and competently

REM[®]
REYHER ENGINEERING MANAGEMENT

REYHER Engineering Management

Phone: +49 40 85363-999

Fax: +49 40 85363-602

Hex. hexagon
CR cross recess
MP Mechanical Properties
S/H/L standard/heavy/light version
Ww Withworth
TDC technical delivery conditions





Table 2

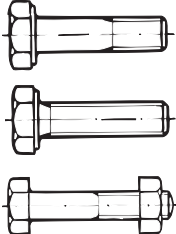
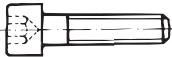
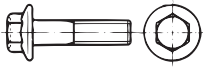
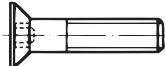
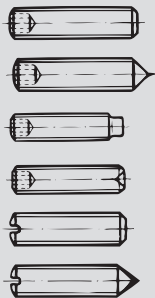
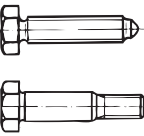
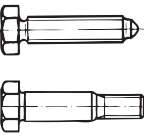
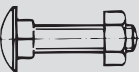
Product standards				Product standards				Product standards			
ISO DIN ISO DIN EN ISO	EN DIN EN	DIN	Title keyword	ISO DIN ISO DIN EN ISO	EN DIN EN	DIN	Title keyword	ISO DIN ISO DIN EN ISO	EN DIN EN	DIN	Title keyword
-	1515	2507	Flange joints	7379	-	9841	Hex. socket head shoulder screws	Basic/Functional standards			
-	1661	6923	Hexagon nuts with flange	7380	-	-	Hex. socket button head screws	225	20225	-	Fasteners: Dimensions
-	(1662), 1665	6921, 6922	Hexagon bolts with flange	7434	27434	553	Slotted set screws TC	272	1660	475 - 1	Hexagon wrench sizes
-	1663, 1664	6926, 6927	Hexagon nuts with flange	7435	27435	417	Slotted set screws CD	273	20273	69	Clearance holes for bolts
-	1666, 1667FG	6926, 6927FG	Hexagon nuts with flange and prevailing torque type	7436	27436	438	Slotted set screws CP	286 -1, 2	20286	7150-7182	ISO system of limits and fits
-	14218, 14219	-	Hex. bolts/nuts with flange FT	7719, 7720	-	980, 6925	Prevailing torque type hex. nuts	885	-	-	Radial under screw head
-	14399-4	6914-6915	Hexagon bolts/nuts (HV)	8100, 8102	1665	6921	Hexagon bolts with flange	887	-	-	Plain washers - general plan
-	14399-6	6916	Plain chamfered washers (HV)	8104	1662	6922	Hexagon bolts with flange	888	-	-	Nominal lengths screws/threads
-	14399-8	7999	Hexagon fit bolts (HV)	8673	-	934, 971-1	Hexagon nuts FT	898 -1	-	267 - 3, 7	TDC fasteners: bolts
299	-	508/787	Screws/Nuts for T-slots	8674	-	934, 972-2	Hexagon nuts FT	898 -2	-	267 - 4, 8	TDC fasteners: nuts CT
773	-	6885 -1, 2	Parallel keys	8675	-	439 -2, 936	Hexagon thin nuts (chamfered) FT	898 -5	-	267 - 3	TDC fasteners: set screws
774	-	6886, 6887	Taper keys with gip head	8676	-	961	Hexagon head screws FT	898 -6	-	267 - 23	TDC fasteners: nuts FT
1051	-	660	Rivet, rivet pins	8733	-	7979	Parallel pins, internal thread	898 -7	-	267 - 25	Torsional test M1-M10
1207	-	84	Slotted cheese head screws	8734	-	6325	Parallel pins, hardened	1051	-	101	Rivets: technical specifications
1234	-	94	Split pins	8735	-	7979	Parallel pins, internal thread	1101	-	7184	Tolerances of form/position
1479	-	7976	Hexagon head tapping screws	8736	28736	7978	Taper pins, internal thread	1891	-	918	Fasteners - terminology
1481	-	7971	Pan head tapping screws	8737	28737	7977, 258	Taper pins CD thread	2320	-	267 - 15	TDC fasteners: locking nuts
1482	-	7972	Csk. head tapping screws	8738	28738	1440	Washers for clevis pins	2702	-	267 - 12	TDC fasteners: tapping screws
1483	-	7973	Rcsk. head tapping screws	8739	-	1470	Grooved pins	2768 -1...2	-	7168 - 1, 2	General tolerances
1580	-	85	Pan head screws	8740	-	1473	Grooved pins with chmafer	2859	-	40080	Sampling plans
2009	-	963	Countersunk head screws	8741	-	1474	Grooved pins	3269	-	267 - 5	TDC fasteners: acceptance inspection
2010	-	964	Rcsk. head screws	8742	-	1475	Grooved pins	3506 -1...4	-	267 - 11	TDC fasteners: stainless steel
2338	-	7	Parallel pins	8743	28743	1475	Grooved pins	3508	-	76 - 1	Thread runouts/undercuts
2339	22339	1	Taper pins	8744	-	1471	Grooved pins	4042	-	267 - 9	TDC fasteners: electroplated coatings
2340	22340	1443	Clevis pins without head	8745	-	1472	Grooved pins	4753	-	78	Thread ends/protrusions
2341	22341	1444	Clevis pins with head	8746	-	1476	Round head grooved pins	4755	-	76 - 1	Thread runouts/undercuts
2342	-	427	Headless screws	8747	-	1477	Grooved pins with csk. head	4757	-	7962	Cross recess for screws
2491	-	6885 -3	Parallel keys	8748	-	7344	Spring-type straight pins H	4759 -1...3	-	267 - 2, 6, 522	Tolerances for fasteners
2492	-	6883, 6884	Gib head/parallel keys	8750	-	7343	Spring-type straight pins S	6157 -1...3	-	267 - 19	Surface discontinuities, bolts
2936	-	911	Hexagon socket screw keys	8751	-	7343	Spring-type straight pins L	6157 -2	(493)	267 - 20, 21	Surface discontinuities, nuts
3912	-	6888	Woodruff Keys	8752	-	1481	Spring pins H	7085/7500-1	-	-	Thread rolling screws
4014	-	931 -1	Hexagon head bolts	8765	-	960	Hexagon head bolts FT	7378	-	962	Split pin holes/wire holes
4016	-	601	Hexagon head bolts	10509	-	6928	Hex. flange head tapping screws	7721	-	-	Csk. head screws: configuration
4017	-	933	Hexagon head screws	10510	-	6901	Tapping screws	8749	-	-	Determ. of shear strength of pins
4018	-	558	Hexagon head screws	10511	-	985	Hexagon, thin locking nuts	8839	28839	267 - 18	TDC fasteners: non-ferrous metal
4026	-	913	Hexagon socket set screws CH	10512	-	982, 6924	Hexagon locking nuts	8991	-	962	Designation system for fasteners
4027	-	914	Hexagon socket set screws TC	10513	-	980, 6925	Hexagon locking nuts	8992	-	267 - 1	TDC fasteners: general requirements
4028	-	915	Hexagon socket set screws CD	10642	-	7991	Hex. socket csk. head screws	-	10204	50049	Certificates
4029	-	916	Hexagon socket set screws CP	10644	-	6900	Screw and washer assemblies	10484	(493)	267 - 21	Widening test on nuts
4032	-	934	Hexagon nuts CT	10663	1661	6923	Hexagon nuts with flange FT	10644	-	6900-1	Screw/washer ass. hardness cl.
4033	-	934	Hexagon nuts II CT	10666	-	7504	Drilling screws with tapping screw thread	10664	-	-	Hexalobular socket
4034	-	555	Hexagon nuts	10669/10673	-	6903/6902	Washers for assemblies	10666	-	7504	MP drilling screws
4035	-	439 -2, 936	Hexagon thin nuts (chamfered)	12125	-	6926	Hexagon locking nuts with flange	10683	-	-	Zinc flake coatings
4036	-	439 -1	Hexagon thin nuts (unchamfered)	12126	-	6927	Hexagon locking nuts with flange	10684	-	267-10	Hot dip galvanized coatings
4161	1661	6923	Hexagon nuts with flange	12474	-	912 (FG)	Hex. socket head cap screws FT	12683	-	-	Mechanical zinc coatings
4162	1662, 1665	6922	Hexagon bolts with flange	13337	-	7346	Spring-type straight pins L	-	13811	-	Sherardizing
4762	-	912	Hexagon socket head cap screws	13918	-	32500	Welding studs for stud welding	15065	-	66	Countersinking
4766	24766	551	Set screws CR	14579...587	-	-	Hex. socket head cap screws	15330	-	-	Hydrogen embrittlement
4775	780, 783	6915	Hexagon nuts (HV)	14588, 14589	-	7337	Blind rivets, terms	16047	-	946	Torque/clamp force testing
7040, 7041	-	982, 6924	Prevailing torque type hex. nuts	15071...073	-	-	Hex. bolts with flange, small S	16048	-	-	Passivation of stainless-steel
7042	-	980, 6925	Prevailing torque type hex. nuts	15480...483	-	7504	Drilling screws	16426	-	-	Fasteners QA system
7043	1663/1666	6926	Hexagon locking nuts with flange	15973...986	-	7337	Blind rivets	-	-	-	-
7044	1664/1667	6927	Hexagon locking nuts with flange	16582 - 585	-	7337	Blind rivets	-	-	-	-
7045	-	7985	Raised cheese head screws CR	21269	-	-	Hex. socket head cap screws FT	-	-	-	-
7046 -1, 2	-	965	Countersunk head screws CR	21670	-	977	Hexagon weld nuts with flange	-	-	-	-
7047	-	966	Rcsk. head screws CR	68	-	13 T 19	Metric screw threads - profile	-	-	-	-
7048	-	-	Cheese head screws CR	228 -1...3	-	259 -1...3	Vw head cap pipe thread G	-	-	-	-
7049	-	7981	Pan head tapping screws CR	261	-	13-12	Selection of pitch threads CT/FT	-	-	-	-
7050	-	7982	Csk. head tapping screws CR	262	-	13-13	Thread selection series	-	-	-	-
7051	-	7983	Raised countersunk head	724	-	13	ISO thread: Basic dimensions	-	-	-	-
7053	-	6928	Hex. washer head tapping screws	965 -1...5	-	13-13...15.27	Metric threads, data/principles	-	-	-	-
7089	-	125 -1.2	Washers, grade A	1478	-	7970	Tapping screws thread	-	-	-	-
7090	-	125 -1, 2	Washers, grade B	1502	-	13-16...18	Thread gauges	-	-	-	-
7091	-	126	Washers, standard design	2901-2904	-	103-1...4	Trapezoidal thread	-	-	-	-
7092	-	433 -1, 2	Washers, small series	5408	-	2244	Thread: Terms	-	-	-	-
7093 -1, 2	-	9021	Washers, large series	6410 -1...3	-	27	Threads description in drawing	-	-	-	-
7094	-	440	Washers, extra large	-	-	-	-	-	-	-	-

Standard types, relations, publishers:

DIN	National German standard (Deutsches Institut für Normung). DIN standards shall still be given for the products/services for which there are no ISO/EN standards and no standardisation necessity.
ISO	International Standardization Organisation
DIN ISO	National German issue of an unmodified, adopted ISO standard
EN	European Norm (CEN = Comité Européen de Normalisation). In general, existing ISO standards should be adopted as EN standards with the ISO standard number → EN ISO. If this does not happen at European standards levels, independent EN standards shall be generated with EN standard numbers which are different to those of the ISO.
DIN EN	National German issue of an unmodified, adopted EN standard. According to the resolution of the European Council, EN standards are to be adopted unmodified and immediately by the EU member states and the corresponding national standards are to be withdrawn.
EN ISO	European standard issue which was adopted unmodified by ISO (EN and ISO standard numbers are identical – the earlier practice of "ISO number + 20,000" has not been in use since Jan. 95. Standards still in use according to this mode are to be converted accordingly). The description is carried out according to ISO.
DIN EN ISO	National German issue of an unchanged EN standard adopted by ISO. The article naming is done according to ISO.

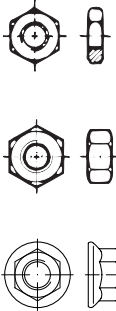
Publisher and author of the standards for "Mechanical fasteners" is the German National Standards Organisation (DIN – Deutsches Institut für Normung e.V.), Berlin, www.fmv.din.de. Reference to the standards sheets from Beuth Verlag GmbH, Burggrafenstrasse 6, 10787 Berlin, www.beuth.de, Fax +030 2601-1260

Table 3: Overview of standards conversion DIN → ISO/EN – Screws/bolts with drive, set screws, screws/bolts without drive

Article group	DIN	→ ISO/EN	Dimension range	Changes	Labelling ①	
1. Screws/bolts with ISO/EN standards 	558 931 933 960 961	ISO 4018 ISO 4014 ISO 4017 ISO 8765 ISO 8676	M 10, 12, 14, 22	new ISO wrench sizes	ISO standard numbers	
	601 Nut with nut DIN 555	ISO 4016 Nut with nut ISO 4034	all other Ø	none = DIN and ISO identical	1. ISO standard numbers 2. DIN standard numbers	
			M 10, 12, 14, 22	screws: new ISO wrench sizes nuts: new wrench size acc. to ISO + ISO heights	ISO standard numbers	
			other Ø up to M 39	screws: none = DIN and ISO identical nuts: new ISO heights	1. ISO standard numbers 2. DIN standard numbers	
	other Ø greater than M 39	none = DIN and ISO identical				
	6914 7999	EN 14399-4 EN 14399-8	all Ø	modified calculation of clamping length lubrication	EN standards numbers	
	912	ISO 4762 (RG) ISO 12474 (FG)	all Ø	none	1. ISO standard numbers 2. DIN standard numbers	
	6921	EN 1665 (EN 1662 – leichte Reihe)	all Ø	marginally increased head heights and wrenching height, property class 12.9 discontinued	ISO standard numbers	
			≥ Ø M 10	new ISO wrench sizes		
	7991	ISO 10642	M 22, M 24	dimensions discontinued		
			all other Ø	modified head heights + head Ø-adjusted shaft lengths	ISO standard numbers	
2. Set screws with ISO/EN standards 	913	ISO 4026	all Ø	none	1. ISO standard numbers 2. DIN standard numbers	
	914	ISO 4027				
	915	ISO 4028				
	916	ISO 4029				
	551	ISO 4766				
	553	ISO 7434				
3. Hexagon head screws without ISO/EN standards 	561 564	– –	Ø M 12, 16	new ISO wrench sizes	DIN standard numbers + wrench size specifications	
	609 ~ 610	– –	all other Ø	none	DIN standard numbers	
			Ø M 10, 12, 14, 22	new ISO wrench sizes	DIN standard numbers + wrench size specification	
			all other Ø	none	DIN standard numbers	
		7968 Nut 7990 Nut with nut DIN 555	screw: – with nut ISO 4034	M 12, (22)	screws: new ISO wrench sizes nuts: new ISO-SW + ISO heights	DIN standard numbers + wrench size specification
				all other Ø	screws: none nuts: new ISO heights	DIN standard numbers
4. Screws/bolts without drive and without ISO/EN standards – with hexagonal nuts with ISO/EN standards 	186/261 Nut 525 Nut 529 Nut 603 Nut 604 Nut 605 Nut 607 Nut 608 Nut 7969 Nut 11014 Nut with nut DIN 555	screw: – with nut ISO 4034	Ø M 10, 12, 14, 22	screws: none nuts: new wrench size acc. to ISO + ISO heights	DIN standard numbers + wrench size specifications	
			all other Ø	screws: none nuts: new ISO heights	DIN standard numbers	

① Labelling with ISO and DIN standard numbers are valid for the transition period, later only the ISO standard number will apply.

Table 4: Overview standards conversion DIN → ISO/EN – Hexagon/square nuts
– Hexagon nuts with prevailing torque element

Article group	DIN →	ISO/EN	Dimension range ①	Changes ①	Labelling ②		
1. Hexagon nuts with ISO/EN standards ①		439-1 (A = without chamfer)	ISO 4036 ISO 4035 = coarse pitch thread	Ø M 10, 12, 14, 22	new ISO wrench sizes (minor height change)	ISO standard numbers	
		439-2 (B = with chamfer)	ISO 8675 = fine pitch thread	all other Ø	none = DIN and ISO identical (minor height change)	1. ISO standard numbers 2. DIN standard numbers	
		555	ISO 4034 (ISO-Typ 1)	Ø M 10, 12, 14, 22	new ISO wrench sizes + new ISO heights	ISO standard number	
		934 Fkl. 6, 8, 10	ISO 4032 = coarse pitch thread (ISO-Typ 1)	other Ø M 5 – M 39	new ISO heights (no wrench sizes change)		
		Fkl. 12	ISO 4033 = coarse pitch thread (ISO-Typ 2)				
	6915	EN 14399-4	all Ø	without coating = lubricated	1. ISO standard number 2. DIN standard numbers		
	6923	EN 1661	Ø M 10	new ISO – wrench sizes	EN standard number		
			other Ø	none = DIN and EN identical	1. EN standard no. 2. DIN standard no.		
	2. Hexagon nuts with prevailing torque element, with ISO/EN standards ①		980 6925	ISO 7042 = coarse pitch thread	Ø M 10, 12, 14, 22	new ISO wrench sizes (DIN 6925 already includes the new ISO wrench sizes) changed nut heights larger wrenching height	ISO standard numbers
				ISO 10513 = fine pitch thread	other Ø	changed nut heights larger wrenching height	ISO standard numbers
982			DIN 6924	Ø M 10, 12, 14, 22	new ISO wrench sizes changed nut heights		
				other Ø	changed nut heights		
6924			ISO 7040 = coarse pitch thread ISO 10512 = fine pitch thread	all Ø	greater tolerance range for nut heights (DIN↔ISO exchangeable)	1. ISO standard number 2. DIN standard numbers	
985		ISO 10511	Ø M 10, 12, 14,	new ISO wrench sizes	ISO standard numbers		
			other Ø	reduced nut heights	ISO standard numbers		
		6926	EN 1663 = coarse pitch thread EN 1666 = fine pitch thread	Ø M 10	new ISO wrench sizes	EN-standard numbers	
				other Ø	none (DIN ↔ EN exchangeable)	1. EN-standard numbers 2. DIN standard numbers	
		6927	EN 1664 = coarse pitch thread EN 1667 = fine pitch thread	Ø M 10	new ISO wrench sizes	EN-standard numbers	
	other Ø			none (DIN ↔ EN exchangeable)	1. EN-standard numbers 2. DIN standard numbers		
3. Nuts without ISO/EN standards		— — — —	Ø M 10, 12, 14, 22	new ISO wrench sizes	DIN standard numbers + wrench size specifications		
			all other Ø	other	DIN standard numbers		

① Comparison of wrench sizes and nut heights DIN : ISO and classification of standards, mechanical properties for steel nuts, see Table 5

② Labelling with ISO and DIN standard numbers are valid for the transition period, later only the ISO standard number will apply.

Table 5: Comparison DIN : ISO

– Wrench sizes for screws and nuts with standard wrench sizes
– Nut heights

Nominal size d	Wrench size s		Nut height m min. – max.				
(sizes to be avoided as much as possible)	DIN	ISO	DIN 555	DIN 4034 ISO-Typ 1	DIN 934	ISO 4032 (RG) 8673 (FG) ISO-Typ 1	ISO 4033 (RG) ISO-Typ 2
M 1	2.5		–	–	0.55 – 0.8	–	–
M 1, 2	3		–	–	0.75 – 1	–	–
M 1, 4	3		–	–	0.95 – 1.2	–	–
M 1, 6	3.2		–	–	1.05 – 1.3	1.05 – 1.3	–
M 2	4		–	–	1.35 – 1.6	1.35 – 1.6	–
M 2.5	5		–	–	1.75 – 2	1.75 – 2	–
M 3	5.5		–	–	2.15 – 2.4	2.15 – 2.4	–
(M 3.5)	6		–	–	2.55 – 2.8	2.55 – 2.8	–
M 4	7		–	–	2.9 – 3.2	2.9 – 3.2	–
M 5	8		3.4 – 4.6	4.4 – 5.6	3.7 – 4	4.4 – 4.7	4.8 – 5.1
M 6	10		4.4 – 5.6	4.6 – 6.1	4.7 – 5	4.9 – 5.2	5.4 – 5.7
(M 7)	11		–	–	5.2 – 5.5	–	–
M 8	13		5.75 – 7.25	6.4 – 7.9	6.14 – 6.5	6.44 – 6.8	7.14 – 7.5
M 10	17	16	7.25 – 8.75	8 – 9.5	7.64 – 8	8.04 – 8.4	8.94 – 9.3
M 12	19	18	9.25 – 10.75	10.4 – 12.2	9.64 – 10	10.37 – 10.8	11.75 – 12
(M 14)	22	21	–	12.1 – 13.9	10.3 – 11	12.1 – 12.8	13.4 – 14.1
M 16	24		12.1 – 13.9	14.1 – 15.9	12.3 – 13	14.1 – 14.8	15.7 – 16.4
(M 18)	27		–	15.1 – 16.9	14.3 – 15	15.1 – 15.8	–
M 20	30		15.1 – 16.9	16.9 – 19	14.9 – 16	16.9 – 18	19 – 20.3
(M 22)	32	34	17.1 – 18.9	18.1 – 20.2	16.9 – 18	18.1 – 19.4	–
M 24	36		17.95 – 20.05	20.2 – 22.3	17.7 – 19	20.2 – 21.5	22.6 – 23.9
(M 27)	41		20.95 – 23.05	22.6 – 24.7	20.7 – 22	22.5 – 23.8	–
M 30	46		22.95 – 25.05	24.3 – 26.4	22.7 – 24	24.3 – 25.6	27.3 – 28.6
(M 33)	50		24.95 – 27.05	27.4 – 29.5	24.7 – 26	27.4 – 28.7	–
M 36	55		27.95 – 30.05	28 – 31.5	27.4 – 29	29.4 – 31	33.1 – 34.7
(M 39)	60		29.75 – 32.25	31.8 – 34.3	29.4 – 31	31.8 – 33.4	–
M 42	65		32.75 – 35.25	32.4 – 34.9	32.4 – 34	32.4 – 34	–
(M 45)	70		34.75 – 37.25	34.4 – 36.9	34.4 – 36	34.4 – 36	–
M 48	75		36.75 – 39.25	36.4 – 38.9	36.4 – 38	36.4 – 38	–
(M 52)	80		40.75 – 43.25	40.4 – 42.9	40.4 – 42	40.4 – 42	–
M 56	85		43.75 – 46.25	43.4 – 45.9	43.4 – 45	43.4 – 45	–
(M 60)	90		46.75 – 49.25	46.4 – 48.9	46.4 – 48	46.4 – 48	–
M 64	95		49.5 – 52.5	49.4 – 52.4	49.1 – 51	49.1 – 51	–
Nut height factor			≤ M 4	–	–	0.8	–
			M 5 – M 39	0.8	0.83 – 1.12	0.84 – 0.93	0.93 – 1.03
			≥ M 42	–	~ 0.8	0.8	–
Product class			C (coarse)		≤ M 16 = A (medium) > M 16 = B (medium coarse)		
Thread tolerance			7 H		6 H		
Property class Steel			5 (M 16 < d ≤ M 39 = 4.5)		6, 8, 10 (ISO 8673 = Fkl. 10 ≤ M 16)		12 (9 – 12)
			≥ M 39		to be agreed upon		–
Mechanical properties according to standard			DIN 267-4	ISO 898-2	DIN 267-4	ISO 898-2 (RG) -6 (FG)	ISO 898-2

Notes: ISO 4032 = also replacement for DIN 970 – RG = Coarse pitch thread ISO 4034 = also replacement for DIN 972
ISO 8673 = also replacement for DIN 971-1 – FG = Fine pitch thread ISO 4033 = also replacement for DIN 971-2 (fine pitch thread → ISO 8674)


Table 6: Comparison DIN : ISO – Nuts with prevailing torque element according to DIN 980, DIN 6925, ISO 7042, ISO 10513

Nominal size d	Wrench size s		Nut height h min. – max.		Minimum wrenching height m'/m _w	
(sizes to be avoided as much as possible)	DIN 980	DIN 6925 ISO 7042 ISO 10513	DIN 980 DIN 6925	ISO 7042 ISO 10513	DIN 980 DIN 6925	ISO 7042 ISO 10513
M 3	5.5		3.4 – 3.7	–	1,65	–
M 4	7		3.9 – 4.2	–	2,2	–
M 5	8		4.8 – 5.1	4.8 – 5.1	2,75	3,52
M 6	10		5.7 – 6.0	5.4 – 6.0	3,3	3,92
(M 7)	11		6.5 – 7.0	–	3,85	–
M 8	13		7.5 – 8.0	7.14 – 8.00	4,4	5,15
M 10	17	16	9 – 10	8.94 – 10.0	5,5	6,43
M 12	19	18	11 – 12	11.57 – 12.00	6,6	8,30
(M 14)	22	21	12 – 14	13.4 – 14.1	7,7	9,68
M 16	24		14 – 16	15.7 – 16.4	8,8	11,28
(M 18)	27		16 – 18	–	9,9	–
M 20	30		18 – 20	19.0 – 20.3	11	13,52
(M 22)	32	–	20 – 22	–	12,2	–
M 24	36		22 – 24	22.6 – 23.9	13,2	16,16
(M 27)	41		25 – 27	–	14,8	–
M 30	46		28 – 30	27.3 – 30.0	16,5	19,44
(M 33)	50		31 – 33	–	18,2	–
M 36	55		34 – 36	33.1 – 36.1	19,8	23,52
(M 39)	60		37 – 39	–	21,5	–

Table 7: Comparison DIN : ISO – Nuts with prevailing torque element according to DIN 982, DIN 6924, ISO 7040, ISO 10512

Nominal size d	Wrench size s		Nut height h min. – max.			Minimum wrenching height m'/m _w	
(sizes to be avoided as much as possible)	DIN 982	DIN 6924 ISO 7040 ISO 10512	DIN 982	DIN 6924	ISO 7040 ISO 10512	DIN 982 DIN 6924	ISO 7040 ISO 10512
M 3	5.5		–	4.2 – 4.5	4.02 – 4.50	1,72	1,72
M 4	7		–	5.7 – 6.0	5.52 – 6.00	2,32	2,32
M 5	8		6.00 – 6.30	6.44 – 6.80	6.22 – 6.80	3,52	3,52
M 6	10		7.70 – 8.00	7.64 – 8.00	7.42 – 8.00	3,92	3,92
(M 7)	11		8.20 – 8.50	8.64 – 9.00	–	4,91	–
M 8	13		9.14 – 9.50	9.14 – 9.50	8.92 – 9.50	5,15	5,15
M 10	17	16	11.14 – 11.50	11.14 – 11.90	11.2 – 11.9	6,43	9,43
M 12	19	18	13.64 – 14.00	14.47 – 14.90	14.2 – 14.9	8,30	8,3
(M 14)	22	21	15.3 – 16.0	16.3 – 17.0	15.9 – 17.0	9,68	9,68
M 16	24		17.3 – 18.0	18.26 – 19.10	17.8 – 19.1	11,28	11,28
(M 18)	27		19.16 – 20.00	19.76 – 20.60	–	12,08	–
M 20	30		20.7 – 22.0	21.5 – 22.8	20.7 – 22.8	13,52	13,52
(M 22)	32	34	23.7 – 25.0	23.2 – 24.5	–	14,48	–
M 24	36		26.7 – 28.0	25.8 – 27.1	25.0 – 27.1	16,16	16,16
(M 27)	41		–	29.4 – 31.0	–	18,00	–
M 30	46		–	31.0 – 32.6	30.1 – 32.6	19,44	19,44
(M 33)	50		–	33.9 – 35.5	–	21,92	–
M 36	55		–	37.3 – 38.9	36.4 – 38.9	23,52	23,52
(M 39)	60		–	40.4 – 42.0	–	25,44	–
M 42	65		–	43.4 – 45.0	–	27,20	–
(M 45)	70		–	46.4 – 48.0	–	28,80	–
M 48	75		–	48.4 – 50.0	–	30,40	–

Table 8: Comparison DIN : ISO – Nuts with prevailing torque element according to DIN 985, ISO 10511

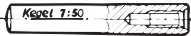
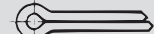
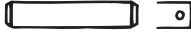
Nominal size d	Wrench size s		Nut height h min. – max.		Minimum wrenching height m'/m _w	
(sizes to be avoided as much as possible)	DIN 985	ISO 10511	DIN 985	ISO 10511	DIN 985	ISO 10511
M 3	5,5		3.7 – 4.0	3.42 – 3.90	1,65	1,24
M 4	7		4.7 – 5.0	4.52 – 5.00	2,2	1,56
M 5	8		4.7 – 5.0	4.52 – 5.00	2,75	1,96
M 6	10		5.7 – 6.0	5.52 – 6.00	3,3	2,32
(M 7)	11		7.14 – 7.50	–	3,85	–
M 8	13		7.64 – 8.00	6.18 – 6.76	4,4	2,96
M 10	17	16	9.64 – 10.0	7.98 – 8.56	5,5	3,76
M 12	19	18	11.57 – 12.00	9.53 – 10.23	6,6	4,56
(M 14)	22	21	13.3 – 14.0	10.22 – 11.32	7,7	5,14
M 16	24		15.3 – 16.0	11.32 – 12.42	8,8	5,94
(M 18)	27		17.66 – 18.50	–	9,9	–
M 20	30		18.7 – 20.0	13.1 – 14.9	11	7,28
(M 22)	32	34	20.7 – 22.0	–	12,2	–
M 24	36		22.7 – 24.0	16.0 – 17.8	13,2	8,72
(M 27)	41		25.7 – 27.0	–	14,8	–
M 30	46		28.7 – 30.0	20.1 – 22.2	16,5	11,12
(M 33)	50		31.4 – 33.0	–	18,2	–
M 36	55		34.4 – 36.0	23.4 – 25.5	19,8	13,52
(M 39)	60		37.4 – 39.0	–	21,5	–
M 42	65		40.4 – 42.0	–	23,1	–
(M 45)	70		43.4 – 45.0	–	24,8	–
M 48	75		46.4 – 48.0	–	26,5	–

Overview of standards conversion DIN → ISO: Bolts, pins, washers for bolts

The most important changes are listed in Table 9. For some articles, the DIN and ISO versions are identical or the minor changes are hardly relevant to the function at all so that exchangeability is possible.

The conversion is done in an appropriate transition time according to the availability from manufacturing or according to the customer's wishes. Further information on request.

Table 9

Article group	DIN	ISO DIN ISO DIN EN ISO	The most important changes
Taper pins, Parallel pins			
	1	2339	length l new according to ISO incl. round end (previously according to DIN excl. round end)
	7	2338	length l new according to ISO incl. round end (previously according to DIN excl. round end) types: A, B, C (type A/tol. m6 new with chamfer/round end)
	6325	8734	new: type A with chamfer/round end, fully hardened (for the most part identical with DIN 6325) type B with chamfer, case hardened
	7977 7978	8737 8736	no serious changes
	7979/D	8733 8735	DIN 7979/C ~ ISO 8733 [unhardened] DIN 7979/D ~ ISO 8735/A [fully hardened] lower hardness for ISO
Grooved pins			
	1470 1471 1472 1473 1474 1475	8739 8744 8745 8740 8741 8742	length l new according to ISO incl. round end (previously according to DIN excl. round end)
	–	8743	new: grooved pins, half-length centre grooved
	1476 1477	8746 8747	type A = no serious changes additional: type B with pilot end
Spring-type straight pin			
	1481	8752	regular finish to Ø of ≤ 8 mm with 2 chamfers (previously to a Ø of ≤ 6 mm)
	7343 7344 7346	8750 8748 13337	no serious changes
	– –	8749 8751	new: pins, grooved pins: shear test new: spring-types straight pin, light duty
Split pins			
	94	1234	no serious changes
Clevis pins,			
	1443 1444	2340 2341	} partially other nominal lengths length tolerances changed
	1433 1434 1435 1436	– – – –	these DIN standards were withdrawn ISO standards are not planned
Washers for pins			
	1440	8738	some outer Ø and thicknesses changed (in general not in danger of being replaced)
	1441	–	no ISO standard planned



Overview of standards conversion DIN → ISO: Thread screws and tapping screws

ISO standards for thread screws and tapping screws include the following changes different to DIN standards:

- new countersunk angle for tapping screws with countersunk/raised countersunk head = 90° according to DIN 66/ISO 7721 (previously 80°)
- tapping screws: cancellation of diameter ST 3.9
- partial changes to the head dimensions

The tables show the standard numbers change DIN : ISO (Tab. 10) and head dimension changes DIN : ISO (Tab. 11–13)

Table 10: Standard numbers change DIN : ISO

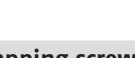
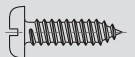
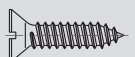
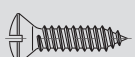
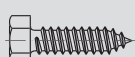
Article group	DIN	ISO	The most important changes
Thread screws	84	1207	no serious changes
	85	1580	no serious changes
	963	2009	minor differences in head height and head diameter (see Table 11)
	964	2010	
	965	7046-1, -2	
	966	7047	
	7985	7045	no serious changes
Tapping screws	7971	1481	no serious changes
	7972	1482	changed countersunk angle (DIN = 80° : ISO = 90°)
	7973	1483	minor differences in head height and head diameter (see Table 12)
	7976	1479	minor differences in the head height – no risk of being replaced (see Table 13)
	7981	7049	no serious changes
	7982	7050	changed countersunk angle (DIN = 80° : ISO = 90°)
	7983	7051	minor differences in head height and head diameter (see Table 12)

Table 11: Slotted and cross recessed countersunk head screws with metric thread

 		Metric screws ISO 2009, 2010, 7046, 7047 DIN 963, 964, 965, 966										
	Thread	M 1.6	M 2	M 2.5	M 3	M 3.5	M 4	M 5	M 6	M 8	M 10	
max. Diameter of head	ISO (new)	3	3.8	4.7	5.5	7.3	8.4	9.3	11.3	15.8	18.3	
	DIN (old)	3	3.8	4.7	5.6	6.5	7.5	9.2	11	14.5	18	
max. Head height	ISO (new)	1	1.2	1.5	1.65	2.35	2.7	2.7	3.3	4.65	5	
	DIN (old)	0.96	1.2	1.5	1.65	1.93	2.2	2.5	3	4	5	

Table 12: Countersunk head tapping screws

		Tapping screws ISO 1482, 1483, 7050, 7051 (α = 90°) DIN 7972, 7973, 7982, 7983 (α = 80°)									
		ST 2.2	ST 2.9	ST 3.5	ST 3.9	ST 4.2	ST 4.8	ST 5.5	ST 6.3	ST 8	ST 9.5
max. Diameter of head	ISO (new)	3.8	5.5	7.3	–	8.4	9.3	10.3	11.3	15.8	18.3
	DIN (old)	4.3	5.5	6.8	7.5	8.1	9.5	10.8	12.4	–	–
max. Head height	ISO (new)	1.1	1.7	2.35	–	2.6	2.8	3	3.15	4.65	5.25
	DIN (old)	1.3	1.7	2.1	2.3	2.5	3	3.4	3.8	–	–

Note on countersunk head screws with metric threading

When countersinking according to ISO 15065 (for ISO countersunk heads) screws can also be used according to DIN 963 – 966.

These merely lie a little deeper in the countersink.

If the countersink is executed according to the withdrawn DIN 74-1:1980, a protrusion may, under certain circumstances, be visible when using ISO countersunk heads above the component part (especially with the diameters M 3.5, M 4 and M 8).

Table 13: Hexagon head tapping screws

		Tapping screws ISO 1479 DIN 7976									
Thread		ST 2.2	ST 2.9	ST 3.5	(ST 3.9)	ST 4.2	ST 4.8	(ST 5.5)	ST 6.3	ST 8	ST 9.5
max. head height	ISO (new)	1.6	2.3	2.6	–	3	3.8	4.1	4.7	6	7.5
	DIN (old)	1.42	1.62	2.42	2.42	2.92	3.12	4.15	4.95	5.95	–



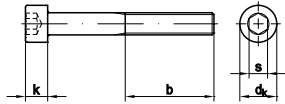
Hexagon and hexalobular socket screws

ISO 4762, 12474

similar DIN 912

Hexagon socket head cap screws

ISO 12474 with metric fine pitch thread



Dimensions	M 1.4	M 1.6	M 2	M 2.5	M 3	M 4	M 5	M 6	M 8	M 10
d _k	2.6	3	3.8	4.5	5.5	7	8.5	10	13	16
k	1.4	1.6	2	2.5	3	4	5	6	8	10
s	1.3	1.5	1.5	2	2.5	3	4	5	6	8
b	14	15	16	17	18	20	22	24	28	32

Dimensions	M 12	M 14	M 16	M 18	M 20	M 22	M 24	M 27	M 30	M 33
d _k	18	21	24	27	30	33	36	40	45	50
k	12	14	16	18	20	22	24	27	30	33
s	10	12	14	14	17	17	19	19	22	24
b	36	40	44	48	52	56	60	66	72	78

Dimensions	M 36	M 39	M 42	M 45	M 48	M 52*	M 56	M 64	M 72	
d _k	54	58	63	68	72	78	84	96	108	
k	36	39	42	45	48	52	56	64	72	
s	27	27	32	36	36	36	41	46	55	
b	84	90	96	102	108	116	124	140	156	

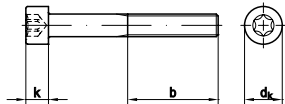
*not standardized, reference values

Dimensions in stock:

Steel/Steel coated: 270, 370, 110 | Stainless steel: 513, 450

ISO 14579

Hexalobular socket head cap screws



Dimensions	M 2	M 2.5	M 3	M 4	M 5	M 6	M 8
d _k	3.8	4.5	5.5	7	8.5	10	13
k	2	2.5	3	4	5	6	8
ISR	T6	T8	T10	T20	T25	T30	T45
b	16	17	18	20	22	24	28

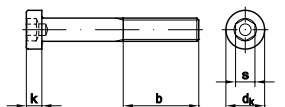
Dimensions	M 10	M 12	M 14	M 16	M 18	M 20	
d _k	16	18	21	24	27	30	
k	10	12	14	16	18	20	
ISR	T50	T55	T60	T70	T80	T90	
b	32	36	40	44	48	52	

Dimensions in stock:

Steel/Steel coated: 380

DIN 6912

Hexagon socket head cap screws,
low head, with centre



Dimensions	M 4	M 5	M 6	M 8	M 10	M 12	M 14
d _k	7	8.5	10	13	16	18	21
k	2.8	3.5	4	5	6.5	7.5	8.5
s	3	4	5	6	8	10	12
b ¹	14	16	18	22	26	30	34
b ²	–	–	–	–	32	36	40
b ³	–	–	–	–	–	–	–

Dimensions	M 16	M 20	M 22	M 24	M 30	M 36	
d _k	24	30	33	36	45	54	
k	10	12	13	14	17.5	21.5	
s	14	17	17	19	22	27	
b ¹	38	46	50	54	66	78	
b ²	44	52	56	60	72	84	
b ³	57	65	69	73	85	97	

b¹ for l ≤ 125 mm

b² for 125 mm

b³ for l > 200mm

Dimensions in stock:

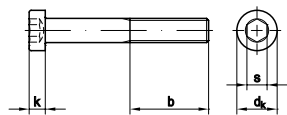
Steel/Steel coated: 298 | Stainless steel: 521



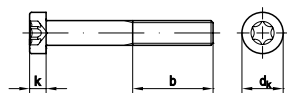
Hexagon and hexalobular socket screws

DIN 7984

Hexagon or hexalobular socket head cap screws with low head



with hexagon socket



with hexalobular socket
~ISO 14580

b¹ for l ≤ 125 mm
b² for l ≤ 200 mm
b³ for l > 200 mm

Dimensions	M 3	M 4	M 5	M 6	M 8
d _k	5.5	7	8.5	10	13
k	2	2.5	3.5	4	5
s	2	2.5	3	4	5
ISR size	T10	T20	T25	T30	T40
b ¹	12	14	16	18	22
b ²	–	–	–	–	28
b ³	–	–	–	–	–

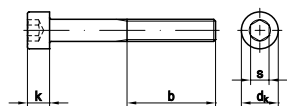
Dimensions	M 10	M 12	M 16	M 20	M 24
d _k	16	18	24	30	36
k	6	7	9	11	13
s	7	8	12	14	17
ISR size	T50	–	–	–	–
b ¹	26	30	38	46	54
b ²	32	36	44	52	60
b ³	–	–	57	65	73

Dimensions in stock:

Steel/Steel coated: 340 | Stainless steel: 540

ASME B 18.3

Hexagon socket head cap screws*
with unified inch thread



all dimensions in inches

*acc. to ASME B 18.3: 2003 table 1A

Dimensions	#2	#4	#5	#6	#8	#10	1/4	5/16
d	0.086	0.112	0.125	0.138	0.164	0.190	0.250	0.3125
d _k	0.140	0.183	0.205	0.226	0.270	0.312	0.375	0.469
k	0.086	0.112	0.125	0.138	0.164	0.190	0.250	0.312
s	5/64	3/32	3/32	7/64	9/64	5/32	3/16	1/4
b	0.62	0.75	0.75	0.75	0.88	0.88	1.00	1.12

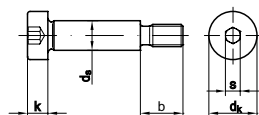
Dimensions	3/8	1/2	5/8	7/8	1	1 1/4	1 1/2	
d	0.375	0.500	0.625	0.875	1.000	1.250	1.500	
d _k	0.562	0.750	0.938	1.312	1.500	1.875	1.250	
k	0.375	0.500	0.625	0.875	1.000	1.250	1.500	
s	5/16	3/8	1/2	3/4	3/4	7/8	1	
b	1.25	1.50	1.75	2.25	2.50	3.12	3.75	

Dimensions in stock:

Steel/Steel coated: 390

ISO 7379

Hexagon socket head shoulder screws



*adjusting shank tolerance:

• steel h8 or f9

• stainless steel f9

**on stock Ø12, standard value Ø13

***not standardized dimensions

Dimensions	M 5	M 6	M 8
d _k	10	13	16
d _s *	6***	8	10
k	4.5	5.5	7
s	3	4	5
b	9.75	11.25	13.25

Dimensions	M 10	M 12	M 16
d _k	18	24	30
d _s *	12**/13	16	20
k	9	11	14
s	6	8	10
b	16.4	18.4	22.4

Dimensions in stock:

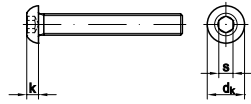
Steel/Steel coated: 322 | Stainless steel: 534



Hexagon and hexalobular socket screws

ISO 7380 -1/-2

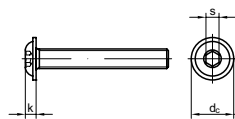
Hexagon or hexalobular socket button head screws



ISO 7380-1 with hexagon socket



ISO 7380-1 with hexalobular socket



ISO 7380-2 with hexagon socket and collar

Dimensions	M 3	M 4	M 5	M 6
d_k	5.7	7.6	9.5	10.5
d_c	6.9	9.4	11.8	13.6
k	1.65	2.2	2.75	3.3
s	2	2.5	3	4
ISR	T10	T20	T25	T30

Dimensions	M 8	M 10	M 12	M 16
d_k	14	17.5	21	28
d_c	17.8	21.9	26	-
k	4.4	5.5	6.6	8.8
s	5	6	8	10
ISR	T40	T50	T50	-

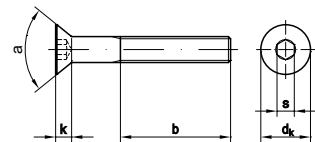
Dimensions in stock:

Steel/Steel coated: 322 | Stainless steel: 534

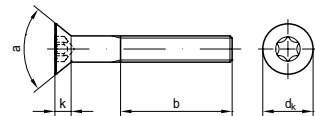
ISO 10642

replaces DIN 7991

Hexagon or hexalobular socket countersunk head screws



with hexagon socket



with hexalobular socket

dimensions for countersinks → DIN 74

*dimensions acc. to DIN 7991

Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
d_k	6.72	8.96	10.2	13.44	17.92	22.4
$k_{max.}$	1.86	2.48	3.1	3.72	4.96	6.2
s	2	2.5	3	4	5	6
ISR	-	T20	T25	T30	T40	-
a	90°	90°	90°	90°	90°	90°
b	18	20	22	24	28	32

Dimensions	M 12	M 14	M 16	M 20	M 22*	M 24*
d_k	26.8	30.88	33.6	40.32	36	39
$k_{max.}$	7.44	8.4	8.8	10.16	13.1	14
s	8	10	10	12	14	14
ISR	-	-	-	-	-	-
a	90°	90°	90°	90°	60°	60°
b	36	40	44	52	(56)	(60)

Dimensions in stock:

Steel/Steel coated: 366 | Stainless steel: 548



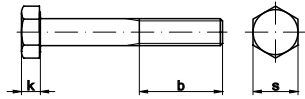
Hexagon screws/bolts

ISO 4014, 8765, 4016

replaces DIN 931, 960, 601

Hexagon head bolts with shank

ISO 8765/DIN 960 with fine pitch thread



b¹ for l ≤ 125 mm

b² for l ≤ 200 mm

b³ for l > 200 mm

Dimensions	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 10	M 12
S _{ISO/DIN}	4	5.5	7	8	10	11	13	16/17	18/19
k	1.4	2	2.8	3.5	4	4.8	5.3	6.4	7.5
b ¹	10	12	14	16	18	20	22	26	30
b ²	–	–	–	22	24	26	28	32	36
b ³	–	–	–	–	–	–	–	45	49

Dimensions	M 14	M 16	M 18	M 20	M 22	M 24	M 27	M 30	M 33
S _{ISO/DIN}	21/22	24	27	30	34/32	36	41	46	50
k	8.8	10	11.5	12.5	14	15	17	18.7	21
b ¹	34	38	42	46	50	54	60	66	72
b ²	40	44	48	52	56	60	66	72	78
b ³	53	57	61	65	69	73	79	85	91

Dimensions	M 36	M 39	M 42	M 45	M 48	M 52	M 56	M 64	
S _{ISO/DIN}	55	60	65	70	75	80	85	95	
k	22.5	25	26	28	30	33	35	40	
b ¹	78	84	90	96	102	–	–	–	
b ²	84	90	96	102	108	116	124	140	
b ³	97	103	109	115	121	129	137	153	

Dimensions in stock:

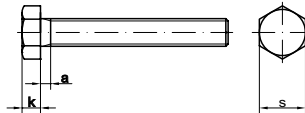
Steel/Steel coated: 224, 362, 137, 173, 95 | Stainless steel: 496, 458 | Non-ferrous materials: 588, 577

ISO 4017, 8676

replaces DIN 933, 961

Hexagon head screws with thread up to head

ISO 8676/DIN 961 with fine pitch thread



Dimensions	M 3	M 4	M 5	M 6	M 7	M 8	M 10	M 12	M 14
S _{ISO/DIN}	5.5	7	8	10	11	13	16/17	18/19	21/22
k	2	2.8	3.5	4	4.8	5.3	6.4	7.5	8.8
a _{max.}	1.5	2.1	2.4	3	3	3.75	4.5	5.25	6

Dimensions	M 16	M 18	M 20	M 22	M 24	M 27	M 30	M 33	M 36
S _{ISO/DIN}	24	27	30	34/32	36	41	46	50	55
k	10	11.5	12.5	14	15	17	18.7	21	22.5
a _{max.}	6	7.5	7.5	7.5	9	9	10.5	10.5	12

Dimensions	M 39	M 42	M 45	M 48	M 52	M 56	M 64		
S _{ISO/DIN}	60	65	70	75	80	85	95		
k	25	26	28	30	33	35	40		
a _{max.}	12	13.5	13.5	15	15	16.5	18		

Dimensions in stock:

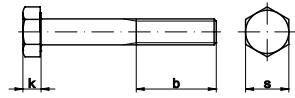
Steel/Steel coated: 240–241, 350, 148, 175 | Stainless steel: 502, 462 | Non-ferrous materials: 588, 577



Hexagon screws/bolts

ASME B 18.2.1

Hex cap screws*



short dimensions with shank
long dimensions with shank

all dimensions in inches
*acc. to ASME B 18.2.1: 2010 table 6,
b¹ for length 2 for length > 6 inch

Dimensions in stock:

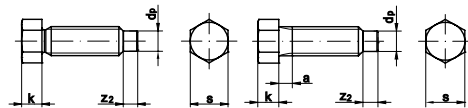
Steel/Steel coated: 386, 387

Dimensions	1/4	5/16	3/8	7/16	1/2	5/8
s	7/16	1/2	9/16	5/8	3/4	15/16
k	5/32	13/64	15/64	9/32	5/16	25/64
b ¹	0.750	0.875	1.000	1.125	1.250	1.500
b ²	1.000	1.125	1.250	1.375	1.500	1.750

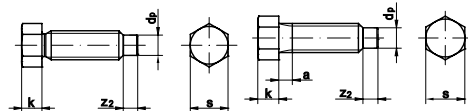
Dimensions	3/4	7/8	1	1 1/4	1 1/2	
s	1 1/8	1 5/16	1 1/2	1 7/8	2 1/4	
k	15/32	35/64	39/64	25/32	15/16	
b ¹	1.750	2.000	2.250	2.750	3.250	
b ²	2.000	2.250	2.500	3.000	3.500	

DIN 561, 564

Hexagon head set screws with small hexagon and dog point or short dog point



DIN 561 type A = with thread undercut
DIN 561 type B = with thread run-cut



DIN 564 type A = with thread undercut
DIN 564 Form B = with thread run-cut

Dimensions	M 6	M 8	M 10	M 12
k	5	6	7	9
s	8	10	13	16
a (type B)	2.5	3	4	4
z ₂	3	4	5	6
d _p	4	5.5	7	8.5

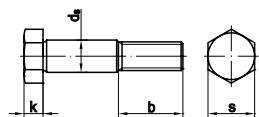
Dimensions	M 16	M 20	M 24	M 30
k	11	14	17	21
s	18	24	30	36
a (type B)	4.5	6	7	7.5
z ₂	8	10	12	15
d _p	12	15	18	23

Dimensions in stock:

Steel/Steel coated: 91, 93

DIN 609

Hexagon fit bolts with long thread



* adjusting shank tol. k6 for drill tol. H7
b¹ for l ≤ 50 mm
b² for 50 mm ≤ l ≤ 150 mm
b³ for l > 150 mm

Dimensions	M 8	M 10	M 12	M 14	M 16
k	5.3	6.4	7.5	8.8	10
s	13	16	18	21	24
d _s *	9	11	13	15	17
b ¹	14.5	17.5	20.5	22	25
b ²	16.5	19.5	22.5	24	27
b ³	21.5	24.5	27.5	29	32

Dimensions	M 20	M 24	M 30	M 36	
k	12.5	15	19	22	
s	30	36	46	55	
d _s *	21	25	32	38	
b ¹	28.5	-	-	-	
b ²	30.5	36.5	43	49	
b ³	35.5	41.5	48	54	

Dimensions in stock:

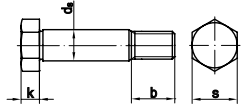
Steel/Steel coated: 102



Hexagon screws/bolts

DIN 610

Hexagon fit bolts
with short thread



* adjusting shank tol. k6 for drill tol. H7

b¹ for l ≤ 50 mm

b² for 50 mm ≤ l < 150 mm

b³ for l ≥ 150 mm

Dimensions	M 8	M 10	M 12	M 14	M 16
k	5.3	6.4	7.5	8.8	10
s	13	16	18	21	24
d _s *	9	11	13	15	17
b ¹	11.5	13.5	15.5	17	19
b ²	13.5	15.5	17.5	19	21
b ³	18.5	20.5	22.5	24	26

Dimensions	M 20	M 24	M 30	M 36	
k	12.5	15	19	22	
s	30	36	46	55	
d _s *	21	25	32	38	
b ¹	22.5	25.5	–	–	
b ²	24.5	28.5	34	40	
b ³	29.5	33.5	39	45	

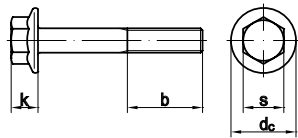
Dimensions in stock:

Steel/Steel coated: 103

EN 1665

replaces DIN 6921

Hexagon flange bolts,
heavy series



b¹ for l ≤ 125 mm

b² for 125 mm ≤ l < 200 mm

b³ for l ≥ 200 mm

Dimensions	M 5	M 6	M 8	M 10	M 12	M 16
k _{EN/DIN}	5.8/5.4	6.6/6.6	8.1/8.1	10.4/9.2	11.8/11.5	15.4/14.4
s _{EN/DIN}	8/8	10/10	13/13	16/15	18/16	24/21
d _c	11.58	14.2	18	22.3	26.6	35
b ¹	16	18	22	26	30	38
b ²	–	–	28	32	36	44
b ³	–	–	–	–	–	57

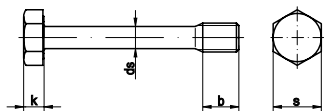
Dimensions in stock:

Steel/Steel coated: 210, 302 | Stainless steel: 489, 522

~DIN 7964

Bolts with waisted shank

type D1 = hexagon head acc. to ISO 4014,
with short thread



Dimensions	M 8	M 10
s	13	16
k	5.3	6.4
d _{s min.}	6	7.5
b	10	12.5

Dimensions in stock:

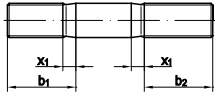
Stainless steel: 535



Studs

DIN 835

Studs



screwed-in end $\approx 2 d$
 b_1 = screwed-in end
 b_2 = nut end

b_2^1 for $l \leq 125$ mm
 b_2^2 for 125 mm
 b_2^3 for $l > 200$ mm

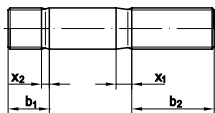
Dimensions	M 6	M 8	M 10	M 12	M 16
b_1	12	16	20	24	32
x_1	2.5	3.2	3.8	4.3	5.0
b_2^1	18	22	26	30	38
b_2^2	24	28	32	36	44
b_2^3	–	–	45	49	57

Dimensions in stock:

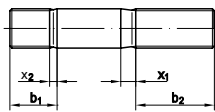
Steel/Steel coated: 107 | Stainless steel: 449

DIN 938, 939

Studs



DIN 938 = with screwed-in end $\approx 1 d$



DIN 939 = with screwed-in end $\approx 1,25 d$

b_1 = screwed-in end
 b_2 = nut end

b_2^1 for $l \leq 125$ mm
 b_2^2 for 125 mm
 b_2^3 for $l > 200$ mm

Dimensions	M 5	M 6	M 8	M 10	M 12	M 14
b_1 (DIN 938)	5	6	8	10	12	14
b_1 (DIN 939)	6.5	7.5	10	12	15	18
x_1	2	2.5	3.2	3.8	4.3	5
x_2	1	1.25	1.6	1.9	2.2	2.5
b_2^1	16	18	22	26	30	34
b_2^2	22	24	28	32	36	40
b_2^3	–	–	–	45	49	53

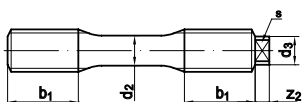
Dimensions	M 16	M 20	M 24	M 27	M 30	
b_1 (DIN 938)	16	20	24	27	30	
b_1 (DIN 939)	20	25	30	35	38	
x_1	5	6.3	7.5	7.5	9	
x_2	2.5	3.2	3.8	3.8	4.5	
b_2^1	38	46	54	60	66	
b_2^2	44	53	60	66	72	
b_2^3	57	65	73	79	85	

Dimensions in stock:

Steel/Steel coated: 168, 170 | Stainless steel: 469, 470

DIN 2510

Bolts with waisted shank
 type L = with long thread



Dimensions	M 12	M 16	M 20	M 22	M 24
d_2	8.5	12	15	16.5	18
d_3	8	12	14	14	14
b_1	20	23	28	30	32
z_2	4	5	6	6	6
s	7	10	11	11	11

Dimensions	M 27	M 30	M 33	M 36	M 39
d_2	20.5	23	25.5	27.5	30.5
d_3	18	18	25	25	28
b_1	35	39	42	45	48
z_2	6	6	9	9	10
s	13	13	22	22	24

Dimensions in stock:

Steel/Steel coated: 220

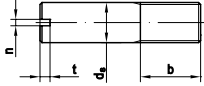


Set screws/grub screw

ISO 2342

similar DIN 427

Slotted headless screws with shank



Dimensions	M 3	M 4	M 5	M 6	M 8
d_s	3	4	5	6	8
b^*	3.6	4.8	6	7.2	9.6
n	0.4	0.6	0.8	1	1.2
t	0.8	1.12	1.28	1.6	2

Dimensions	M 10	M 12	M 16	M 20	
d_s	10	12	16	20	
b^*	12	14	18	22	
n	1.6	2	2.5	3	
t	2.4	2.8	3.2	4	

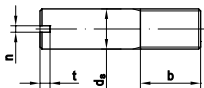
Dimensions in stock:

Steel/Steel coated: 219, 76 | Stainless steel: 495, 439

ISO 7435

similar DIN 417

Slotted headless screws with shank



Dimensions	M 3	M 4	M 5	M 6
d_p	2	2.5	3.5	4
b^*	1.5	2	2.5	3
n	0.4	0.6	0.8	1
t	0.8	0.96	1.12	1.28

Dimensions	M 8	M 10	M 12	M 16
d_p	5.5	7	8.5	12
b^*	4	5	6	7
n	1.2	1.6	2	2.5
t	1.6	2	2.4	2.8

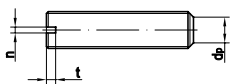
Dimensions in stock:

Steel/Steel coated: 325, 76

ISO 4766

similar DIN 551

Slotted grub screws with flat point



Dimensions	M 1	M 1.4	M 1.6	M 2	M 2.5	M 3	M 3.5
n	0.2	0.2	0.25	0.25	0.4	0.4	0.5
t	0.4	0.48	0.56	0.64	0.72	0.8	0.96
d_p	0.5	0.7	0.8	1	1.5	2	2.2

Dimensions	M 4	M 5	M 6	M 8	M 10	M 12*	
n	0.6	0.8	1	1.2	1.6	2	
t	1.12	1.28	1.6	2	2.4	2.8	
d_p	2.5	3.5	4	5.5	7	8.5	

*dimensions acc. to DIN 551: 1956-04

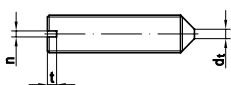
Dimensions in stock:

Steel/Steel coated: 287, 89 | Stainless steel: 518, 444 | Non-ferrous materials: 590, 573

ISO 7434

similar DIN 553

Slotted grub screws with cone point



Dimensions	M 1*	M 1.2*	M 1.4	M 1.6	M 2	M 2.5	M 3
n	0.2	0.2	0.2	0.25	0.25	0.4	0.4
t	0.4	0.4	0.48	0.56	0.64	0.72	0.8
$d_{t \max.}$	0.1	0.12	0.14	0.16	0.2	0.25	0.3

Dimensions	M 3.5	M 4	M 5	M 6	M 8	M 10	
n	0.5	0.6	0.8	1	1.2	1.6	
t	0.96	1.12	1.28	1.6	2	2.4	
$d_{t \max.}$	0.35	0.4	0.5	1.5	2	2.5	

* dimensions acc. to DIN 553

Dimensions in stock:

Steel/Steel coated: 324, 90 | Stainless steel: 535, 444 | Non-ferrous materials: 593, 574

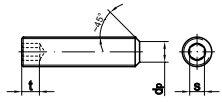


Set screws/grub screw

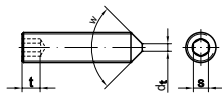
ISO 4026, 4027

similar DIN 913, 914

Hexagon socket set screws, with flat point or cone point
screws only for pressure load, hardness class 45H



ISO 4026, DIN 913 = with flat point



ISO 4027, DIN 914 = with cone point

t_1 for I above the dashed step line with angle $W_{DIN 914} = 120^\circ$

t_2 for below the dashed step line with angle $W_{DIN 914} = 90^\circ$

→ step line see product standard

Dimensions in stock:

Steel/Steel coated: 257, 259, 128, 131 | Stainless steel: 507, 509, 454, 455

Dimensions	M 1.4	M 1.6	M 2	M 2.5	M 3
s	0.7	0.7	0.9	1.3	1.5
$d_{p \text{ max. }} / d_{t \text{ max. }}$	0.45	0.8	1	1.5	2
t_1	0.6	0.7	0.8	1.2	1.2
t_2	1.4	0.5	0.7	2	2

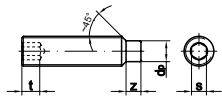
Dimensions	M 4	M 5	M 6	M 8	M 10
s	2	2.5	3	4	5
$d_{p \text{ max. }} / d_{t \text{ max. }}$	2.5	3.5	4	5.5	7
t_1	1.5	2	2	3	4
t_2	2.5	3	3.5	5	6

Dimensions	M 12	M 14	M 16	M 20	M 24
s	6	6	8	10	12
$d_{p \text{ max. }} / d_{t \text{ max. }}$	8.5	10	12	15	18
t_1	4.8	5.6	6.4	8	10
t_2	8	9	10	12	15

ISO 4028

similar DIN 915

Hexagon socket set screws with full dog point



z_1 and t_1 for above dashed step line

z_2 and t_2 for below the dashed step line

* dimensions acc. to DIN 915

Dimensions	M 1.4*	M 2*	M 3	M 4	M 5	M 6	M 8
s	0.7	0.9	1.5	2	2.5	3	4
$z_1 \text{ max. (short)}$	0.65	0.75	1	1.25	1.5	1.75	2.25
t_1	0.6	0.8	1.2	1.5	2	2	3
d_p	0.7	1	2	2.5	3.5	4	5.5
$z_2 \text{ max. (long)}$	1.05	1.25	1.75	2.25	2.75	3.25	4.3
t_2	1.4	1.7	2	2.5	3	3.5	5

Dimensions	M 10	M 12	M 14	M 16	M 20	M 24	
s	5	6	6	8	10	12	
$z_1 \text{ max. (short)}$	2.75	3.25	3.8	4.3	5.3	6.3	
t_1	4	4.8	5.6	6.4	8	10	
d_p	7	8.5	10	12	15	18	
$z_2 \text{ max. (long)}$	5.3	6.3	7.36	8.36	10.36	12.43	
t_2	6	8	9	10	12	15	

Dimensions in stock:

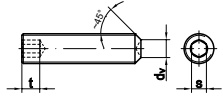
Steel/Steel coated: 260, 132 | Stainless steel: 509, 456

Set screws/grub screw

ISO 4029

similar DIN 916

Hexagon socket set screws
with cup point



t_1 for l above the dashed step line
 t_2 for l below the dashed step line

→ step line see product standard

Dimensions in stock:

Steel/Steel coated: 262, 133 | Stainless steel: 510, 456

Dimensions	M 1.4	M 1.6	M 1.8	M 2	M 2.5	M 3	M 4	M 5
s	0.7	0.7	0.7	0.9	1.3	1.5	2	2.5
$d_{v \text{ max.}}$	0.7	0.8	0.9	1	1.2	1.4	2	2.5
t_1	0.6	0.7	0.8	0.8	1.2	1.2	1.5	2
t_2	1.4	1.5	1.6	1.7	2	2	2.5	3

Dimensions	M 6	M 8	M 10	M 12	M 14	M 16	M 20	M 24
s	3	4	5	6	6	8	10	12
$d_{v \text{ max.}}$	3	5	6	8	9	10	14	16
t_1	2	3	4	4.8	5.6	6.4	8	10
t_2	3.5	5	6	8	9	10	12	15

REYHER

REM – REYHER Engineering Management

TECHNICAL COMPETENCE & HIGH QUALITY COMMITMENT



The REM – REYHER Engineering Management team deals with all technical matters and details involving fasteners and fixing technology. Our engineers and technicians are always at the cutting-edge of technology – for the benefit of you, our customer.

Products received are tested in-house using the latest methods and technologies. We are well-known in the industry for very high product quality requirements and our stringent choice of suppliers.

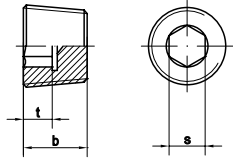
For more information, see www.reyher.de



Screw plugs/pipe plugs

DIN 906

Hexagon socket pipe plugs
with taper thread



Dimensions	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
s	4	5	6	7	8	8	10	10	12
t _{min.}	4	4	5	5	5	5	5	5	6
b*	8	8	10	10	10	10	10	10	12

Dimensions	M 26	M 27	M 30	M 33	M 36	M 38	M 42	R 1/8	R 1/4
s	12	12	17	17	19	19	22	5	7
t _{min.}	6	6	6	6	7.5	7.5	11.5	4	5
b*	12	12	12	12	15	15	18	8	10

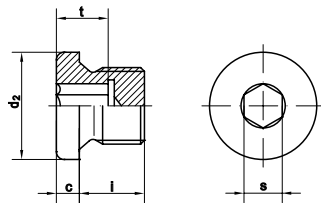
Dimensions	R 3/8	R 1/2	R 3/4	R 1	R 1 1/4	R 1 1/2	R 1 3/4	R 2	
s	8	10	12	17	22	24	32	32	
t _{min.}	5	5	6	6	11.5	11.5	13	13	
b*	10	10	12	12	18	20	22	22	

Dimensions in stock:

Steel/Steel coated: 107 | Stainless steel: 449 | Non-ferrous materials: 576

DIN 908

Hexagon socket screw plugs
with cylindrical thread



Dimensions	M 8x1*	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5
s	5	5	6	6	8	8	10
t _{min.}	2.4	5	7	7	7.5	7.5	7.5
d ₂	12	14	17	19	21	23	25
c	3	3	3	4	3	4	4
i	8	8	12	12	12	12	14

Dimensions	M 22x1.5	M 24x1.5	M 26x1.5	M 27x2	M 30x1.5	M 30x2	M 33x2
s	10	12	12	12	17	17	17
t _{min.}	7.5	7.5	9	9	9	9	9
d ₂	27	29	31	32	36	36	39
c	4	4	4	4	4	4	5
i	14	14	16	16	16	16	16

Dimensions	M 36x1.5	M 36x2	M 38x1.5	M 42x1.5	M 45x1.5	M 48x1.5	M 52x1.5
s	19	19	19	22	22	24	24
t _{min.}	10.5	10.5	10.5	10.5	10.5	10.5	10.5
d ₂	42	42	42	49	52	55	60
c	5	5	5	5	5	5	5
i	16	16	16	16	16	16	16

Dimensions	M 52x2	M 56x2	M 64x2	G 1/8 A	G 1/4 A	G 3/8 A	G 1/2 A
s	32	32	32	5	6	8	10
t _{min.}	10.5	14	14	5	7	7.5	7.5
d ₂	64	72	72	14	12	22	26
c	5	5	5	3	3	3	4
i	16	20	20	8	12	12	14

Dimensions	G 3/4 A	G 1 A	G 1 1/8 A	G 1 1/4 A	G 1 1/2 A	G 1 3/4 A	G 2 A
s	12	17	19	22	24	32	32
t _{min.}	9	9	10.5	10.5	10.5	14	14
d ₂	32	39	44	49	55	62	68
c	4	5	5	5	5	5	5
i	16	16	16	16	16	20	20

* not standardized, reference values

Dimensions in stock:

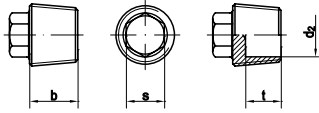
Steel/Steel coated: 108 | Stainless steel: 449 | Non-ferrous materials: 577



Screw plugs/pipe plugs

DIN 909

Hexagon head pipe plugs
with taper thread



Dimensions	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5
b*	8	10	10	10	10	10	10
d ₂	–	–	–	–	–	12	14
s	7	7	9	10	10	13	13
t	–	–	–	–	–	6	6

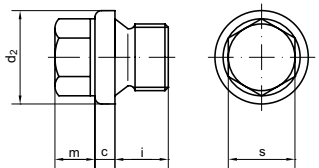
Dimensions	M 24x1.5	M 26x1.5	M 27x2	M 30x1.5	M 30x2	M 33x2	R 1/8
b*	12	12	12	12	12	12	8
d ₂	16	16	16	20	23	23	–
s	17	17	17	19	19	19	7
t	7	7	7	7	7	7	–

Dimensions	R 1/4	R 3/8	R 1/2	R 3/4	R 1	R 1 1/4	
b*	10	10	10	12	12	18	
d ₂	–	–	12	16	23	32	
s	9	10	13	17	19	24	
t	–	–	6	7	7	13	

Dimensions in stock:
Steel/Steel coated: 109

DIN 910

Hexagon head screw plugs,
heavy type, cylindrical thread



Dimensions	M 8x1*	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5
c	3	3	3	3	3	4	4	4
d ₂	14	14	17	19	21	23	25	27
m	6	6	6	6	6	6	8	8
s	10	10	13	13	17	17	19	19
i	8	8	12	12	12	12	14	14

Dimensions	M 24x1.5	M 26x1.5	M 27x2	M 30x1.5	M 30x2	M 33x2	M 36x1.5	M 36x2
c	4	4	4	4	4	5	5	5
d ₂	29	31	32	36	36	39	42	42
m	9	10	10	10	10	11	11	11
s	22	24	24	24	24	27	27	27
i	14	16	16	16	16	16	16	16

Dimensions	M 38x1.5	M 42x1.5	M 42x2	M 45x1.5	M 45x2	M 48x1.5	M 48x2	M 52x1.5
c	4	5	5	5	5	5	5	5
d ₂	44	49	49	55	52	55	55	60
m	11	12	12	12	12	12	12	12
s	27	30	30	30	30	36	30	30
i	16	16	16	16	16	16	16	16

Dimensions	M 56x2	M 64x2	G 1/8 A	G 1/4 A	G 3/8 A	G 1/2 A	G 5/8 A*	G 3/4 A
c	5	5	3	3	3	4	4	4
d ₂	64	72	14	18	22	26	28	32
m	15	15	6	6	6	8	8	10
s	36	36	10	13	17	19	22	24
i	20	20	8	12	12	14	14	16

Dimensions	G 7/8 A*	G 1 A	G 1 1/8 A	G 1 1/4 A	G 1 1/2 A	G 1 3/4 A	G 2 A	
c	4	5	4	5	5	5	5	
d ₂	36	39	44	49	55	62	68	
m	10	11	11	12	12	15	15	
s	24	27	27	30	30	36	36	
i	14	16	16	16	16	20	20	

* not standardized, reference values

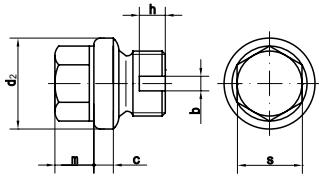
Dimensions in stock:
Steel/Steel coated: 109 | Stainless steel: 450 | Non-ferrous materials: 577



Screw plugs/pipe plugs

DIN 5586

Hexagon head screw plugs with collar and vent
type B = with melted sealing



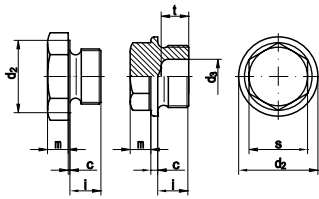
Dimensions	G 1/8 A	G 1/4 A	G 1/2 A	G 3/4 A	G 1 A	G 1 1/2 A	G 2 A
a	4	6	7	7	7	7	7
h	3	3	4	6	6	6	6
h	5	7	8	10	10	10	10
c	3	3	4	4	5	5	5
d ₂	14	18	26	32	39	55	68
m	8	6	8	10	11	12	15

Dimensions in stock:

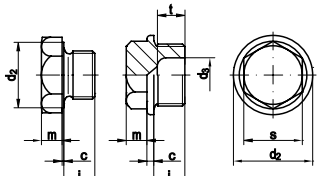
Steel/Steel coated: 289

DIN 7604

Hexagon head screw plugs with collar, light type, cylindrical fine pitch thread



≤M 16 ≥M 18
type A = short stud end



≤M 16 ≥M 18
type C = long stud end

Dimensions	M 8x1	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5
c	0.5	0.5	0.5	0.5	0.5	2
d ₂	12	14	17	19	21	23
d ₃	–	–	–	–	–	10
i _{type A/type C}	–/8	6/8	9	9/–	9/–	9/–
l _{type A/type C}	–/12.5	10.5/12.5	15.5	15.5/–	15.5/–	17/–
m	4	4	6	6	6	6
s	12	14	17	19	22	17
t _{type A/type C}	–	–	–	–	–	8/–

Dimensions	M 22x1.5	M 26x1.5	M 30x1.5	M 38x1.5	M 45x1.5	M 52x1.5
c	2	2.5	2.5	3	3	3
d ₂	27	31	36	44	52	60
d ₃	14	16	20	26	32	38
i _{type A/type C}	9/–	9/12	9/12	–/12	–/12	–/12
l _{type A/type C}	17/–	19.5/22.5	19.5/22.5	–/23	–/23	–/23
m	6	8	8	8	8	8
s	19	22	22	22	24	27
t _{type A/type C}	8/–	8/10	8/10	–/10	–/10	–/10

Dimensions in stock:

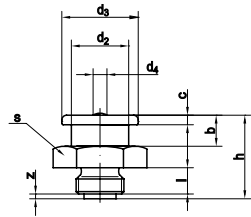
Steel/Steel coated: 330 | Stainless steel: 535



Lubricating nipples

DIN 3404

Lubricating nipples



Dimensions	M 6x1	M 6x1	M 8x1	M 8x1	M 10x1
b	4.8	6.5	4.8	6.5	6.5
c	1.7	2.0	1.7	2.0	2.0
d ₂	7.2	12	7.2	12	12
d ₃	10	16	10	16	16
d ₄	1.5	1.5	2.5	2.5	2.9
h _{max.}	13	17	13.7	16.7	17.6
l	4.9	5.3	4.9	5.3	5.5
s	11	17	11	17	17
z _{max.}	0.6	0.8	0.6	0.8	1.0

Dimensions	M 16x1.5	G 1/4	G 1/4	G 3/8	
b	8.5	6.5	8.5	8.5	
c	3.0	2.0	3.0	3.0	
d ₂	18	12	18	18	
d ₃	22	16	22	22	
d ₄	5.0	2.9	5.0	5.0	
h _{max.}	23.1	16	22	22	
l	7.5	5.5	7.5	7.5	
s	22	17	22	22	
z _{max.}	1.5	1	1.5	1.5	

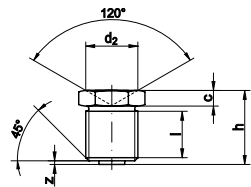
Dimensions in stock:

Steel/Steel coated: 222 | Non-ferrous materials: 588

DIN 3405

Lubricating nipples, cupped type

type A = with thread acc. to DIN 13-5



Dimensions	M 6x1	M 8x1
h _{max.}	9.5	9.5
l	5.5	5.5
d ₂	6	8
c	3	3
s	7	9
z _{max.}	0.7	0.7

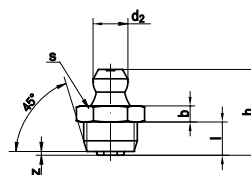
Dimensions in stock:

Steel/Steel coated: 222

DIN 71412

Lubricating nipples, cone type, with hexagon

type A = cone head straight/axial



Dimensions	M 6x1	M 6x1	M 8x1	AR 1/8	M 10x1	AR 1/4
h _{max.}	16	16	16	16	16	16
l	5.5	5.5	5.5	5.5	5.5	5.5
d ₂	6.5	6.5	6.5	6.5	6.5	6.5
b*	3	3	3	3	3	3
s	7	9	9	11	11	14
z _{max.}	0.7	0.7	0.7	0.7	0.7	0.7

Dimensions in stock:

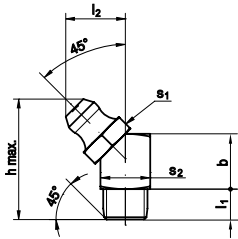
Steel/Steel coated: 384 | Stainless steel: 551



Lubricating nipples

DIN 71412

Lubricating nipples, cone type,
with hexagon or square
type B = cone head 45° angled



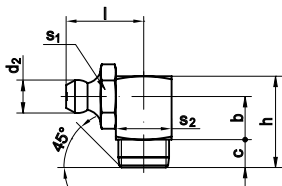
Dimensions	M 6x1	M 8x1	M 10x1
$h_{max.}$	21	21	21
l_1	5.5	5.5	5.5
l_2	10	10	11
b	10	10	10
s_1	7	9	11
s_2 square	9	9	11

Dimensions in stock:

Steel/Steel coated: 384

DIN 71412

Lubricating nipples, cone type,
with hexagon or square
type C = cone head 90° angled



Dimensions	M 6x1	M 8x1	M 8x1.5*	M 10x1
$h_{max.}$	18	18	18	18
c	5.5	5.5	5.5	5.5
d_2	6.5	6.5	6.5	6.5
b	8.5	8.5	8.5	8.5
s_1	9	9	9	11
s_2 square	9	9	9	11
l	14.3	14.3	14.3	15.3

* intermediate sizes not included in the standard

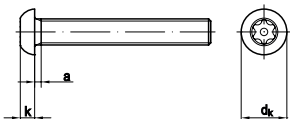
Dimensions in stock:

Steel/Steel coated: 384

Theft resistant screw/locking screws

Article 88116

Theft resistant screws
with button head, metric thread
and pin hex. socket drive
similar to ISO 7380



Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
d_k	5.7	7.6	9.5	10.5	14	17.5
$a_{min.}$	0.5	0.7	0.8	1	1.25	1.5
$k_{min.}$	1.4	1.95	2.5	3	4.1	5.2
ISR size	T10	T20	T25	T30	T40	T45

Dimensions in stock:

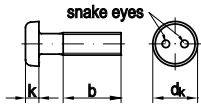
Stainless steel: 557



Theft resistant screw/locking screws

Article 88111

Theft resistant screws
with pan head, metric thread
and snake eyes drive
similar to DIN 85



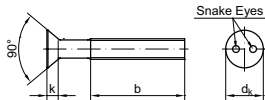
Dimensions	M 3	M 4	M 5	M 6
$b_{min.}$	25	38	38	38
d_k	6	8	10	12
k	1.8	2.4	3	3.6

Dimensions in stock:

Stainless steel: 556

Artikel 88112

Theft resistant screws
with pan head, metric thread
and snake eyes drive
similar to DIN 963



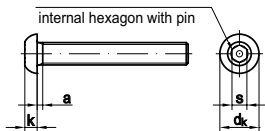
Dimensions	M 3	M 4	M 5	M 6
$b_{min.}$	19	22	25	28
d_k	5.6	7.5	9.2	11
k	1.65	2.2	2.5	3

Dimensions in stock:

Stainless steel: 556

Article 88113

Theft resistant screws
with button head, metric thread
and hexagon socket with pin
similar to ISO 7380



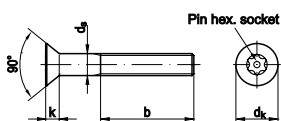
Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12
$a_{min.}$	0.5	0.7	0.8	1	1.25	1.5	1.75
$d_{k max.}$	5.7	7.6	9.5	10.5	14	17.5	21
$k_{min.}$	1.4	1.95	2.5	3	4.1	5.2	6.24
s	2	2.5	3	4	5	6	8

Dimensions in stock:

Stainless steel: 556

Article 88117

Theft resistant screws with countersunk
head, metric thread
and pin hex. socket drive
similar to ISO 10642



b_1 for $l \leq 125$ mm
 b_2 for 125 mm, b_3 for > 200 mm

Dimensions	M 3	M 3.5	M 4	M 5	M 6	M 8	M 10
$d_{k max.}$	5.7	6.6	7.6	9.5	10.5	14	17.5
$a_{min.}$	0.5	0.6	0.7	0.8	1	1.25	1.5
$k_{min.}$	1.4	1.9	1.95	2.5	3	4.1	5.2
ISR size	T10	T15	T20	T25	T30	T40	T45
b_1	12	12	14	16	18	22	26
b_2	-	-	-	-	24	28	32
b_3	-	-	-	-	-	-	45

Dimensions in stock:

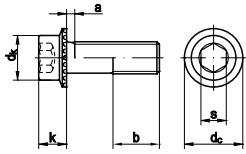
Stainless steel: 558



Theft resistant screw/locking screws

Article 88912

Hexagon socket cap screws with flange and ribs

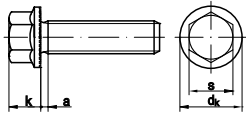


Dimensions	M 5	M 6	M 8	M 10	M 12
a _{max.}	2.4	3	3.7	4.5	5.2
b	22	24	28	32	36
d _c	11	13.5	17	19.5	22.5
d _k	9	11	14	17	19
k	5	6	8	10	12
s	4	5	6	8	10
qty. ribs	28	36	48	60	72

Dimensions in stock:
Steel/Steel coated: 418

Article 88913

Hexagon head screws with flange and ribs

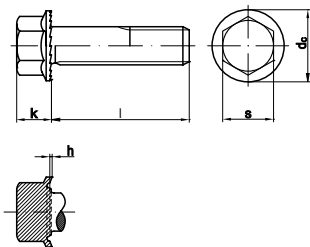


Dimensions	M 5	M 6	M 8	M 10	M 12	M 14	M 16
a _{max.}	1.6	2	2.5	3	3.5	4	4
d _k	11.2	14.2	18.2	21	24	27.5	31
k	4.3	5.5	7	8.5	10	12	14
s	8	10	13	15	17	19	22
qty. ribs	28	36	48	48	60	60	72

Dimensions in stock:
Steel/Steel coated: 418

Article 88933

Hexagon head locking screws with flange



Dimensions	M 5	M 6	M 8	M 10	M 12	M 16
d _c	11.2	14.25	18.25	21	24	31
h _{min.}	0.15	0.17	0.2	0.25	0.25	0.28
k	4.3	5.5	7	7.9	8.7	11.2
s	8	10	13	15	17	22
qty. serrations	24	24	24	24	24	24

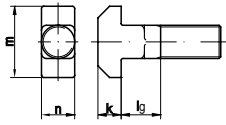
Dimensions in stock:
Steel/Steel coated: 420



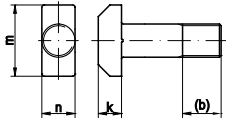
Other screws with metric thread

DIN 186, 261

T-head bolts



DIN 186 type B = with square neck and long thread



DIN 261

b¹ for l ≤ 125 mm

b² for l ≤ 200 mm

b³ for l > 200 mm

Dimensions	M 6	M 8	M 10	M 12
m	16	18	21	26
n	6	8	10	12
k	4.5	5.5	7	8
l _g (186 B)	10	13	16	19
b ₁	18	22	26	30
b ₂	–	–	–	–

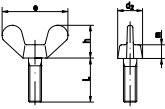
Dimensions	M 16	M 20	M 24	
m	30	36	43	
n	16	20	24	
k	10.5	13	15	
l _g (186 B)	25	31	37	
b ₁	38	46	54	
b ₂	44	52	60	

Dimensions in stock:

Steel/Steel coated: 74, 75

DIN 316

Wing screws with rounded wings



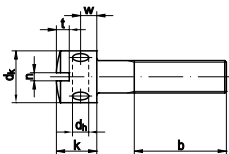
Dimensions	M 4	M 5	M 6	M 8	M 10	M 12	M 16
d ₂	7	9.5	11.5	14.5	18.5	21.5	27.5
e	20	25	31.5	37	49.5	63.5	71.5
g	1.5	1.9	1.9	2.4	4	4.5	6
h	9.5	12	16	19	24	32.3	36.3
m	3.9	5.3	6.5	8.3	10	12	15

Dimensions in stock:

Steel/Steel coated: 75 | Stainless steel: 439 | Non-ferrous materials: 571

DIN 404

Slotted capstan screws



Dimensions	M 3	M 4	M 5	M 6
∅ d _k	5.5	7	8.5	10
k	4	5	6.5	8
n	0.8	1	1.2	1.6
t _{min.}	1	1.4	1.7	2.2
∅ d _h	1.5	2	2.5	3
w	1.5	2	2.5	3
b	19	22	25	28

Dimensions in stock:

Steel/Steel coated: 76 | Stainless steel: 439

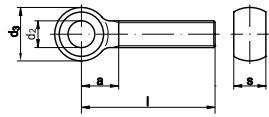
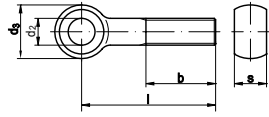


Other screws with metric thread

DIN 444

Eye bolts

type B = product grade B



with thread near the eye

b¹ for l ≤ 125 mm

b² for 125 mm

b³ for l > 200 mm

Dimensions	M 5	M 6	M 8	M 10	M 12
d ₂	5	6	8	10	12
d ₃	12	14	18	20	25
s	6	7	9	12	14
a	11	14	16	18	23
b ₁	16	18	22	26	30
b ₂	–	–	28	32	36
b ₃	–	–	–	–	49

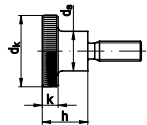
Dimensions	M 16	M 20	M 24	M 30	
d ₂	16	18	22	27/28	
d ₃	32	40	45	55	
s	17	22	25	30	
a	27	32	40	46	
b ₁	38	46	54	66	
b ₂	44	52	60	72	
b ₃	57	65	73	85	

Dimensions in stock:

Steel/Steel coated: 82 | Stainless steel: 442 | Non-ferrous materials: 572

DIN 464

Knurled thumb screws, high type



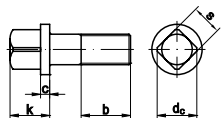
Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
d _k	12	16	20	24	30	36
k	2.5	3.5	4.0	5.0	6.0	8.0
h	5.7	7.64	9.64	11.57	15.57	19.48
d ₅	6	8	10	12	16	20

Dimensions in stock:

Steel/Steel coated: 84 | Stainless steel: 443 | Non-ferrous materials: 573

DIN 478

Square head bolts with collar



¹ acc. to ISO 272

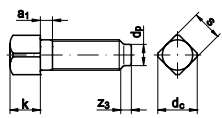
Dimensions	M 8	M 10	M 12	M 16
k	10	13	15	20
c	2	3	3	4
b	22	26	30	38
d _c	13.5	16.5	19.5	25
s	8	10	13	16 ¹ /17

Dimensions in stock:

Steel/Steel coated: 87

DIN 479

Square head bolts with short dog point



Dimensions	M 6	M 8	M 10	M 12	M 16	M 20
k	6	8	10	12	16	20
a ₁	3	4	4.5	5.3	6	7.5
s	6	8	10	13	16 ¹ /17	21 ¹ /22
d _p	4	5.5	7	8.5	12	15
z ₁	1.5	2	2.5	3	4	5

Dimensions in stock:

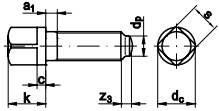
Steel/Steel coated: 87



Other screws with metric thread

DIN 480

Square head bolts with collar
and short dog point with rounded end



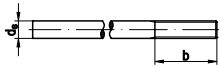
¹ acc. to ISO 272

Dimensions in stock:
Steel/Steel coated: 88

Dimensions	M 10	M 12	M 16	M 20
k	13	16	20	25
c _{max.}	3.12	4.15	4.15	5.15
a ₁	4.5	5.3	6	7.5
s	10	13	16 ¹ / 17	21 ¹ / 22
d _c	13	17	21 ¹ / 22	27 ¹ / 28
z ₃	2.5	3	4	5

DIN 525

Studs for welding



* not standardized, reference values

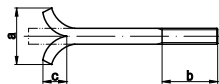
Dimensions in stock:
Steel/Steel coated: 88

Dimensions	M 6	M 8	M 10	M 12	M 14*	M 16
b	35	40	45	55	60	65
d _s	6	8	10	12	14	16

Dimensions	M 20	M 22*	M 24	M 27*	M 30	M 36
b	75	80	85	95	105	125
d _s	20	22	24	27	30	36

DIN 529

Masonry bolts
type C = with split swivel



Dimensions in stock:
Steel/Steel coated: 88

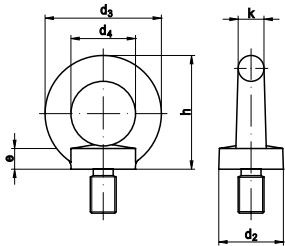
Dimensions	M 8	M 10	M 12	M 16	M 20	M 24	M 30
b	20	25	30	40	50	60	75
a	24	30	36	48	60	75	95
c	12	15	18	24	30	36	45



Other screws with metric thread

DIN 580

Lifting eye bolts



more information → [TI-148](#)

*dimensions not standardized,
geometry of the next higher dimension

**small type

Dimensions	M 6**	M 8	M 10	M 12	M 14*	M 16	M 18
d ₂	17	20	25	30	35	35	40
d ₃	28	36	45	54	63	63	72
d ₄	16	20	25	30	35	35	40
h	31	36	45	53	62	62	71
e	4	6	8	10	12	12	14
k	6	8	10	12	14	14	16

Dimensions	M 20	M 22*	M 24	M 27*	M 30	M 33*	M 36
d ₂	40	50	50	65	65	75	75
d ₃	72	90	90	108	108	126	126
d ₄	40	50	50	60	60	70	70
h	71	90	90	109	109	128	128
e	14	18	18	22	22	26	26
k	16	20	20	14	14	28	28

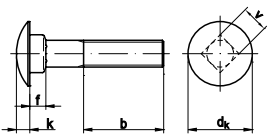
Dimensions	M 39	M 42	M 45	M 48	M 52	M 56	M 64
d ₂	85	85	100	100	110	110	120
d ₃	144	144	166	166	184	184	206
d ₄	80	80	90	90	100	100	110
h	147	147	168	168	187	187	208
e	30	30	35	35	38	38	42
k	32	32	38	38	42	42	48

Dimensions in stock:

Steel/Steel coated: 94 | Stainless steel: 446

DIN 603

Cup head square neck bolts



b¹ for l ≤ 125 mm

b² for l ≤ 200 mm

b³ for l > 200 mm

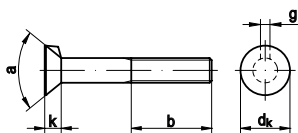
Dimensions	M 5	M 6	M 8	M 10	M 12	M 16	M 20
d _k	13.5	16.55	20.65	24.65	30.65	38.8	46.8
k	3.3	3.88	4.88	5.38	6.95	8.95	11.05
f	4.1	4.6	5.6	6.6	8.75	12.9	15.9
v	5.48	6.48	8.58	10.58	12.7	16.7	20.84
b ₁	16	18	22	26	30	38	46
b ₂	22	24	28	32	36	44	52
b ₃	–	–	41	45	49	57	65

Dimensions in stock:

Steel/Steel coated: 99 | Stainless steel: 447 | Non-ferrous materials: 574

DIN 604

Flat countersunk nib bolts



b¹ for l ≤ 125 mm

b² for l ≤ 200 mm

b³ for l > 200 mm

Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24
d _k	12.55	16.55	19.65	24.65	32.8	32.8	38.8
k	4	5	5.5	7	9	11.5	13
a	90°	90°	90°	90°	90°	60°	60°
g	2.5	3	3.2	3.6	4.2	5.4	6.6
b ₁	18	22	26	30	38	46	54
b ₂	24	28	32	36	44	52	60
b ₃	–	41	45	49	57	65	73

Dimensions in stock:

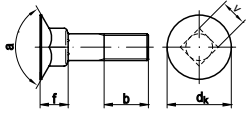
Steel/Steel coated: 101



Other screws with metric thread

DIN 605

Flat countersunk square neck bolts with long square

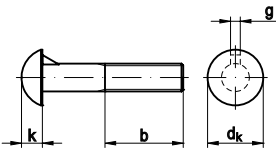


Dimensions	M 6	M 8	M 10
d_k	16.55	20.65	24.65
f	7.45	9.45	11.55
b	18	22	26
v	6.48	8.58	10.58
countersunk angle	120°	120°	120°

Dimensions in stock:
Steel/Steel coated: 102

DIN 607

Cub head nib bolts



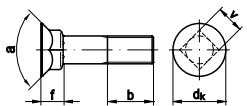
b^1 for $l \leq 125$ mm
 b^2 for $l \leq 200$ mm
 b^3 for $l > 200$ mm

Dimensions	M 8	M 10	M 12	M 16
d_k	16.55	19.65	24.65	30.65
k	6.38	7.45	9.65	11.75
g	3	3.2	3.6	4.2
b_1	22	26	30	38
b_2	28	32	36	44
b_3	–	–	–	57

Dimensions in stock:
Steel/Steel coated: 102

DIN 608

Flat countersunk square neck bolts with short square

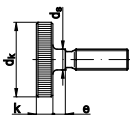


Dimensions	M 8	M 10	M 12	M 16
d_k	16	19.65	24.65	32
f	7	8.45	11.05	13.5
b	22	26	30	38
v	8	10.58	12.7	16
countersunk angle	90°	90°	90°	90°

Dimensions in stock:
Steel/Steel coated: 102

DIN 653

Knurled thumb screws, low type



Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
$\varnothing d_k$	12	16	20	24	30	36
$k_{max.}$	2.5	3.5	4	5	6	8
$\varnothing d_s$	3	4	5	6	8	10
e	2	3	3	4	5	6

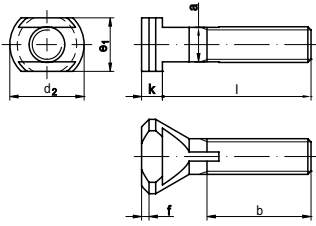
Dimensions in stock:
Steel/Steel coated: 104 | Stainless steel: 448



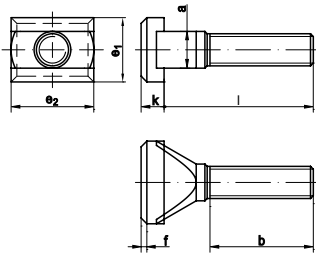
Other screws with metric thread

DIN 787

T-slot screws



head shape up to M 12x12



head shape from M 12x14*

* $e_2 \geq e_1$

Dimensions	M 8	M 10	M 12	M 16
$a_{max.}$	7.7	9.7	11.7	15.7
l	32/40/50/ 65/80	32/40/50/ 65/100	40/50/65/80/100/ 125/200/250/320	65/80/100/ 125/160/ 200/250
b	20/30/35/ 40/45	20/30/35/ 40/60	30/35/40/ 50/60/70/ 100/120/120	40/50/60/ 70/80/ 100/120
e_1/d_2	13/16	15/20	18/25	25
f	1.6	1.6	2.5	2.5
k	6	6	7	9
for T-slots	8	10	12	16

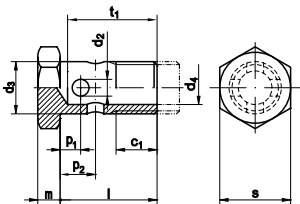
Dimensions	M 16	M 20	M 24	M 24
$a_{max.}$	17.7	19.7	23.7	27.7
l	65/80/100/ 125/160/ 200/250	65/80/100/ 125/160/200/ 250/320/400	100/160/ 250/315	100/160/ 250/315
b	40/50/60/ 70/80/ 100/120	40/50/60/ 70/80/100 / 120/120/120	60/80 / 120/120	60/80/ 120/120
e_1/d_2	25	32	40	44
f	2.5	2.5	(4)	4
k	9	12	16	18
for T-slots	18	20	24	28

Dimensions in stock:

Steel/Steel coated: 107

DIN 7643

Hollow screws for ring type banjos short thread length



Dimensions	M 8x1	M 10x1	M 12x1.5	M 14x1.5
pipe Ø	4 und 5	5	8	10
c_1	8.5	8.5	11	11
l_1	17	19	24	26
t_1	15	17	22	24
b_2	–	2.8	3.5	4.5
d_3	8	10	12	14
d_4	4	5.5	7	9
m	5	6	6	6
p_1	–	4.5	5	5.5
p_2	–	6.5	8	9.5
s	12	14	17	19

Dimensions	M 16x1.5	M 18x1.5	M 22x1.5	M 26x1.5
pipe Ø	12	15	18	22
c_1	11	11	13	13
l_1	28	32	39	45
t_1	26	29	35.5	41
b_2	5.5	7	9	11
d_3	16	18	22	26
d_4	11	13	16	20
m	6	6	7	7
p_1	6.5	7.5	9	10.5
p_2	11.5	14	18	22.5
s	22	24	27	32

Dimensions in stock:

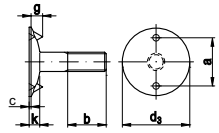
Steel/Steel coated: 330



Other screws with metric thread

DIN 15237

Seating screws
for the attachment of components

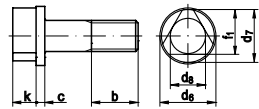


Dimensions	M 6	M 8	M 10	M 12
d_3	20	28	35	42
a	14	20	25	30
$c_{max.}$	1	1	1	1.2
g	3.5	5	6	7
k	2.5	3.5	4.5	5.2
l	20	25/30/35/40	30/35/40/50	35/40/50/60
b	12	15/18/18/20	18/20/20/20	20/25/28/28

Dimensions in stock:
Steel/Steel coated: 383

DIN 22424

Triangle head bolts
type A = with full shank

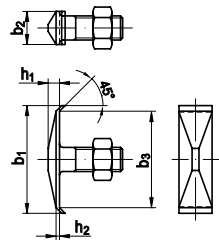


Dimensions	M 8	M 10	M 12
$c_{max.}$	1	1	1.2
k	3.5	4.5	5.2
$d_6 \text{ max.}$	15.2	18.2	
$d_7 \text{ min.}$	13.9	16.9	
$d_8 \text{ min.}$	9.3	11.8	
b	15/18/18/20	18/20/20/20	20/25/28/28
$f_1 \text{ min.}$	11.55	14.3	

Dimensions in stock:
Steel/Steel coated: 383

DIN 25193

Mushroom head anchor screws

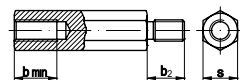


Dimensions	M 8	M 10
b_1	55	55
b_2	20	20
b_3	49	49
h_1	5	5
h_2	1.5	1.5

Dimensions in stock:
Steel/Steel coated: 383

Article 88086

Spacers with thread



Dimensions	M 3	M 4	M 5	M 6
$b_{min.}$	2.5/3/3.5/ 5/6/7	5/6/8/9	11	10/15/16
b_2	6	8	10	13
s	5.5	7	8	10

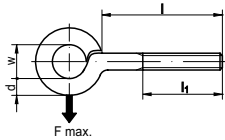
Dimensions in stock:
Steel/Steel coated: 391



Other screws with metric thread

Article 88136

Screw eyes
type 48



Dimensions	M 3	M 4	M 5	M 6
w	5	6	8	10
d	2.6	3.5	4.4	5.2
l	11/16	11/16/21/26/32/42	16/21/26/32/42/52/62	11/16/21/26/32/42/52/62/72/82
l ₁	10/15	10/15/20/25/30/40	15/20/25/30/40/50/60	10/15/20/25/30/40/50/60/70/80
F _{max.}	7.50 kg	12.50 kg	20 kg	35 kg

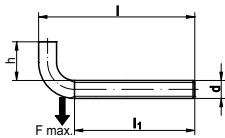
Dimensions	M 8	M 10	M 12	
w	12	14	18	
d	7	8.9	10.6	
l	21/26/32/42/52/62/82/102	32/42/52/62/72/82/102	102	
l ₁	20/25/30/40/50/60/80/100	30/40/50/60/80/70/100	100	
F _{max.}	50 kg	100 kg	175 kg	

Dimensions in stock:

Steel/Steel coated: 413 | Stainless steel: 559

Article 88138

Straight screw hooks
type 4E



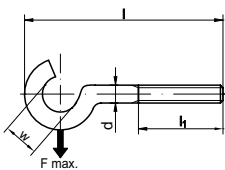
Dimensions	M 4	M 5	M 6	M 8
h	10	12	14	18
d	3.5	4.4	5.2	7
l	40	50	60	60
l ₁	25	35	45	45
F _{max.}	12.5 kg	20 kg	35 kg	50 kg

Dimensions in stock:

Steel/Steel coated: 415

Article 88142

Cup hooks
type 11E



Dimensions	M 4	M 5	M 6	M 8
w	12/16	16	18	22
d	3.5	4.4	5.2	7
l	40/50	50/60	50/60	70/80
l ₁	20/25	23/30	20/30	32/42
F _{max.}	9 kg	12.50 kg	25 kg	40 kg

Dimensions in stock:

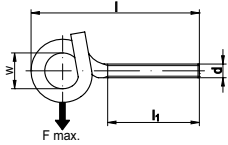
Steel/Steel coated: 415



Other screws with metric thread

Article 88145

Heavy ceiling hooks
type 18E



Dimensions	M 10	M 12	M 12
W	22	22	22
d	8.9	10.6	10.6
L	120/140	160	180
l ₁	73	93	115
F _{max.}	125 kg	175 kg	175 kg

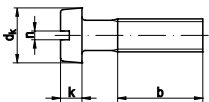
Dimensions in stock:
Steel/Steel coated: 416

Slotted and cross recessed screws with metric thread

ISO 1207

similar DIN 84

Slotted cheese head screws



Dimensions	M 1	M 1.2	M 1.4	M 1.6	M 1.8	M 2	M 2.5
d _k	2	2.3	2.6	3	3.4	3.8	4.5
k	0.7	0.8	0.9	1.1	1.2	1.3	1.6
n	0.25	0.3	0.3	0.4	0.4	0.5	0.6
b	25	25	25	25	25	25	25

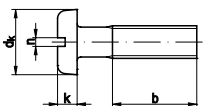
Dimensions	M 3	M 3.5	M 4	M 5	M 6	M 8	M 10
d _k	5.5	6	7	8.5	10	13	16
k	2	2.4	2.6	3.3	3.9	5	6
n	0.8	1	1.2	1.2	1.6	2	2.5
b	25	38	38	38	38	38	38

Dimensions in stock:
Steel/Steel coated: 194, 61 | Stainless steel: 481, 429 | Non-ferrous materials: 582, 565

ISO 1580

similar DIN 85

Slotted pan head screws

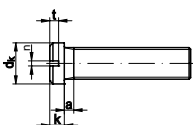


Dimensions	M 2	M 2.5	M 3	M 4	M 5	M 6	M 8
d _k	4	5	6	8	10	12	16
k	1.3	1.5	1.8	2.4	3	3.6	4.8
n	0.5	0.6	0.8	1.2	1.1	1.6	2
b	25	25	25	38	38	38	38

Dimensions in stock:
Steel/Steel coated: 209, 63 | Stainless steel: 487, 431 | Non-ferrous materials: 585, 566

DIN 920

Slotted pan head screws
with small head



Dimensions	M 3	M 4	M 5
a _{max.}	1	1.4	1.6
d _k	4	5.5	6.5
k	1.8	2.4	2.7
n	0.5	0.6	0.8
t _{max.}	1.15	1.5	1.6

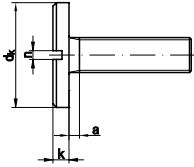
Dimensions in stock:
Steel/Steel coated: 135



Slotted and cross recessed screws with metric thread

DIN 921

Slotted pan head screws with large head



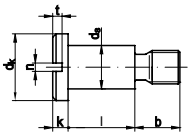
Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
$d_{\max}$	1	1.4	1.6	2	2.5	3
d_k	8	12	16	20	25	30
k	1.8	2.4	2.7	3.1	3.8	4.6
n	0.8	1	1.2	1.6	2	2.5
$t_{\max}$	1.15	1.5	1.6	1.9	2.4	2.8

Dimensions in stock:

Steel/Steel coated: 135

DIN 923

Slotted pan head screws with shoulder



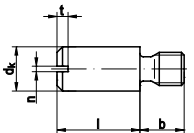
Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
d_k	7	8.5	11	13	16	20
k	1.8	2.4	2.7	3.1	3.8	4.6
b	4.5	6	7	9	11	13.5
d_s	4	5.5	7	8	10	13

Dimensions in stock:

Steel/Steel coated: 136 | Stainless steel: 458

DIN 927

Slotted shoulder screws



Dimensions	M 3	M 4	M 5	M 6	M 8
d_k	4	5.5	6.5	8	10
b	4.5	6	7	8	11
n	0.5	0.6	0.8	1	1.2
$t_{\max}$	1.05	1.42	1.63	2	1.9

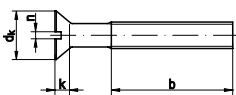
Dimensions in stock:

Steel/Steel coated: 136

ISO 2009

replaces DIN 963

Slotted countersunk head screws



Dimensions	M 1	M 1.2	M 1.4	M 1,6	M 2	M 2.5
d_k ISO/DIN	1.9	2.3	2.6	3	3.8	4.7
k ISO/DIN	0.6	0.72	0.84	1/0.96	1.2	1.5
b*	1)	1)	1)	15	16	18
n	0.25	0.3	0.3	0.4	0.5	0.6

Dimensions	M 3	M 3.5	M 4	M 5	M 6	M 8
d_k ISO/DIN	5.5/5.6	7.3/6.5	8.4/7.5	9.3/9.2	11.3/11	15.8/14.5
k ISO/DIN	1.65	2.35/1.93	2.7/2.2	2.7/2.5	3.3/3	4.65/4
b*	19	38	22	25	28	34
n	0.8	1	1.2	1.2	1.6	2

Dimensions	M 10	M 12	M 16	M 20		
d_k ISO/DIN	18.3/18	22	29	36		
k ISO/DIN	5	6	8	10		
b*	40	46	58	70		
n	2.5	3	4	5		

* minimum lengths

1) only with thread up to near the head

Dimensions in stock:

Steel/Steel coated: 212, 177 | Stainless steel: 489, 471 | Non-ferrous materials: 586, 580

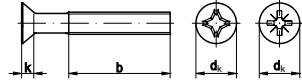


Slotted and cross recessed screws with metric thread

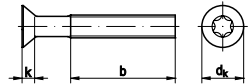
ISO 7046

replaces DIN 965

Countersunk head screws



with Phillips cross recess H
with Pozidriv cross recess Z



with hexalobular socket

* minimum length

Dimensions in stock:

Steel/Steel coated: 308, 180 | Stainless steel: 526, 474

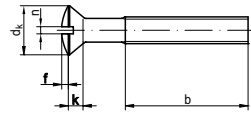
Dimensions	M 1,6	M 2	M 2.5	M 3	M 4
d_k ISO/DIN	3	3.8	4.7	5.5/5.6	8.4/7.5
k ISO/DIN	1/0.96	1.2	1.5	1.65	2.7/2.2
b^*	15	16	18	19	22
n	0.4	0.5	0.6	0.8	1
cross recess size	0	1	1	1	2
ISR	T5	T6	T8	T10	T20

Dimensions	M 5	M 6	M 8	M 10
d_k ISO/DIN	9.3/9.2	11.3/11	15.8/14.5	18.3/18
k ISO/DIN	2.7/2.5	3.3/3	4.65/4	5
b^*	25	28	34	40
n	1.2	1.6	2	2.5
cross recess size	2	3	4	4
ISR	T25	T30	T40	T50

ISO 2010

replaces DIN 964

Slotted raised countersunk head screws



Dimensions	M 2	M 2.5	M 3	M 4
d_k ISO/DIN	3.8	4.7	5.6	8.4/7.5
k ISO/DIN	1.2	1.5	1.65	2.7/2.2
b	16	18	19	22
f	0.5	0.6	0.75	1
n	0.5	0.6	0.8	1

Dimensions	M 5	M 6	M 8	M 10
d_k ISO/DIN	9.3/9.2	11.3/11	15.8/14.5	18.3/18
k ISO/DIN	2.7/2.5	3.3/3	4.65/4	5
b	25	28	34	40
f	1.25	1.5	2	2.5
n	1.2	1.6	2	2.5

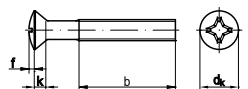
Dimensions in stock:

Steel/Steel coated: 214, 179 | Stainless steel: 491, 473 | Non-ferrous materials: 587, 581

ISO 7047

replaces DIN 966

Raised countersunk head screws with Phillips cross recess H



Dimensions	M 2.5	M 3	M 4	M 5	M 6	M 8
d_k ISO/DIN	4.7	5.6	8.4/7.5	9.3/9.2	11.3/11	15.8/14.5
k ISO/DIN	1.5	1.65	2.7/2.2	2.7/2.5	3.3/3	4.65/4
b	18	19	22	25	28	34
f	0.6	0.75	1	1.25	1.5	2
n	0.6	0.8	1	1.2	1.6	2
cross recess size	1	1	2	2	3	4

Dimensions in stock:

Steel/Steel coated: 310, 182 | Stainless steel: 528, 477

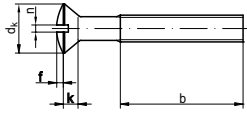


Slotted and cross recessed screws with metric thread

ISO 2010

replaces DIN 964

Slotted raised countersunk head screws



Dimensions	M 2	M 2.5	M 3	M 4
d_k ISO/DIN	3.8	4.7	5.6	8.4/7.5
k ISO/DIN	1.2	1.5	1.65	2.7/2.2
b	16	18	19	22
f	0.5	0.6	0.75	1
n	0.5	0.6	0.8	1

Dimensions	M 5	M 6	M 8	M 10
d_k ISO/DIN	9.3/9.2	11.3/11	15.8/14.5	18.3/18
k ISO/DIN	2.7/2.5	3.3/3	4.65/4	5
b	25	28	34	40
f	1.25	1.5	2	2.5
n	1.2	1.6	2	2.5

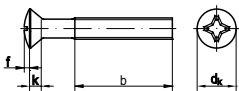
Dimensions in stock:

Steel/Steel coated: 214, 179 | Stainless steel: 491, 473 | Non-ferrous materials: 587, 581

ISO 7047

replaces DIN 966

Raised countersunk head screws with Phillips cross recess H



Dimensions	M 2.5	M 3	M 4	M 5	M 6	M 8
d_k ISO/DIN	4.7	5.6	8.4/7.5	9.3/9.2	11.3/11	15.8/14.5
k ISO/DIN	1.5	1.65	2.7/2.2	2.7/2.5	3.3(3)	4.65/4
b	18	19	22	25	28	34
f	0.6	0.75	1	1.25	1.5	2
n	0.6	0.8	1	1.2	1.6	2
cross recess size	1	1	2	2	3	4

Dimensions in stock:

Steel/Steel coated: 310, 182 | Stainless steel: 528, 477

ISO 7045

similar DIN 7985

Pan head screws with cross recess



with Phillips cross recess H
with Pozidriv cross recess Z

Dimensions	M 1.6	M 2	M 2.5	M 3
d_k	3.2	4	5	6
k	1.3	1.6	2	2.4
cross recess size	0	1	1	1

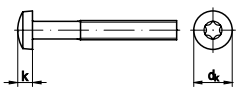
Dimensions in stock:

Steel/Steel coated: 342 | Stainless steel: 541

ISO 14583

~DIN 7985

Hexalobular socket pan head screws



Dimensions	M 1.6	M 2	M 2.5	M 3	M 4
d_k	3.2	4	5	6	8
k	1.3	1.6	2	2.4	3.1
ISR	T5	T6	T8	T10	T20

Dimensions	M 5	M 6	M 8	M 10	
d_k	10	12	16	20	
k	3.8	4.6	6	7.5	
ISR	T25	T30	T45	T50	

Dimensions in stock:

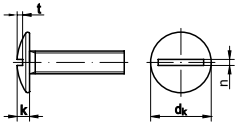
Steel/Steel coated: 380, 344 | Stainless steel: 549, 542



Slotted and cross recessed screws with metric thread

Article 88107

Slotted mushroom head screws
with thread up to head



Dimensions	M 5	M 6	M 8
d_k	12	15	19
k	2.8	3.3	4.3
$n_{min.}$	1.3	1.6	1.8
t	1.5	2	2.7

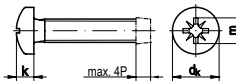
Dimensions in stock:

Steel/Steel coated: 408 | Stainless steel: 556

Tapping screws, thread rolling screws and thread cutting screws

DIN 7500 C

Thread rolling screws
with metric thread
and Pozidriv cross recess Z
type C = pan head acc. to DIN 7985



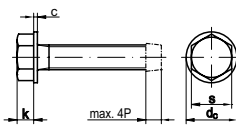
Dimensions	M 2	M 2.5	M 3	M 3.5	M 4	M 5	M 6	M 8
max. groove section	1.6	1.8	2	2.4	2.8	3.2	4	5
cross recess size	1	1	1	2	2	2	3	4
$d_{k \max.}$	4	5	6	7	8	10	12	16
$k_{\max.}$	1.6	2	2.4	2.7	3.1	3.8	4.6	6

Dimensions in stock:

Steel/Steel coated: 325

DIN 7500 ~D

Thread rolling screws
with metric thread
~ type D = hexagon head with collar



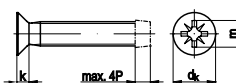
Dimensions	M 4	M 5	M 6	M 8
max. groove section	2.8	3.2	4	5
s	7	8	10	13
d_c	8.1	10.1	12.6	16.4
c	0.55	0.75	0.9	1.2
k	3.1	3.8	4.6	6

Dimensions in stock:

Steel/Steel coated: 326

DIN 7500 M

Thread rolling screws
with metric thread
and Pozidriv cross recess Z
type M = countersunk head acc. to DIN 965



Dimensions	M 2	M 2.5	M 3	M 3.5	M 4	M 5	M 6	M 8
max. groove section	1.6	1.8	2	2.4	2.8	3.2	4	5
cross recess size	1	1	1	2	2	2	3	4
$d_{k \max.}$	3.5	4.7	5.6	6.5	7.5	9.2	11	14.5
$k_{\max.}$	1.2	1.5	1.65	1.93	2.2	2.5	3	4

Dimensions in stock:

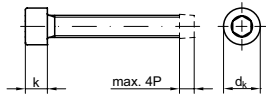
Steel/Steel coated: 326



Tapping screws, thread rolling screws and thread cutting screws

DIN 7500 E

Thread rolling screws with metric thread
type E = hexagon socket head cap
acc. to DIN 912

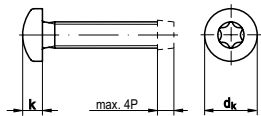


Dimensions	M 4	M 5	M 6	M 8
$d_{K \max.}$	7	8.5	10	13
$k_{\max.}$	4	5	6	8
s	2.5	3	4	5

Dimensions in stock:
Steel/Steel coated: 326

DIN 7500 CE/PE

Drilling screws with tapping screw thread
type K = hexagon head with collar
acc. to DIN 6928

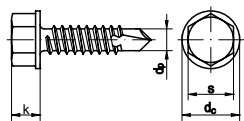


Dimensions	M 3	M 4	M 5	M 6	M 8
$d_{K \max.}$	5.6	8	9.50	12	16
$d_{p \max.}$	2.4	3.1	3.7	4.6	6
$d_{c \max.}$	T10	T20	T25	T30	T40

Dimensions in stock:
Steel/Steel coated: 325

DIN 7504 K

Drilling screws with tapping screw thread
type K = hexagon head with collar acc. to
DIN 6928



Dimensions	St 2.9	St 3.5	St 3.9	St 4.2
f. sheet thicknesses	0.7 to 0.19	0.7 to 2.25	0.7 to 2.4	1.75 to 3.0
$d_{p \max.}$	2.3	2.8	3.1	3.6
$d_{c \max.}$	6.3	8.3	8.3	8.8
$k_{\max.}$	2.8	3.4	3.4	4.1
s	4	5.5	5.5	7

Dimensions	St 4.8	St 5.5	St 6.3	
f. sheet thicknesses	1.75 to 4.4	1.75 to 5.25	2.0 to 6.0	
$d_{p \max.}$	4.1	4.8	5.8	
$d_{c \max.}$	10.5	11	13.5	
$k_{\max.}$	4.3	5.4	5.9	
s	8	8	10	

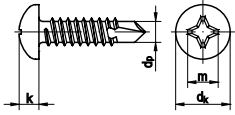
Dimensions in stock:
Steel/Steel coated: 327



Tapping screws, thread rolling screws and thread cutting screws

DIN 7504 N

**Drilling screws
with tapping screw thread
and Phillips cross recess H**
type N = pan head acc. to DIN 7981



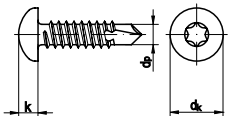
Dimensions	St 2.9	St 3.5	St 3.9	St 4.2
f. sheet thicknesses	0.7 to 1.9	0.7 to 2.25	0.7 to 2.4	1.75 to 3.0
$d_{p \text{ max.}}$	2.3	2.8	3.1	3.6
$d_{k \text{ max.}}$	5.6	6.9	7.5	8.2
$k_{\text{max.}}$	2.2	2.6	2.8	3.05
cross recess size	1	2	2	2

Dimensions	St 4.8	St 5.5	St 6.3	
f. sheet thicknesses	1.75 to 4.4	1.75 to 5.25	2.0 to 6.0	
$d_{p \text{ max.}}$	4.1	4.8	5.8	
$d_{k \text{ max.}}$	9.5	10.8	12.5	
$k_{\text{max.}}$	3.7	4	4.6	
cross recess size	2	3	3	

Dimensions in stock:
Steel/Steel coated: 327

DIN 7504 N

**Drilling screws
with tapping screw thread
and hexalobular socket**
type N = pan head acc. to ISO 14583



Dimensions	ST 2.9	ST 3.5	ST 3.9*	ST 4.2
f. sheet thicknesses	0.7 to 1.9	0.7 to 2.25	0.7 to 2.4	1.75 to 3.0
$d_{p \text{ max.}}$	2.3	2.8	3.2	3.6
$d_{k \text{ max.}}$	5.6	7	7.5	8
$k_{\text{max.}}$	2.4	2.6	2.8	3.1
ISR size	T10	T15	T20	T20

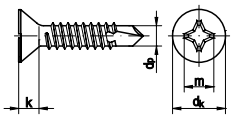
Dimensions	ST 4.8	ST 5.5	ST 6.3	
f. sheet thicknesses	1.75 to 4.4	1.75 to 5.25	2.0 to 6.0	
$d_{p \text{ max.}}$	4.1	4.8	5.8	
$d_{k \text{ max.}}$	9.5	11	12	
$k_{\text{max.}}$	3.7	4	4.6	
ISR size	T25	T25	T30	

* not standardized, reference values

Dimensions in stock:
Steel/Steel coated: 327

DIN 7504 P

**Drilling screws
with tapping screw thread
and Phillips cross recess H**
type P = countersunk head acc. to DIN 7982



countersunk head = 80°

Dimensions	ST 2.9	ST 3.5	ST 3.9	ST 4.2
f. sheet thicknesses	0.7 to 1.9	0.7 to 2.25	0.7 to 2.4	1.75 to 3.0
$d_{p \text{ max.}}$	2.3	2.8	3.2	3.6
$d_{k \text{ max.}}$	5.5	6.8	7.5	8.1
$k_{\text{max.}}$	1.7	2.1	2.3	2.5
cross recess size	1	2	2	2

Dimensions	ST 4.8	ST 5.5	ST 6.3	
f. sheet thicknesses	1.75 to 4.4	1.75 to 5.25	2.0 to 6.0	
$d_{p \text{ max.}}$	4.1	4.8	5.8	
$d_{k \text{ max.}}$	9.5	10.8	12.4	
$k_{\text{max.}}$	3.0	3.4	3.8	
cross recess size	2	3	3	

Dimensions in stock:
Steel/Steel coated: 328

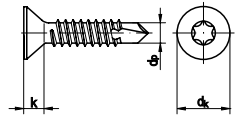


Tapping screws, thread rolling screws and thread cutting screws

DIN 7504 P

**Drilling screws
with tapping screw thread
and hexalobular socket**

type P = countersunk head acc. to DIN 7982



countersunk head = 80°

Dimensions in stock:

Steel/Steel coated: 328

Dimensions	ST 2.9	ST 3.5	ST 3.9	ST 4.2
f. sheet thicknesses	0.7 to 1.9	0.7 to 2.25	0.7 to 2.4	1.75 to 3.0
$d_{p \text{ max.}}$	2.3	2.8	3.2	3.6
$d_{K \text{ max.}}$	5.5	6.8	7.5	8.1
$k_{\text{max.}}$	1.7	2.1	2.3	2.5
ISR size	T10	T15	T20	T20

Dimensions	ST 4.8	ST 5.5	ST 6.3	
f. sheet thicknesses	1.75 to 4.4	1.75 to 5.25	2.0 to 6.0	
$d_{p \text{ max.}}$	4.1	4.8	5.8	
$d_{K \text{ max.}}$	9.5	10.8	12.4	
$k_{\text{max.}}$	3	3.4	3.8	
ISR size	T25	T25	T30	

DIN 7513 A

Thread cutting screws

type A = hexagon head acc. to DIN 933



* for materials with medium property classes

Dimensions	M 4	M 5	M 6	M 8
s	7	8	10	13
k	2.8	3.5	4	5.3
core hole $\varnothing^*$	3.6	4.5	5.5	7.4

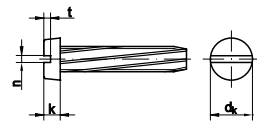
Dimensions in stock:

Steel/Steel coated: 328

DIN 7513 B

Thread cutting screws

type B = slotted cheese head acc. to DIN 84



* for materials with medium property classes

Dimensions	M 3	M 4	M 5	M 6
$d_{k \text{ max.}}$	5.5	7	8.5	10
k	2	2.6	3.3	3.9
n	0.8	1.2	1.2	1.6
$t_{\text{min.}}$	0.85	1.1	1.3	1.6
core hole $\varnothing^*$	2.7	3.6	4.5	5.5

Dimensions in stock:

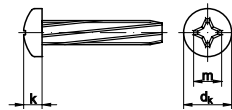
Steel/Steel coated: 329



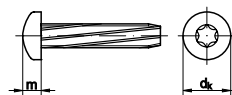
Tapping screws, thread rolling screws and thread cutting screws

DIN 7516 A

Thread cutting screws
type A = pan head acc. to DIN 7985



with Phillips cross recess H



with hexalobular socket

Dimensions	M 3	M 4	M 5	M 6	M 8
$d_{k \max.}$	6	8	10	12	16
$k_{\max.}$	2.4	3.1	3.8	4.6	6
cross recess size	1	2	2	3	4
ISR	T10	T20	T25	T30	T40
core hole $\varnothing^*$	2.7	3.6	4.5	5.5	7.4

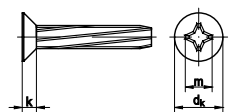
* for materials with medium property classes

Dimensions in stock:

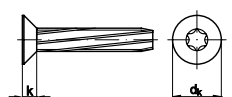
Steel/Steel coated: 329

DIN 7516 D

Thread cutting screws
type D = countersunk head acc. to DIN 965



with Phillips cross recess H



with hexalobular socket

Dimensions	M 3	M 4	M 5	M 6	M 8
$d_{k \max.}$	5.6	7.5	9.2	11	14.5
$k_{\max.}$	1.65	2.2	2.5	3	4
cross recess size	1	2	2	3	4
ISR	T10	T20	T25	T30	T40

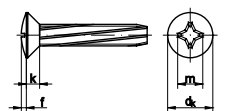
* for materials with medium property classes

Dimensions in stock:

Steel/Steel coated: 329

DIN 7516 E

Thread cutting screws
with Phillips cross recess H
type E = raised countersunk head acc. to DIN 966



* for materials with medium property classes

Dimensions	M 3	M 4	M 5	M 6	M 7
$d_{k \max.}$	5.6	7.5	9.2	11	14.5
f	0.75	1	1.25	1.5	2
$k_{\max.}$	1.65	2.2	2.5	3	4
cross recess size	1	2	2	3	4
core hole $\varnothing^*$	2.7	3.6	4.5	5.5	7.4

Dimensions in stock:

Steel/Steel coated: 329

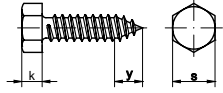


Tapping screws, thread rolling screws and thread cutting screws

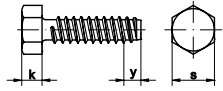
ISO 1479

replaces DIN 7976

Hexagon head tapping screws



type C = with cone end



type F = with flat end

Dimensions	ST 2.9	ST 3.5	ST 3.9	ST 4.2
$k_{ISO/DIN}$	2.3/1.5	2.6/2.3	2.3	3/2.8
s	5	5.5	7	7
$y_{type\ C}$	2.6	3.2	3.5	3.7
$y_{type\ F}$	–	–	–	2.8

Dimensions	ST 4.8	ST 5.5	ST 6.3	ST 8
$k_{ISO/DIN}$	3.8/3	4.1/4	4.7/4.8	6/5.8
s	7	8	10	13
$y_{type\ C}$	4.2	5	6	7.5
$y_{type\ F}$	3.2	–	3.6	–

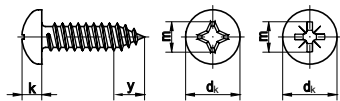
Dimensions in stock:

Steel/Steel coated: 203, 333 | Stainless steel: 486, 536

ISO 7049, 14585

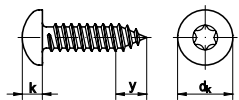
replaces DIN 7981

Pan head tapping screws with cross recess or hexalobular socket

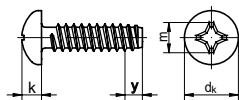


type C-H = with cone end and Phillips cross recess H

type C-Z = with cone end and Pozidriv cross recess Z



type C-ISR = with cone end and hexalobular drive



type F-H = with flat end and Phillips cross recess H

* dimension not ISO standardized, values from DIN 7981

Dimensions	ST 2.2	ST 2.9	ST 3.5	ST 3.9*
$d_k\ ISO/DIN$	4/4.2	5.6	7/6.9	7.5
$k_{max.}\ ISO/DIN$	1.6/1.8	2.4/2.2	2.6	2.8
cross recess size	1	1	2	2
ISR	T6	T10	T15	T15
$y_{type\ C}$	2	2.6	3.2	3.5
$y_{type\ F}$	1.6	2.1	2.5	2.7

Dimensions	ST 4.2	ST 4.8	ST 5.5	ST 6.3
$d_k\ ISO/DIN$	8/8.2	9.5	11/10.8	12/12.5
$k_{max.}\ ISO/DIN$	3.1/3.05	3.7/3.5	4/3.95	4.6/4.55
cross recess size	2	2	3	3
ISR	T20	T25	T25	T30
$y_{type\ C}$	3.7	4.2	5	6
$y_{type\ F}$	2.8	3.2	3.6	3.6

Dimensions in stock:

Steel/Steel coated: 310, 380, 335 | Stainless steel: 529, 550, 537

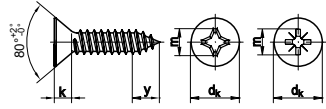


Tapping screws, thread rolling screws and thread cutting screws

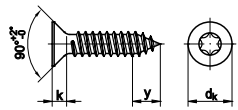
ISO 7050, 14586

replaces DIN 7982

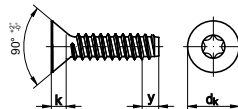
Countersunk head tapping screws with cross recess or hexalobular drive



type C-H = with cone end and Phillips cross recess H
type C-Z = with cone end and Pozidriv cross recess Z



type C-ISR = with cone end and hexalobular drive



type F-ISR = with flat end and hexalobular drive

Dimensions	ST 2.2	ST 2.9	ST 3.5	ST 3.9
d_k ISO/DIN	3.8/4.3	5.5	7.3/6.8	-/7.5
$k_{max.}$ ISO/DIN	1.1/1.3	1.7	2.35/2.1	-/2.3
cross recess size	0	1	2	2
ISR	-	10	15	15
$y_{type C}$	2	2.6	3.2	3.2
$y_{type F}$	1.6	2.1	2.5	2.7

Dimensions	ST 4.2	ST 4.8	ST 5.5	ST 6.3
d_k ISO/DIN	8.4/8.1	9.3/9.5	10.3/10.8	11.3/12.4
$k_{max.}$ ISO/DIN	2.6/2.5	2.8/3	3/3.4	3.15/3.8
cross recess size	2	2	3	3
ISR	20	25	25	30
$y_{type C}$	3.7	4.3	5	6
$y_{type F}$	2.8	3.2	3.6	3.6

assembly instructions → [TI-184](#)

Dimensions in stock:

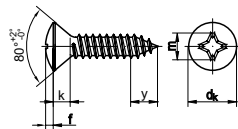
Steel/Steel coated: 312, 381, 338 | Stainless steel: 530, 550, 538

ISO 7051

replaces DIN 7983

Countersunk head tapping screws with Phillips cross recess H

type C = with cone end



Dimensions	ST 2.9	ST 3.5	ST 3.9*	ST 4.2
d_k ISO/DIN	5.5	7.3/6.8	-/7.5	8.4/8.1
$k_{max.}$ ISO/DIN	1.7/1.7	2.35/2.1	-/2.3	2.6/2.5
cross recess size	1	2	2	2
$y_{type C}$	2.6	3.2	3.5	3.7

Dimensions	ST 4.8	ST 5.5	ST 6.3	
d_k ISO/DIN	9.3/9.5	10.3/10.8	11.3/12.4	
$k_{max.}$ ISO/DIN	2.8/3	3/3.4	3.15/3.8	
cross recess size	2	3	3	
$y_{type C}$	4.3	5	6	

* dimensions acc. to DIN 7983

Dimensions in stock:

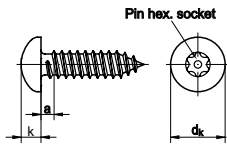
Steel/Steel coated: 313, 339 | Stainless steel: 530, 539



Tapping screws, thread rolling screws and thread cutting screws

Article 88114

Theft resistant screws with raised head and hex. socket drive
type C = with cone end



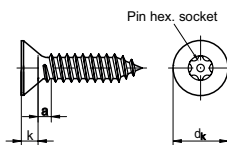
Dimensions	ST 3.5	ST 4.2	ST 4.8	ST 5.5	ST 6.3
d_k	6.9	8.2	9.5	10.8	12.5
k	2.6	3.05	3.55	3.95	4.55
$a_{max.}$	1.3	1.4	1.6	1.8	1.8
Pin - ISR - size	T10	T15	T25	T27	T27

Dimensions in stock:

Stainless steel: 557

Article 88115

Theft resistant screws with countersunk head and hex. socket drive
type C = with cone end



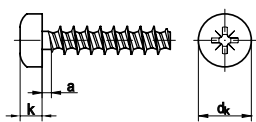
Dimensions	ST 2.9	ST 3.5	ST 4.2	ST 4.8	ST 5.5	ST 6.3
d_k	5.5	6.8	8.1	9.5	10.8	12.4
k	1.7	2.1	2.5	3	3.4	3.8
$a_{max.}$	1.1	1.3	1.4	1.6	1.8	1.8
Pin - ISR - size	T10	T15	T20	T25	T27	T30

Dimensions in stock:

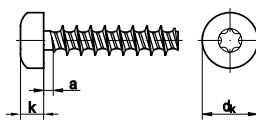
Stainless steel: 557

Article 88200

Pan head screws with thread for plastic (thermoplastics)



with Pozidriv cross recess Z



with hexalobular socket

a_1 for ($L > 3xd$)

a_2 for ($L > 3xd$)

ISR = hexalobular socket

CR = cross recess

Dimensions	2.2	2.5	3	3.5
$dk_{KS/ISR}$	3.9/4	4.4/4.2	5.3/5.6	6.1/6.9
$k_{CR/ISR}$	1.5/1.5	1.7/1.6	2/2.1	2.5/2.3
a_1	2.2	2.5	3	3.5
a_2	1.1	1.3	1.5	1.8
cross recess size	1	1	1	1
ISR size	T6	T8	T10	T10

Dimensions	4	5	6	
$dk_{KS/ISR}$	7/7.5	8.8/8.2	10.5/10.8	
$k_{CR/ISR}$	2.7/2.6	3.4/2.9	4/3.8	
a_1	4	6	7	
a_2	2	3	3.5	
cross recess size	2	2	2	
ISR size	T20	T20	T25	

Dimensions in stock:

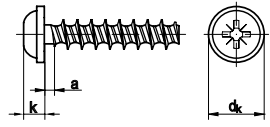
Steel/Steel coated: 416, 416



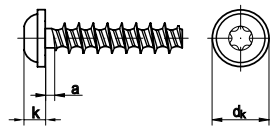
Tapping screws, thread rolling screws and thread cutting screws

Article 88202

Pan head screws with collar
with screw thread for plastic
(thermoplastics)



with Pozidriv cross recess Z



with hexalobular socket

a_1 for ($L > 3x_d$)

a_2 for ($L > 3x_d$)

ISR = hexalobular socket

CR = cross recess

Dimensions in stock:

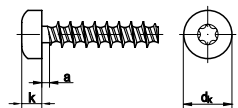
Steel/Steel coated: 416, 416

Dimensions	2.2	2.5	3	3.5
d_k KS /ISR	4.4/4.5	5	6	7
k CR/ISR	1.6/1.4	1.8/1.5	2.1	2.4
a_1	2.2	2.5	3	3.5
a_2	1.1	1.3	1.5	1.8
cross recess size	1	1	1	1
ISR size	T6	T6	T10	T10

Dimensions	4	5	6	
d_k KS /ISR	8	10	12	
k CR/ISR	2.5/2.6	3.2/3.3	4/3.6	
a_1	4	6	7	
a_2	2	3	3.5	
cross recess size	2	2	2	
ISR size	T20	T20	T25	

Article 88203

Pan head screws with screw thread
for plastic (thermoplastics),
with hexalobular socket
RSTplus = higher preloads



Dimensions	2.2	2.5	3	3.5
d_k	3.9	4.4	5.3	6.1
k	1.6	1.9	2.3	2.7
$a_{max.}$	1.1	1.3	1.5	1.8
ISR size	T6	T8	T10	T15

Dimensions	4	5	6	
d_k	7	8.8	10.5	
k	3.1	3.5	4.2	
$a_{max.}$	2	2.5	3	
ISR size	T20	T25	T30	

Dimensions in stock:

Steel/Steel coated: 417

Article 88204

Pan head screws with collar
with screw thread for plastic (thermoplastics),
with hexalobular socket
RSTplus = higher preloads



Dimensions	2.2	2.5	3	3.5
d_k	5	5.5	6.5	7.5
k	1.6	1.9	2.3	2.7
$a_{max.}$	1.1	1.3	1.5	1.8
ISR size	T6	T8	T10	T15

Dimensions	4	5	6	
d_k	9	11	13.5	
k	3.1	3.5	4.2	
$a_{max.}$	2	2.5	3	
ISR size	T20	T25	T30	

Dimensions in stock:

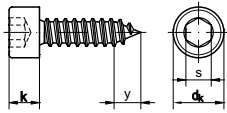
Steel/Steel coated: 417



Tapping screws, thread rolling screws and thread cutting screws

Article 88312

Cylindrical head tapping screws with hexagon socket
type C = with cone end

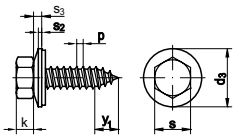


Dimensions	ST 4.8	ST 5.5	ST 6.3
d_k	8.5	10	10
k	5	6	6
s	4	5	5
y~	4.3	5	6

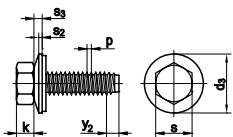
Dimensions in stock:
Stainless steel: 536

Article 88176, 88276

Tapping screws for facing with assembled sealing washer



88176 type A = with cone end



88276 type BZ = with flat end

Dimensions	88176 6.5
s	3/8 "
k	4
p	2.54
y ₁	6
y ₂	–
d ₃ (washer)	16/18*
S ₂ (washer)	1
S ₃ (washer)	2
f. sheet thicknesses	0.60 – 1.50
for drilling Ø	4.5

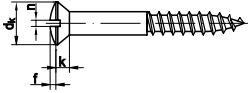
Dimensions in stock:
Stainless steel: 560, 560



Wood screws

DIN 95

Slotted raised countersunk head wood screws



Dimensions	1.6	2	2.5	3	3.5
d _k	3	3.8	4.7	5.6	6.5
k	0.96	1.2	1.5	1.65	1.93
f	0.4	0.5	0.6	0.75	0.9
n	0.4	0.5	0.6	0.8	0.8

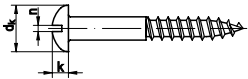
Dimensions	4	4.5	5	6	8
d _k	7.5	8.3	9.2	11	14.5
k	2.2	2.35	2.5	3	4
f	1	1.1	1.25	1.5	2
n	1	1	1.2	1.6	2

Dimensions in stock:

Steel/Steel coated: 66 | Stainless steel: 433 | Non-ferrous materials: 567

DIN 96

Slotted round head wood screws



Dimensions	1.6	2	2.5	3	3.5
d _k	3.2	4	5	6	7
k	1.1	1.4	1.7	2.1	2.4
n	0.4	0.5	0.6	0.8	0.8

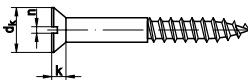
Dimensions	4	4.5	5	6	8
d _k	8	9	10	12	16
k	2.8	3.1	3.5	4.2	5.6
n	1	1	1.2	1.6	2

Dimensions in stock:

Steel/Steel coated: 66 | Stainless steel: 434 | Non-ferrous materials: 568

DIN 97

Slotted countersunk head wood screws



Dimensions	1.6	2	2.5	3	3.5	4
d _k	3	3.8	4.7	5.6	6.5	7.5
k	0.96	1.2	1.5	1.65	1.93	2.2
n	0.4	0.5	0.6	0.8	0.8	1

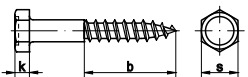
Dimensions	4.5	5	5.5	6	7	8
d _k	8.3	9.2	10.2	11	12.5	14.5
k	2.35	2.5	2.75	3	3.5	4
n	1	1.2	1.2	1.6	2	2

Dimensions in stock:

Steel/Steel coated: 66 | Stainless steel: 434 | Non-ferrous materials: 569

DIN 571

Hexagon head wood screws



Dimensions	5	6	7	8
b	> 0.6 l	> 0.6 l	> 0.6 l	> 0.6 l
k	3.5	4	5	5.5
s	8	10	12	13

Dimensions	10	12	16	20
b	> 0.6 l	> 0.6 l	> 0.6 l	> 0.6 l
k	7	8	10	13
s	17	19	24	30

Dimensions in stock:

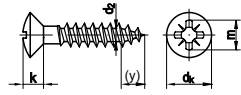
Steel/Steel coated: 93 | Stainless steel: 445



Chipboard screws

Article 88095

Chipboard screws with countersunk head and Pozidriv cross recess Z



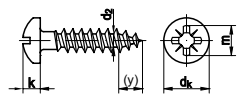
Dimensions	ST 3.5	ST 4
d_k	7	8
$k_{min.}$	2.1	2.4
d_2	2.5	2.67
cross recess size	2	2

Dimensions in stock:

Non-ferrous materials: 596

Article 88096

Chipboard screws with round head and Pozidriv cross recess Z



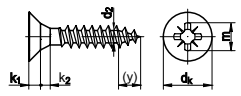
Dimensions	ST 3	ST 3.5	ST 4	ST 4.5	ST 5	ST 6
d_2	1.9	2.5	2.67	2.7	3	3.7
d_k	6	7	8	9	10	12
$k_{1 max.}$	2.25	2.6	2.8	3	3.5	4.1
y	3	3.4	4	4.3	4.8	5.7
cross recess size	1	2	2	2	2	3

Dimensions in stock:

Steel/Steel coated: 404 | Stainless steel: 554

Article 88097

Chipboard screws with countersunk head and Pozidriv cross recess Z



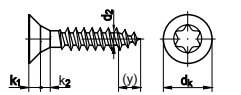
Dimensions	ST 3	ST 3.5	ST 4	ST 4.5	ST 5	ST 6
d_2	1.9	2.5	2.67	2.7	3	3.7
d_k	6	7	8	9	10	12
$k_{1 max.}$	1.9	2.1	2.5	2.7	3	3.6
$k_{2 max.}$	1.6	1.8	2	2.2	2.5	3
y	3	3.4	4	4.3	4.8	5.7
cross recess size	1	2	2	2	2	3

Dimensions in stock:

Steel/Steel coated: 404 | Stainless steel: 554

Article 88098

Chipboard screws with countersunk head and hexalobular socket



Dimensions	ST 3	ST 3.5	ST 4	ST 4.5	ST 5	ST 6	ST 8
d_2	1.9	2.5	2.67	2.7	3	3.7	5
d_k	6	7	8	9	10	12	15.1
$k_{1 max.}$	1.9	2.1	2.5	2.7	3	3.6	4.4
$k_{2 max.}$	1.6	1.8	2	2.2	2.5	3	3.8
y	3	3.4	4	4.3	4.8	5.7	6.5
cross recess size	T10	T15	T20	T20	T25	T30	T40

Dimensions in stock:

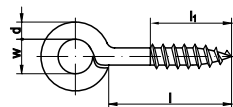
Steel/Steel coated: 406 | Stainless steel: 555



Hooks/special bolts with wood screw thread

Article 88133

Screw eyes
with wood screw thread
type 1



Dimensions	6x3	8x3	8x4	10x3	10x4	10x6	12x3	12x4
w	3	8	4	3	4	6	3	4
d	2	2	2.3	2	2.3	2.9	2	2.3
l	6	8	8	10	10	10	12	12
l ₁	4	5	5	7	7	7	8	8

Dimensions	12x6	12x8	12x10	16x4	16x6	16x8	16x10	16x12
w	6	8	10	4	6	8	10	12
d	2.9	3.3	3.7	2.3	2.9	3.3	3.7	3.9
l	12	12	12	16	16	16	16	16
l ₁	8	8	8	10	10	10	10	10

Dimensions	20x6	20x8	20x10	20x12	25x8	25x10	25x12	25x14
w	6	8	10	12	8	10	12	14
d	2.9	3.3	3.7	3.9	3.3	3.7	3.7	4
l	20	20	20	20	25	25	25	25
l ₁	12	12	12	12	15	15	15	15

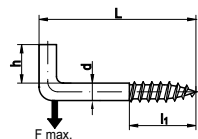
Dimensions	25x16	30x8	30x10	30x12	30x14	30x16	30x18	40x12
w	16	8	10	12	14	16	18	12
d	4.6	3.3	3.7	3.9	4	4.6	5	3.9
l	25	30	30	30	30	30	30	40
l ₁	15	18	18	18	20	18	18	22

Dimensions	40x14	40x16	40x18	40x20	50x14	50x16	50x18	50x20
w	14	16	18	20	14	16	18	20
d	4	4.6	5	5.2	4	4.6	5	5.2
l	40	40	40	40	50	50	50	50
l ₁	25	22	22	22	25	25	25	25

Dimensions in stock:
Steel/Steel coated: 413

Article 88137

Square bend screw hooks
with wood screw thread
type 4



Dimensions	2.8	2.8	3.3	4.1
h	8	10	11	11
d	2.3	2.3	2.6	3.2
l	20	25	30	40
l ₁	8	10	12	15
F _{max.} for plugs	7.5 kg 4	7.5 kg 4	10 kg 5	12.5 kg 6

Dimensions	4.8	4.8	5.5	6
h	13	13	18	18
d	3.8	3.8	4.2	4.7
l	50	60	80	100
l ₁	22	25	32	38
F _{max.} for plugs	15 kg 6	15 kg 6	20 kg 8	25 kg 8

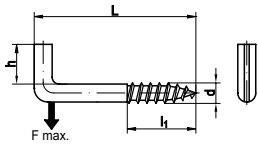
Dimensions in stock:
Steel/Steel coated: 415



Hooks/special bolts with wood screw thread

Article 88139

Square bend slotted screw hooks with wood screw thread
type 7

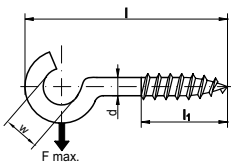


Dimensions	4.4	5.2	5.8
h	9	10	12
d	4.4	5.2	5.8
l	40/50	30/40/50/60	80/100
l ₁	18/22	13/18/22/25	30/38
F _{max.}	25 kg	40 kg	50 kg
for plugs	6	8	8

Dimensions in stock:
Steel/Steel coated: 415

Article 88140/88141

Screw hooks/Cup hooks with wood screw thread
type 11/type 11 k



Dimensions	2.8	3.3	3.6	4.1
w	6/8	10 – 11	12 – 14	16 – 20
d	2.3	2.6	2.8	3.2
l	20/25	30	40	50/60
l ₁	6/8	10	12	15 /22
F _{max.}	4 kg	4 kg	7.5 kg	9 kg
for plugs	4	5	5	6

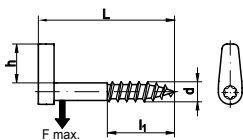
Dimensions	4.8	5.5	6	6.4
w	22 – 23	25 – 26	25 – 30	25
d	3.8	4.2	4.7	5.2
l	70	80	100	80
l ₁	22	26	30	24
F _{max.}	10 kg	12.5 kg	15 kg	25 kg
for plugs	6	8	8	10

type 11 k = coated white

Dimensions in stock:
Steel/Steel coated: 415, 415

Article 88143

Right angle screw hooks with hexalobular drive and wood screw thread
type 10



Dimensions	5.2	5.8
h	9	10
d	5.2	5.8
l	50	
l ₁	25	30
ISR	T15	T20
F _{max.}	40 kg	50 kg
for plugs	8	8

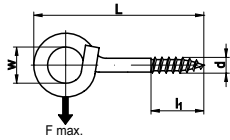
Dimensions in stock:
Steel/Steel coated: 415



Hooks/special bolts with wood screw thread

Article 88144

Heavy duty screw eyes
with wood screw thread
type 18



Caution: unfit for swings

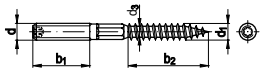
Dimensions in stock:

Steel/Steel coated: 415

Dimensions	8.2	9	10
w	22	22	22
d	8.2	8.9	9.9
l	100	120/140	140
l ₁	40	45/48	48
F _{max.}	100 kg	125 kg	150 kg
for plugs	12	12	14

Article 88149

Hanger bolts



d = nominal size,

*hexalobular socket only for steel zinc
plated, depending on producer

Dimensions in stock:

Steel/Steel coated: 416 | Stainless steel: 559

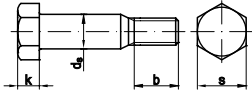
Dimensions	M 6	M 8	M 10	M 12
d ₁	5	7	8.9	10.7
d ₃	3.8	5.4	7	8.5
SW	-	6	8	10
ISR size*	T15	T25	T25	T30



Steel constr. bolts, nuts and washers

DIN 7968

Hexagon fit bolts
for steel structure



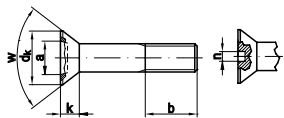
with nut acc. to ISO 4032 or ISO 4034

Dimensions in stock:
Steel/Steel coated: 331

Dimensions	M 12	M 16	M 20	M 24	M 27	M 30
b	20.5	24.5	28.5	33	35.5	38.5
k	8	10	13	15	17	19
d _{s min.}	12.74	16.74	20.71	24.71	27.71	30.67
s	18	24	30	36	41	46

DIN 7969

Slotted countersunk head bolts
for steel structures



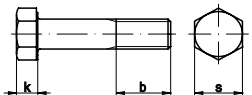
with nut acc. to ISO 4032 or ISO 4034,
b₁ for l ≤ 60 with M 12 and l ≤ 80 with M 16 – M 24
b₂ for l > 60 with M 12 and l > 80 with M 16 – M 24

Dimensions in stock:
Steel/Steel coated: 332

Dimensions	M 12	M 16	M 20	M 24
W	75°	75°	60°	60°
b ₁	22	28	32	38
b ₂	28	35	40	50
d _{k max.}	21	28	32	38
k	7	9	11.5	13
n	2.5	2.5	3	3
t	3	3	3.5	3.5
a _{max.}	14.7	19.6	22.4	26.6

DIN 7990

Hexagon head bolts
with hexagon nut for steel structures



with nut acc. to ISO 4032 or ISO 4034

Dimensions in stock:
Steel/Steel coated: 345

Dimensions	M 12	M 16	M 20	M 24	M 27	M 30
k	8	10	13	15	17	19
s	18	24	30	36	41	46
b	20.5	24.5	28.5	33	35.5	38.5

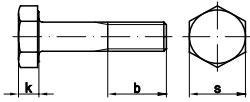


Steel constr. bolts, nuts and washers

EN 14399-4

replaces DIN 6914

Hexagon bolts with large head for high-strength structural bolting, system HV



Dimensions	M 12	M 16	M 20	M 22	M 24	M 27	M 30	M 36
k	8	10	13	14	15	17	19	23
s	22	27	32	36	41	46	50	60
b	23	28	33	34	39	41	44	52

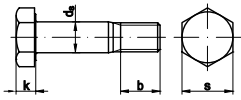
Dimensions in stock:

Steel/Steel coated: 373

EN 14399-8

replaces DIN 7999

Hexagon fit bolts with large head for high-strength structural bolting, system HV



Dimensions	M 12	M 16	M 20	M 22	M 24	M 27	M 30	M 36
k	8	10	13	14	15	17	19	23
d _s	13	17	21	23	25	28	31	37
b	23	28	33	34	39	41	44	52
s	22	27	32	36	41	46	50	60

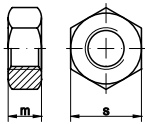
Dimensions in stock:

Steel/Steel coated: 379

EN 14399-4

replaces DIN 6915

Hexagon nuts for high-strength structural bolting, system HV



Dimensions	M 12	M 16	M 20	M 22
m	10	13	16	18
s	22	27	32	36

Dimensions	M 24	M 27	M 30	M 36
m	20	22	24	29
s	41	46	50	60

Dimensions in stock:

Steel/Steel coated: 379

DIN 6917 Square taper washers for friction grip bolts	Dimensions see TI-86 (washers/rings - square washers)
DIN 6918 Square taper washers for friction grip bolts	

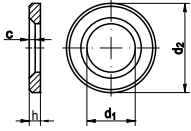


Steel constr. bolts, nuts and washers

EN 14399-6

replaces DIN 6916

Plain chamfered washers for high-strength structural bolting, system HV



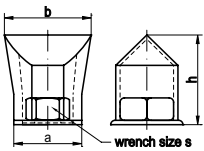
Dimensions	M 12	M 16	M 20	M 22	M 24	M 27	M 30	M 36
$d_{1 \min.}$	13	17	21	23	25	28	31	37
$d_{2 \max.}$	24	30	37	39	44	50	56	66
h	3	4	4	4	4	5	5	6
$c_{\min.}$	1.6	1.6	2	2	2	2.5	2.5	2.5

Dimensions in stock:

Steel/Steel coated: 379

Article 88916

Safety sockets for HV



Dimensions	M 12	M 16	M 20	M 24	M 27	M 30	M 36
a	32	40	45	56	61	69	76
b	45	54	61	80	85	89	110
h	39	52	54	64	68	73	86
s	22	27	32	41	46	50	60

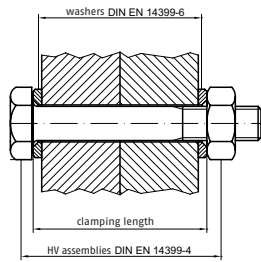
Dimensions in stock:

Steel/Steel coated: 379

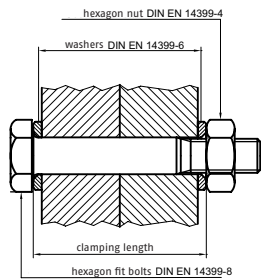


Clamping length for bolts for steel constructions

Bolts, system HV
acc. to EN 14399 - 4



fit bolts acc. to
EN 14399 - 8



The maximum clamping length values are set in such a way that the bolt thread in preload condition exceeds the nuts by min. 1P. Details on washer thickness EN 14399-6

→ TI-58, -85, -86

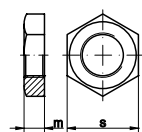
Thread	M 12		M 16		M 20		M 22		M 24		M 27		M 30		M 36	
Nominal length	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
30	11	16														
35	16	21	12	17												
40	21	26	17	22	13	18										
45	26	31	22	27	18	23										
50	31	36	27	32	23	28	22	27	19	24						
55	36	41	32	37	28	33	27	32	24	29						
60	41	46	37	42	33	38	32	37	29	34	26	31				
65	46	51	42	47	38	43	37	42	34	39	31	36				
70	51	56	47	52	43	48	42	47	39	44	36	41	34	39		
75	56	61	52	57	48	53	47	52	44	49	41	46	39	44		
80	61	66	57	62	53	58	52	57	49	54	46	51	44	49		
85	66	71	62	67	58	63	57	62	54	59	51	56	49	54	43	48
90	71	76	67	72	63	68	62	67	59	64	56	61	54	59	48	53
95	76	81	72	77	68	73	67	72	64	69	61	66	59	64	53	58
100	81	86	77	82	73	78	72	77	69	74	66	71	64	69	58	63
105	86	91	82	87	78	83	77	82	74	79	71	76	69	74	63	68
110	91	96	87	92	83	88	82	87	79	84	76	81	74	79	68	73
115	96	101	92	97	88	93	87	92	84	89	81	86	79	84	73	78
120	101	106	97	102	93	98	92	97	89	94	86	91	84	89	78	83
125			102	107	98	103	97	102	94	99	91	96	89	94	83	88
130			107	112	103	108	102	107	99	104	96	101	94	99	88	93
135			112	117	108	113	107	112	104	109	101	106	99	104	93	98
140			117	122	113	118	112	117	109	114	106	111	104	109	98	103
145			122	127	118	123	117	122	114	119	111	116	109	114	103	108
150			127	132	123	128	122	127	119	124	116	121	114	119	108	113
155			132	137	128	133	127	132	124	129	121	126	119	124	113	118
160			137	142	133	138	132	137	129	134	126	131	124	129	118	123
165			142	147	138	143	137	142	134	139	131	136	129	134	123	128
170			147	152	143	148	142	147	139	144	136	141	134	139	128	133
175			152	157	148	153	147	152	144	149	141	146	139	144	133	138
180			157	162	153	158	152	157	149	154	146	151	144	149	138	143
185			162	166	158	162	157	161	154	159	151	156	149	154	143	148
190			167	171	163	167	162	166	159	164	156	161	154	159	148	153
195			172	176	168	172	167	171	164	169	161	166	159	164	153	158
200			177	181	173	177	172	176	169	174	166	171	164	169	158	163
210			187	191	183	187	182	186	179	184	176	181	174	179	168	173
220			197	201	193	197	192	196	189	194	186	191	184	189	178	183
230					203	207	202	206	199	204	196	201	194	199	188	193
240					213	217	212	216	209	214	206	211	204	209	198	203
250					223	227	222	226	219	224	216	221	214	219	208	213
260					233	237	232	236	229	233	226	230	224	228	218	222

Design standards and assembly instructions → EN 1090-1/EN 1993-1, -8

Hexagon nuts

DIN 431

Pipe nuts with thread
acc. to ISO 228-1
type B = with thread one-sided countersunk



Dimensions	G 1/8	G 1/4	G 3/8	G	G
m _{max.}	6.48	6.48	7.58	5.58	9.58
s _{max.}	18	21	27	34	36

Dimensions	G 1	G 1	G 1	G 1	G 2
m _{max.}	10.58	11.7	12.7	13.7	13.7
s _{max.}	46	55	60	70	75

Dimensions in stock:

Steel/Steel coated: 77 | Stainless steel: 439 | Non-ferrous materials: 572



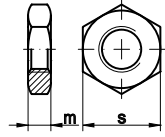
Hexagon nuts

ISO 4035

replaces DIN 439

Hexagon thin nuts

type B = chamfered



Dimensions	M 2	M 2.5	M 3	M 3.5	M 4	M 5	M 6	M 8
$m_{max.}$	1.2	1.6	1.8	2	2.2	2.7	3.2	4
$s_{ISO/DIN}$	4	5	5.5	6	7	8	10	13

Dimensions	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
$m_{max.}$	5	6	7	8	9	10	11	12
$s_{ISO/DIN}$	16/17	18/19	21/22	24	27	30	34/32	36

Dimensions	M 27	M 30	M 33	M 35	M 36	M 39	M 42	M 48
$m_{max.}$	13.5	15	16.5	17.5	18	19.5	21	24
$s_{ISO/DIN}$	41	46	50	55	55	60	65	75

Dimensions in stock:

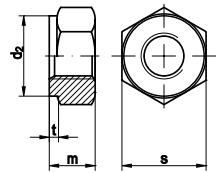
Steel/Steel coated: 268, 79 | Stainless steel: 513, 441 | Non-ferrous materials: 590, 572

DIN 2510

Hexagon nuts

for bolted connections with reduced shank

type NF = standard



Dimensions	M 12	M 14*	M 16	M 20	M 24	M 27	M 30
s	22	24	27	32	36	41	46
m	12	14	16	20	24	27	30
d_2	21	23	26	31	35	40	45
t	2	2	2	2	3	3	3

Dimensions	M 33	M 36	M 39	M 42	M 45	M 48	
s	50	55	60	65	70	75	
m	33	36	39	42	45	48	
d_2	49	53.5	58.5	63.5	68.5	73.5	
t	3	3	3	3	3	4	

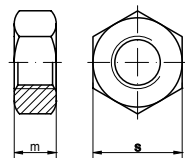
* not standardized, reference values

Dimensions in stock:

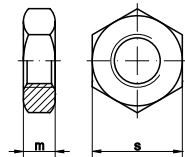
Steel/Steel coated: 220

ASME B 18.2.2

Nuts with unified inch thread



Hex nuts*



Hex jam nuts*

Dimensions	1/4	5/16	3/8	7/16	1/2	9/16	5/8
s	7/16	1/2	9/16	11/16	3/4	7/8	15/16

m (hex nuts)	0.226	0.273	0.337	0.385	0.448	0.496	0.559
--------------	-------	-------	-------	-------	-------	-------	-------

m (jam nuts)	0.163	0.195	0.227	0.26	0.323	0.324	0.387
--------------	-------	-------	-------	------	-------	-------	-------

Dimensions	3/4	7/8	1	1 1/8	1 1/4	1 1/2	1 3/4
s	1 1/8	1 5/16	1 1/2	1 11/16	1 7/8	2 1/4	2 5/8

m (hex nuts)	0.665	0.776	0.887	0.999	1.094	1.317	1.540
--------------	-------	-------	-------	-------	-------	-------	-------

m (jam nuts)	0.446	0.51	0.575	0.639	0.751	0.88	1.009
--------------	-------	------	-------	-------	-------	------	-------

all dimensions in inches

*acc. to ASME B 18.2.2: 2010 table 4

Dimensions in stock:

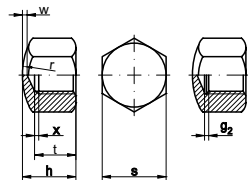
Steel/Steel coated: 389, 389 | Stainless steel: 551 | |



Hexagon nuts

DIN 917

Hexagon cap nuts,
low type



from M 10 thread undercuts acc. to DIN 76-1
(type D short) with the dimension $g_2 \text{ MAX}$

Dimensions in stock:

Steel/Steel coated: 135 | Stainless steel: 457 | Non-ferrous materials: 577

Dimensions	M 4	M 5	M 6	M 8	M 10	M 12
$x_{\text{max.}}/g_2 \text{ max.}$	1.05	1.2	1.5	1.87	2.25	6.4
h	5.5	7	9	12	14	16
r	8	10	12	15	20	25
$s_{\text{ISO/DIN}}$	7	8	10	13	16/17	18/19
$t_{\text{min.}}$	4.16	4.96	6.71	9.21	10.65	13.15
$w_{\text{min.}}$	1	1	1.5	2	2	2

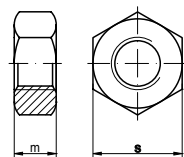
Dimensions	M 14	M 16	M 20	M 24	M 30	M 36
$x_{\text{max.}}/g_2 \text{ max.}$	7.3	7.3	9.3	10.7	12.7	14
h	18	20	25	30	34	44
r	28	30	35	40	60	70
$s_{\text{ISO/DIN}}$	21/22	24	30	36	46	55
$t_{\text{min.}}$	14.65	16.65	20.58	23.58	27.58	35.5
$w_{\text{min.}}$	2	2	2.5	3	3	4

ISO 4032, 4033, 8673, 4034

replaces DIN 934, 555

Hexagon regular nuts

ISO 8673 with metric fine pitch thread



Dimensions	M 1	M 1.2	M 1.4	M 1.6	M 1.7*	M 2	M 2.3*	M 2.5
$m_{\text{ISO/DIN}}$	0.8	1	1.2	1.3	1.4	1.6	1.8	2
$s_{\text{ISO/DIN}}$	2.5	3	3	3.2	3.5	4	4.5	5

Dimensions	M 2.6*	M 3	M 3.5	M 4	M 5	M 6	M 7	M 8
$m_{\text{ISO/DIN}}$	2	2.4	2.8	3.2	4.7/4	5.2/5	5.5	6.8/6.5
$s_{\text{ISO/DIN}}$	5	5.5	6	7	8	10	11	13

Dimensions	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
$m_{\text{ISO/DIN}}$	8.4/8	10.8/10	12.8/11	14.8/13	15.8/15	18/16	19.4/18	21.5/19
$s_{\text{ISO/DIN}}$	16/17	18/19	21/22	24	27	30	34/32	36

Dimensions	M 26*	M 27	M 28**	M 30	M 32**	M 33	M 35**	M 36
$m_{\text{ISO/DIN}}$	22	23.8/22	22	25.6/24	26	28.7/26	29	31/29
$s_{\text{ISO/DIN}}$	41	41	41	46	50	50	55	55

Dimensions	M 38**	M 39	M 40**	M 42	M 45	M 48	M 50	M 52
$m_{\text{ISO/DIN}}$	31	33.4/31	31	34	36	38	38	42
$s_{\text{ISO/DIN}}$	60	60	60	65	70	75	75	80

Dimensions	M 56	M 58**	M 60	M 64	M 68	M 72	M 76	M 80
$m_{\text{ISO/DIN}}$	45	48	48	51	54	58	61	64
$s_{\text{ISO/DIN}}$	85	90	90	95	100	105	110	115

Dimensions	M 85	M 90	M 95*	M 100	M 105*	M 110	M 120*	
$m_{\text{ISO/DIN}}$	68	72	75	80	82	88	95	
$s_{\text{ISO/DIN}}$	120	130	135	145	150	155	175	

DIN 555 product grade C

* dimensions acc. to DIN 934:1963

** not standardized, reference values

Dimensions in stock:

Steel/Steel coated: 263, 268, 346 | Stainless steel: 511, 543, 466 | Non-ferrous materials: 589, 594, 578



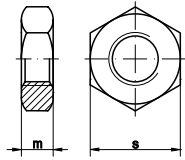
Hexagon nuts

ISO 4035, 8675

replaces DIN 439-2, 936

Hexagon thin nuts chamfered

ISO 8675 with metric fine pitch thread



* acc. to DIN 936:1963

Dimensions in stock:

Steel/Steel coated: 268, 349, 166 | Stainless steel: 513, 543, 468 | Non-ferrous materials: 590, 594, 579

Dimensions	M 2	M 2.5	M 3	M 3.5	M 4	M 5	M 6	M 8
m _{ISO/DIN}	1.2	1.6	1.8	2	2.2	2.7	3.2	4/5
s _{ISO/DIN}	4	5	5.5	6	7	8	10	13

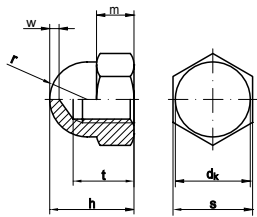
Dimensions	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
m _{ISO/DIN}	5/6	6/7	7/8	8	9	10/9	11/10	12/10
s _{ISO/DIN}	16/17	18/19	21/22	24	27	30	34/32	36

Dimensions	M 26	M 27	M 28*	M 30	M 32*	M 33	M 35*	M 36
m _{ISO/DIN}	13/12	13.5/12	14/12	15/12	16/14	16.5/14	17.5/14	18/14
s _{ISO/DIN}	41	41	41	46	50	50	55	55

Dimensions	M 38*	M 39	M 40*	M 42	M 45	M 48	M 50*	M 52
m _{ISO/DIN}	19/16	19.5/16	20/16	21/16	22.5/18	24/18	25/20	26/20
s _{ISO/DIN}	60	60	60	65	70	75	75	80

DIN 1587

Hexagon domed cap nuts, high type



* not standardized, reference values

Dimensions in stock:

Steel/Steel coated: 209 | Stainless steel: 488 | Non-ferrous materials: 585

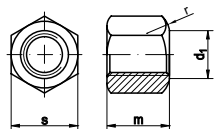
Dimensions	M 3*	M 4	M 5	M 6	M 8	M 10	M 12	M 14
d _{k max.}	5.8	6.5	7.5	9.5	12.5	15	17	20
m _{max.}	2.4	3.2	4	5	6.5	8	10	11
r	2.9	3.25	3.75	4.75	6.25	7.5	8.5	10
s _{ISO/DIN}	5.5	7	8	10	13	16/17	18/19	21/22
t _{min.}	4.5	5.26	7.21	7.71	10.65	12.65	15.65	17.65
w _{min.}	2	2	2	2	2	2	3	4
h	6	8	10	12	15	18	22	25

Dimensions	M 16	M 18	M 20	M 22	M 24	M 27*	M 30*
d _{k max.}	23	26	28	33	34	39	44
m _{max.}	13	15	16	18	19	22	24
r	11.5	13	14	16.5	17	19.5	22
s _{ISO/DIN}	24	27	30	34/32	36	41	46
t _{min.}	20.58	24.58	25.58	28.58	30.5	35	39
w _{min.}	4	5	5	5	6	7	7
h	28	32	34	39	42	45	50

DIN 6330

Hexagon nuts with a height of 1,5 d

type B = with one spherical bearing face



* wrench sizes acc. to DIN 6330: 1965-03

Dimensions in stock:

Steel/Steel coated: 291 | Stainless steel: 518

Dimensions	M 6	M 8	M 10	M 12	M 14	M 16
d ₁	7	9	11.5	14	16	18
m	9	12	15	18	21	24
r	9	11	15	17	20	22
s	10	13	16/17*	18/19*	22	24

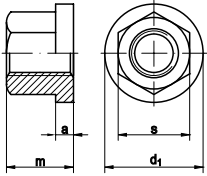
Dimensions	M 18	M 20	M 22	M 24	M 27	M 30
d ₁	20	22	25	26	29	32
m	27	30	33	36	40	45
r	25	27	29	32	37	41
s	27	30	32	36	41	46



Hexagon nuts

DIN 6331

Hexagon nuts with a height of 1.5 d, with collar



Dimensions	M 6	M 8	M 10	M 12	M 14	M 16	M 18
a	3	3.5	4	4	4	5	5
d ₁	14	18	22	25	28	31	34
m	9	12	15	18	21	24	27
s	10	13	16	18	22	24	27

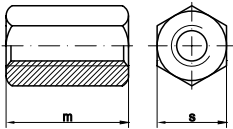
Dimensions	M 20	M 22	M 24	M 27	M 30	M 36	M 42
a	6	6	6	7	8	10	12
d ₁	37	40	45	50	58	68	80
m	30	33	36	40	45	54	63
s	30	32	36	41	46	55	65

Dimensions in stock:

Steel/Steel coated: 291 | Stainless steel: 518

~DIN 6334

Hexagon nuts, with a height of 3 d



Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24	M 30	M 36
m	18	24	30	36	48	60	72	90	108
s	10	13	17	19	24	30	36	46	55

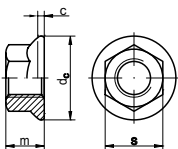
Dimensions in stock:

Steel/Steel coated: 292 | Stainless steel: 519

EN 1661

replaces DIN 6923

Hexagon flange nuts



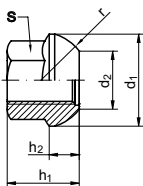
Dimensions	M 4	M 5	M 6	M 8	M 10	M 12	M 16	M 20
d _{c max.}	10	11.8	14.2	17.9	21.8	26	34.5	42.8
m _{max.}	4.65	5	6	8	10	12	16	20
s	7	8	10	13	15	18	24	30

Dimensions in stock:

Steel/Steel coated: 210, 303 | Stainless steel: 488, 522

DIN 74361

Domed anchor nuts
type A



Dimensions	M 18x1.5	M 20x1.5
d ₁	28	33
d ₂	21	24.5
h ₁	25	27
h ₂	75	9
r	16	18
s	24	27

Dimensions in stock:

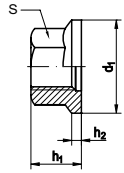
Steel/Steel coated: 385



Hexagon nuts

DIN 74361

Flat collar nuts
type B



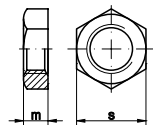
Dimensions	M 14x1.5	M 18x1.5	M 20x1.5	M 22x1.5
d ₁	27	29	34	36
h ₁	15	18	20	22
h ₂	3	4	5	6
s	19	24	27	30

Dimensions in stock:

Steel/Steel coated: 385

DIN 80705

Thin hexagonal nuts
with small wrench size



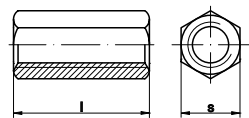
Dimensions	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5	M 26x1.5	M 30x2
m	6	6	6	6	7	8	8
s	19	22	24	27	30	36	41

Dimensions in stock:

Steel/Steel coated: 385

Article 88087

Hexagon couplings
with continuous metric internal thread



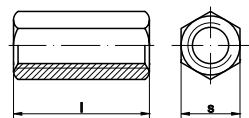
Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24	M 30
s	10	13	17	19	24	30	36	46
l	20/25/ 30/40	30	30	40/50	50	50	50	90

Dimensions in stock:

Steel/Steel coated: 391 | Stainless steel: 551

Article 88090

Hexagon nuts with trapezoidal thread,
with a height of 1.5 d



Dimensions	TR 16x4	TR 20x4	TR 24x5	TR 30x6
s	27	30	36	46
m	24	30	36	45

Dimensions in stock:

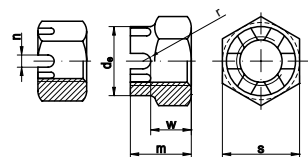
Steel/Steel coated: 392



Locking nuts

DIN 935-1

Hexagon slotted and castle nuts



≤ M 10 ≥ M 12

Dimensions	M 4	M 5	M 6	M 8	M 10	M 12	M 14	M 16
d _{e max.}	–	–	–	–	–	16	18	22
m	5	6	7.5	9.5	12	15	16	19
n _{min.}	1.2	1.4	2	2.5	2.8	3.5	3.5	4.5
S _{ISO/DIN}	7	8	10	13	16/17	18/19	21/22	24
W _{max.}	3.2	4	5	6.5	8	10	11	13
split pin	1x10	1.2x12	1.6x14	2x16	2.5x20	3.2x22	3.2x25	4x28

Dimensions	M 18	M 20	M 22	M 24	M 27	M 28*	M 30	M 32*
d _{e max.}	25	28	32	34	38	38	42	46
m	21	22	26	27	30	30	33	35
n _{min.}	4.5	4.5	5.5	5.5	5.5	5.5	7	7
S _{ISO/DIN}	27	30	34/32	36	41	41	46	50
W _{max.}	15	16	18	19	22	22	24	26
split pin	4x32	4x36	5x36	5x40	5x45	5x50	6.3x50	6.3x56

Dimensions	M 33	M 36	M 38*	M 39	M 40*	M 42	M 45	M 48
d _{e max.}	46	50	55	55	55	58	62	65
m	35	38	40	40	48	46	48	50
n _{min.}	7	7	7	7	7	9	9	9
S _{ISO/DIN}	50	55	60	60	60	65	70	75
W _{max.}	26	29	31	31	31	34	36	38
split pin	6.3x56	6.3x63	6.3x70	6.3x71	6.3x70	8x71	8x80	8x80

Dimensions	M 52	M 56	M 60	M 64	M 68	M 72	M 76	M 80
d _{e max.}	70	75	80	85	90	95	100	105
m	54	57	63	66	69	73	76	79
n _{min.}	9	9	11	11	11	11	11	11
S _{ISO/DIN}	80	85	90	95	100	105	110	115
W _{max.}	42	45	48	51	54	58	61	64
split pin	8x90	8x100	10x100	10x100	10x112	10x112	10x125	10x140

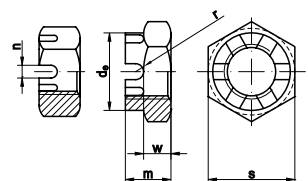
* acc. to DIN 935: 1963

Dimensions in stock:

Steel/Steel coated: 165 | Stainless steel: 468

DIN 937

Hexagon thin slotted and castle nuts



≤ M 10 ≥ M 12

Dimensions	M 6	M 8	M 10	M 12	M 14	M 16	M 18	M 20
d _{e max.}	–	–	–	17	19	22	25	28
m	6	8	9	10	11	12	13	13
n _{min.}	2	2.5	2.8	3.5	3.5	4.5	4.5	4.5
s	10	13	17	19	22	24	27	30
W _{max.}	3.5	4.5	5	6	7	7	8	8
split pin	1.6x14	2x16	2.5x20	3.2x22	3.2x25	4x28	4x32	4x36

Dimensions	M 22	M 24	M 26*	M 27	M 28*	M 30	M 32*	M 33
d _{e max.}	30	34	38	38	38	42	46	46
m	15	15	30	17	30	18	20	20
n _{min.}	5.5	5.5	5.5	5.5	5.5	7	7	7
s	32	36	41	41	41	46	50	50
W _{max.}	9	9	22	11	22	11	13	13
split pin	5x36	5x40	5x50	5x45	5x50	6.3x50	6x60	6.3x56

Dimensions	M 35*	M 36	M 39	M 40*	M 42	M 48	M 52	
d _{e max.}	50	50	55	55	58	65	70	
m	20	20	22	22	23	25	27	
n _{min.}	7	7	7	7	9	9	9	
s	55	55	60	60	65	75	80	
W _{max.}	13	13	13	13	14	16	18	
split pin	6x65	6.3x63	6.3x71	6x70	8x71	8x80	8x90	

* acc. to DIN 937: 1963

Dimensions in stock:

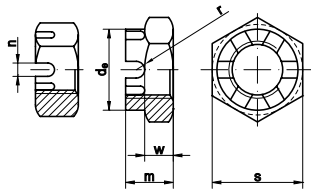
Steel/Steel coated: 168



Locking nuts

DIN 979

Hexagon thin slotted and castle nuts



≤ M 10 ≥ M 12

Dimensions	M 16	M 18	M 20	M 24	M 30	M 36	M 42	M 48	M 52
$d_{e \max.}$	22	25	28	34	42	50	58	65	70
m	13	15	16	19	24	29	33	36	38
$n_{\min.}$	4.5	4.5	4.5	5.5	7	7	9	9	9
s	24	27	30	36	46	55	65	75	80
$w_{\max.}$	7	9	10	11	15	20	22	24	26
split pin	4x28	4x32	4x36	5x40	6.3x50	6.3x63	8x71	8x80	8x90

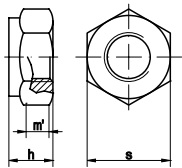
Dimensions in stock:

Steel/Steel coated: 187

ISO 7042, 10513

replaces DIN 980, 6925

Prevailing torque type hexagon high nuts
all-metal nuts,
ISO 10513 with metric fine pitch thread



standard conversion → TI-9

Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
$h_{\max.}$	3.7	4.2	5.1	6	8	10
$m'_{\min. \text{ ISO/DIN}}$	-1.65	-1.2	3.52/2.75	3.92/3.3	5.15/4.4	6.43/5.5
$s_{980/6925}$	5.5	7	8	10	13	17/16

Dimensions	M 12	M 14	M 16	M 18	M 20	M 22
$h_{\max.}$	12	14	16	18	20	22
$m'_{\min. \text{ ISO/DIN}}$	8.30/6.6	9.68/7.7	11.28/8.8	-1/9.9	13.52/11	-1/12.2
$s_{980/6925}$	19/18	22/21	24	27	30	32/-

Dimensions	M 24	M 27	M 30	M 33	M 36	
$h_{\max.}$	24	27	30	33	36	
$m'_{\min. \text{ ISO/DIN}}$	16.16/13.2	-1/14.8	19.44/16.5	-1/18.2	23.52/19.8	
$s_{980/6925}$	36	41	46	50	55	

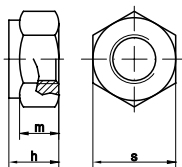
Dimensions in stock:

Steel/Steel coated: 305, 365, 187, 304 | Stainless steel: 523, 479

ISO 7040, 10512

replaces DIN 982, 6924

Prevailing torque type hexagon regular nuts
with non-metallic insert,
ISO 10512 with metric fine pitch thread



temperature resistance of the insert
see price pages,
standard conversion → TI-9

Dimensions	M 3	M 4	M 5	M 6	M 8	M 10
$h_{\text{ISO/DIN}}$	4.5	6	6.8/6.3	8	9.5	11.9/11.5
$m_{\min.}$	2.15	2.9	4.4	4.9	6.44	8.04
$s_{\text{ISO/DIN}}$	5.5	7	8	10	13	16/17

Dimensions	M 12	M 14	M 16	M 20	M 24	
$h_{\text{ISO/DIN}}$	14.9/14	17/16	19.1/18	22.8/22	27.1/28	
$m_{\min.}$	10.37	12.1	14.1	16.9	20.2	
$s_{\text{ISO/DIN}}$	18/19	21/22	24	30	36	

Dimensions in stock:

Steel/Steel coated: 305, 365, 189 | Stainless steel: 523, 480

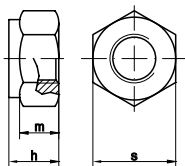


Locking nuts

ISO 10511

replaces DIN 985

Prevailing torque type hexagon thin nuts
with non-metallic insert



temperature resistance of the insert

see price pages

* not ISO standardized, reference values

** not ISO standardized

Dimensions	M 2.5*	M 3	M 4	M 5	M 6	M 7	M 8	M 10
$h_{\max. \text{ ISO/DIN}}$	3,6	3.9/4	5	5	6	7.5	6.8/8	5,6/10
$m_{\min. \text{ ISO/DIN}}$	–	1.55/2.4	1.9/2.9	2.5/3.2	2.9/4	4.7	3.7/5.5	4.7/6.5
$S_{\text{ISO/DIN}}$	5	5.5	7	8	10	11	13	16/17

Dimensions	M 12	M 14	M 16	M 18**	M 20	M 22**	M 24	M 27**
$h_{\max. \text{ ISO/DIN}}$	10.2/12	11.3/14	12,4/16	18.5	14.9/20	22	17.8/24	27
$m_{\min. \text{ ISO/DIN}}$	5.7/8	6.4/9.5	7.4/10.5	13	9.1/14	15	10.9/15	17
$S_{\text{ISO/DIN}}$	18/19	21/22	24	27	30	34/32	36	41

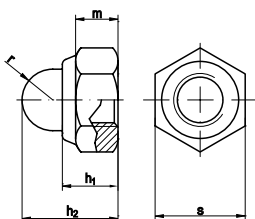
Dimensions	M 30	M 33**	M 36	M 39**	M 42**	M 45**	M 48**	
$h_{\max. \text{ ISO/DIN}}$	22.2/30	33	25.5/36	39	42	45	48	
$m_{\min. \text{ ISO/DIN}}$	13.9/19	22	16.9/25	27	29	32	36	
$S_{\text{ISO/DIN}}$	46	50	55	60	65	70	75	

Dimensions in stock:

Steel/Steel coated: 364, 190 | Stainless steel: 547, 480 | Non-ferrous materials: 595, 582

DIN 986

Prevailing torque type hexagon domed cap nuts
with non-metallic insert



temperature resistance of the insert

see price pages

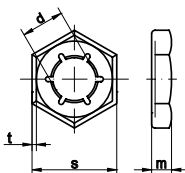
Dimensions in stock:

Steel/Steel coated: 191 | Stainless steel: 480

Dimensions	M 4	M 5	M 6	M 8	M 10	M 12	M 16
h_1	5.6	6	7.5	8.9	10.5	13.5	16.5
h_2	9.6	10.5	12	14	18.1	22.5	27.5
$m_{\min.}$	2.9	4.4	4.9	6.44	8.04	10.37	14.1
r	2.5	3	3.5	4.6	5.8	6.8	8.8
s	7	8	10	13	17	19	24

DIN 7967

Self locking counter nuts



Dimensions	M 6	M 8	M 10	M 12	M 14	M 16	M 20	M 22
d	5.3	6.9	8.6	10.4	12	14.1	17.6	19.6
m	3	3.5	4	4.5	5	5	6	6
s	10	13	17	19	22	24	30	32
t	0.4	0.5	0.5	0.6	0.6	0.7	0.8	0.8

Dimensions	M 24	M 27	M 30	M 33	M 36	M 42	M 48	
d	21	24.2	26.6	29.8	32.2	37.6	43.9	
m	7	7	8	8	9	11	14	
s	36	41	46	50	55	65	75	
t	0.9	1	1.1	1.2	1.3	1.4	1.6	

Dimensions in stock:

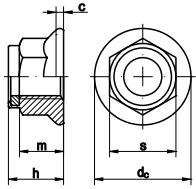
Steel/Steel coated: 331 | Stainless steel: 536



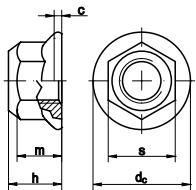
Locking nuts

EN 1663, 1664

Prevailing torque type
hexagon nuts with flange



EN 1663 = with non-metallic insert



EN 1664 = all-metal hexagon nut

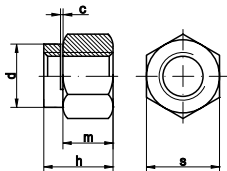
Dimensions	M 5	M 6	M 8	M 10	M 12	M 16
$c_{min.}$	1	1.1	1.2	1.5	1.8	2.4
d_c	11.8	14.2	17.9	21.8	26	34.5
$h_{max. (1663)}$	7.1	9.1	11.1	13.5	16.1	20.3
$h_{max. (1664)}$	6.2	7.3	9.4	11.4	13.8	18.3
$m_{min.}$	4.7	5.7	7.6	9.6	11.6	15.3
s	8	10	13	16	18	24

Dimensions in stock:

Steel/Steel coated: 210, 210

Article 88105

Prevailing torque type hexagon nuts,
THERMAG nuts
all-metal nut



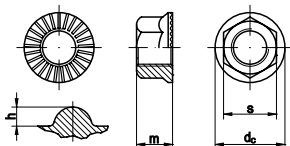
Dimensions	M 8 SW12	M 8 SW13	M 10 SW14	M 10 SW17	M 12 SW17	M 12 SW19
d	11.5	12.5	13.5	16.5	16.5	18.5
s	12	13	14	17	17	19
m	5.5	5.5	6.5	6.5	7.5	7.5
c	0.5	0.5	0.5	0.5	0.5	0.5

Dimensions in stock:

Steel/Steel coated: 188

Article 88914

Hexagon nuts with flange
and lock ribs



Dimensions	M 5	M 6	M 8	M 10	M 12	M 14	M 16
d_c	11.2	14.2	18.2	21	24	27.5	31
m	4.3	5.5	7	8.5	10	12	14
h	0.1	0.1	0.1	0.1	0.1	0.1	0.1
s	8	10	13	15	17	19	22
qty. ribs	28	36	48	48	60	60	72

Dimensions in stock:

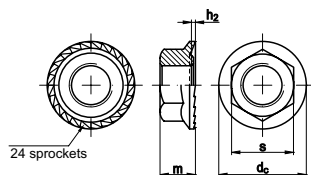
Steel/Steel coated: 420



Locking nuts

Article 88934

Hexagon locking nuts with flange



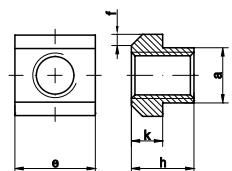
Dimensions	M 5	M 6	M 8	M 10	M 12	M 16
d_c	11.2	14.25	18.25	21	24	31
m	4.3	5.5	7	7.9	8.7	11.2
$h_{2 \text{ min.}}$	0.15	0.17	0.2	0.25	0.25	0.28
qty. serrations	24	24	24	24	24	24

Dimensions in stock:

Steel/Steel coated: 421

DIN 508

T-slot nuts



Dimensions	M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 20	M 24
a	6	8	10	12	14	16	18	22	28
e	10	13	15	18	22	25	28	35	44
f	1.6	1.6	1.6	2.5	2.5	2.5	2.5	2.5	4
h	8	10	12	14	16	18	20	28	36
k	4	6	6	7	8	9	10	14	18

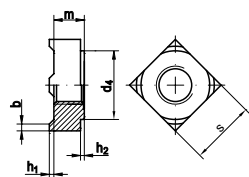
Dimensions in stock:

Steel/Steel coated: 88

Welding nuts

DIN 928

Square weld nuts



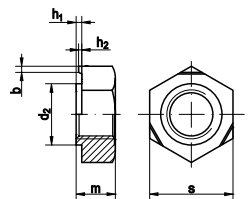
Dimensions	M 4	M 5	M 6	M 8	M 10	M 12
b	0.8	1	1.2	1.5	1.8	2
$d_{1 \text{ min.}}$	6.4	8.2	9.1	12.8	15.6	17.4
h_1	0.6	0.8	0.8	1	1.2	1.4
$h_{2 \text{ min.}}$	0.4	0.6	0.7	1.1	1.25	1.75
m	3.5	4.2	5	6.5	8	9.5
s	7	9	10	14	17	19

Dimensions in stock:

Steel/Steel coated: 137

DIN 929

Hexagon weld nuts



Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12	M 14	M 16
b	0.8	0.8	0.8	0.9	1	1.25	1.25	1.5	1.5
d_2	4.5	6	7	8	10.5	12.5	14.8	16.8	18.8
h_1	0.55	0.65	0.7	0.75	0.9	1.15	1.4	1.8	1.8
h_2	0.25	0.35	0.4	0.4	0.5	0.65	0.8	1	1
m	3	3.5	4	5	6.5	8	10	11	13
s	7.5	9	10	11	14	17	19	22	24

Dimensions in stock:

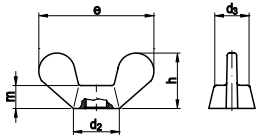
Steel/Steel coated: 137 | Stainless steel: 458



Special forms

DIN 315

Wing nuts
rounded wings



* acc. to DIN 315:1956

** not standardized, reference values

Dimensions	M 3*	M 4	M 5	M 6	M 8	M 10
$e_{\max.}$	19	20	26	33	39	51
$h_{\max.}$	9.5	10.5	13	17	20	25
$m_{\max.}$	3.9	4.6	6.5	8	10	12
$d_{2 \max.}$	7	8	11	13	16	20
$d_{3 \max.}$	6	7	9	11	12.5	16.5

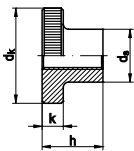
Dimensions	M 12	M 14**	M 16	M 20	M 24
$e_{\max.}$	65	63.5	73	90	110
$h_{\max.}$	33.5	32.3	37.5	46.5	56.5
$m_{\max.}$	14	12	17	21	25
$d_{2 \max.}$	23	21.5	29	35	44
$d_{3 \max.}$	19.5	–	23	29	37.5

Dimensions in stock:

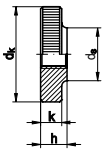
Steel/Steel coated: 75 | Stainless steel: 438 | Non-ferrous materials: 571

DIN 466, 467

Knurled nuts



DIN 466 = high type



DIN 467 = low type

Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12*
d_k	12	16	20	24	30	36	35
d_s	6	8	10	12	16	20	20
k	2.5	3.5	4	5	6	8	8
$h_{\text{DIN 466}}$	7.5	9.5	11.5	15	18	23	23
$h_{\text{DIN 467}}$	3	4	5	6	8	10	10

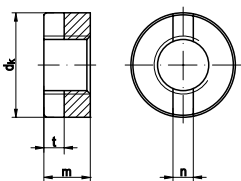
* not standardized, reference values

Dimensions in stock:

Steel/Steel coated: 84, 85 | Stainless steel: 443, 443 | Non-ferrous materials: 573, 573

DIN 546

Slotted round nuts



Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12	M 16
$d_{k \max.}$	6	8	9	11	14	18	21	26
$m_{\max.}$	2.5	3.5	4.2	5	6.5	8	10	12
n	1.2	1.4	2	2.5	3	3.5	4	4
t	1	1.2	1.5	2	2.5	3.2	3.8	3.8

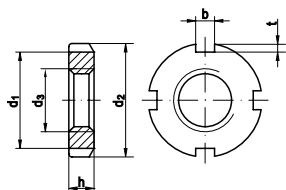
Dimensions in stock:

Steel/Steel coated: 88 | Stainless steel: 444 | Non-ferrous materials: 573

Special forms

DIN 981

Locknuts for rolling bearings



Dimensions	KM 0	KM 1	KM 2	KM 3	KM 4	KM 5	KM 6
d ₁	M 10x0.75	M 12x1	M 15x1	M 17x1	M 20x1	M 25x1.5	M 30
d ₂	18	22	25	28	32	38	45
d ₃	13.5	17	21	24	26	32	38
h	4	4	5	5	6	7	7
b	3	3	4	4	4	5	5
t	2	2	2	2	2	2	2
lockwasher*	MB 0	MB 1	MB 2	MB 3	MB 4	MB 5	MB 7

Dimensions	KM 7	KM 8	KM 9	KM 10	KM 11	KM 12	KM 13
d ₁	M 35x1.5	M 40x1.5	M 45x1.5	M 50x1.5	M 55x2	M 60x2	M 65x2
d ₂	52	58	65	70	75	80	85
d ₃	44	50	56	61	67	73	79
h	8	9	10	11	11	11	12
b	5	6	6	6	7	7	7
t	2	2.5	2.5	2.5	3	3	3
lockwasher*	MB 7	MB 8	MB 9	MB 10	MB 11	MB 12	MB 13

Dimensions	KM 14	KM 15	KM 16	KM 17	KM 18	KM 19	KM 20
d ₁	M 70x2	M 75x2	M 80x2	M 85x2	M 90x2	M 95x2	M 100x2
d ₂	92	98	105	110	120	125	130
d ₃	85	90	95	102	108	113	120
h	12	13	15	15	16	17	18
b	8	8	8	8	10	10	10
t	3.5	3.5	3.5	3.5	4	4	4
lockwasher*	MB 14	MB 15	MB 16	MB 17	MB 18	MB 19	MB 20

Dimensions	KM 21	KM 22	KM 23	KM 24	KM 25	KM 26	KM 27
d ₁	M 105x2	M 110x2	M 115x2	M 120x2	M 125x2	M 130x2	M 135x2
d ₂	140	145	150	155	160	165	175
d ₃	126	133	137	138	148	149	160
h	18	19	19	20	21	21	22
b	12	12	12	12	12	12	14
t	5	5	5	5	5	5	6
lockwasher*	MB 21	MB 22	MB 23	MB 24	MB 25	MB 26	MB 27

Dimensions	KM 28	KM 29	KM 30	KM 31	KM 32	KM 34	
d ₁	M 140x2	M 145x2	M 150x2	M 155x3	M 160x3	M 165x3	
d ₂	180	190	195	200	210	210	
d ₃	160	171	171	182	182	193	
h	22	24	24	25	25	26	
b	14	14	14	16	16	16	
t	6	6	6	7	7	7	
lockwasher*	MB 28	MB 29	MB 30	MB 31	MB 32	MB 33	

* Lockwashers DIN 5406

Dimensions in stock:

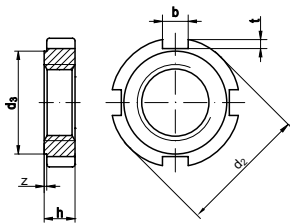
Steel/Steel coated: 189



Special forms

DIN 1804

Slotted round nuts



Dimensions	M 8x1	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5
d ₂	20	25	28	30	32	34	36	40
d ₃	16	20	23	25	27	28	30	34
b	4	5	5	5	5	6	6	6
h	5	6	6	7	7	8	8	9
t	1.5	2	2	2	2	2.5	2.5	2.5
z	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
qty. slots	4	4	4	4	4	4	4	4

Dimensions	M 24x1.5	M 26x1.5	M 28x1.5	M 30x1.5	M 32x1.5	M 35x1.5	M 38x1.5	M 40x1.5
d ₂	42	45	50	50	52	55	58	62
d ₃	36	38	43	43	45	48	50	54
b	6	7	7	7	7	7	8	8
h	9	10	10	10	11	11	11	12
t	2.5	3	3	3	3	3	3.5	3.5
z	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
qty. slots	4	4	4	4	4	4	4	4

Dimensions	M 42x1.5	M 45x1.5	M 48x1.5	M 50x1.5	M 52x1.5	M 55x1.5	M 58x1.5	M 60x1.5
d ₂	62	68	75	75	80	80	90	90
d ₃	54	60	67	67	70	70	80	80
b	8	8	8	8	10	10	10	10
h	12	12	13	13	13	13	13	13
t	3.5	3.5	3.5	3.5	4	4	4	4
z	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
qty. slots	4	6	6	6	6	6	6	6

Dimensions	M 62x1.5	M 65x1.5	M 68x1.5	M 70x1.5	M 72x1.5	M 75x1.5	M 80x2	M 85x2
d ₂	95	95	100	100	110	110	115	120
d ₃	85	85	90	90	100	100	105	110
b	10	10	10	10	10	10	10	10
h	14	14	14	14	14	14	16	16
t	4	4	4	4	4	4	4	4
z	0.5	0.5	0.5	0.5	0.5	0.5	1	1
qty. slots	6	6	6	6	6	6	6	6

Dimensions	M 90x2	M 95x2	M 100x2	M 110x2	M 120x2			
d ₂	130	135	145	155	165			
d ₃	120	120	130	140	150			
b	10	12	12	12	12			
h	16	16	16	16	18			
t	4	5	5	5	5			
z	1	1	1	1	1			
qty. slots	6	6	6	6	6			

Dimensions in stock:

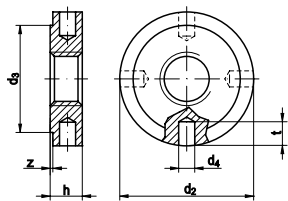
Steel/Steel coated: 212 | Stainless steel: 489



Special forms

DIN 1816

Round nuts
with set pin holes inside



Dimensions	M 12x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5	M 24x1.5	M 26x1.5
d ₂	28	32	34	36	40	42	45
d ₃	23	27	28	30	34	36	38
d ₄	3	4	4	4	4	4	5
h	6	7	8	8	9	9	10
t	5	6	6	6	6	6	6
z	0.5	0.5	0.5	0.5	0.5	0.5	0.5
qty. slots	4	4	4	4	4	4	4

Dimensions	M 28x1.5	M 30x1.5	M 35x1.5	M 40x1.5	M 42x1.5	M 45x1.5	M 48x1.5
d ₂	50	50	55	62	62	68	75
d ₃	43	43	48	54	54	60	67
d ₄	5	5	5	6	6	6	6
h	10	10	11	12	12	12	13
t	7	7	7	8	8	8	10
z	0.5	0.5	0.5	0.5	0.5	0.5	0.5
qty. slots	4	4	4	4	4	6	6

Dimensions	M 50x1.5	M 55x1.5	M 60x1.5	M 70x1.5	M 75x2	M 80x2	
d ₂	75	80	90	100	110	115	
d ₃	67	70	80	90	100	105	
d ₄	6	6	6	8	8	8	
h	13	13	13	14	14	16	
t	10	10	10	12	12	12	
z	0.5	0.5	0.5	0.5	0.5	1	
qty. slots	6	6	6	6	6	6	

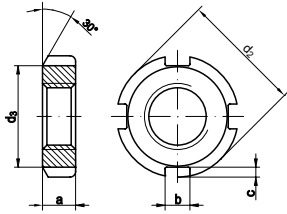
Dimensions in stock:
Steel/Steel coated: 212



Special forms

DIN 70852

Locknuts for hook spanners



Dimensions	M 10x1	M 12x1.5	M 14x1.5	M 16x1.5	M 18x1.5	M 20x1.5	M 22x1.5	M 24x1.5
a	5	6	6	6	6	6	7	7
b	4.5	4.5	4.5	5.5	5.5	5.5	6.5	6.5
c	1.8	1.8	1.8	2.3	2.3	2.3	2.8	2.8
d ₂	20	22	24	28	30	32	36	38
d ₃	18	18	20	23	25	27	30	32
qty. slots	4	4	4	4	4	4	4	4
lockwasher*	10	12	14	16	18	20	22	24

Dimensions	M 26x1.5	M 28x1.5	M 30x1.5	M 32x1.5	M 35x1.5	M 38x1.5	M 40x1.5	M 42x1.5
a	7	7	7	8	8	8	8	8
b	6.5	6.5	6.5	7	7	7	7	8
c	2.8	2.8	2.8	3.3	3.3	3.3	3.3	3.3
d ₂	40	42	44	48	50	54	56	60
d ₃	34	36	38	41	43	47	49	52
qty. slots	4	4	4	4	4	4	4	4
lockwasher*	26	28	30	32	35	38	40	42

Dimensions	M 45x1.5	M 48x1.5	M 50x1.5	M 52x1.5	M 55x1.5	M 60x1.5	M 65x1.5	M 70x1.5
a	8	8	8	8	8	9	9	9
b	8	8	8	8	8	11	11	11
c	3.3	3.3	3.3	3.3	3.3	4.3	4.3	4.3
d ₂	62	65	68	70	75	80	85	90
d ₃	54	57	60	62	67	71	76	81
qty. slots	6	6	6	6	6	6	6	6
lockwasher*	45	48	50	52	55	60	65	70

Dimensions	M 75x1.5	M 80x1.5	M 85x1.5	M 90x1.5	M 95x1.5
a	10	10	10	10	10
b	11	11	11	11	11
c	4.3	4.3	4.3	4.3	4.3
d ₂	95	100	108	112	118
d ₃	86	91	99	103	109
qty. slots	6	6	6	6	6
lockwasher*	75	80	85	90	95

* Lockwashers DIN 70952

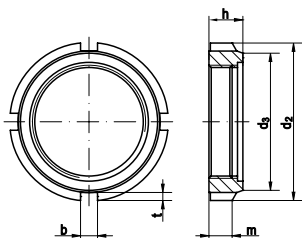
Dimensions in stock:

Steel/Steel coated: 384

Article 88081

Locknuts GUK

with non-metallic insert



Dimensions	M 12x1	M 15x1	M 17x1	M 20x1	M 25x1.5	M 30x1.5
d ₂	21	24	28	32	38	44
d ₃	18	21	24	27	33	38
h	7.6	8.6	8.7	9.6	10.5	10.7
m	4.5	5.5	5.5	6	6.5	6.6
b	3	4	4	4	5	5
t	1.5	1.5	2	2.5	2.5	3
qty. slots	4	4	4	4	4	4

Dimensions	M 35x1.5	M 40x1.5	M 45x1.5	M 50x1.5	M 55x2	M 60x2
d ₂	50	56	62	68	75	80
d ₃	44	50	55	61	68	73
h	11.3	12.3	12.3	12.9	13.4	13.4
m	7	7.7	7.8	8.1	8.2	8.2
b	5	6	6	6	7	7
t	3	3	3.5	3.5	3.5	3.5
qty. slots	4	4	4	4	6	6

Dimensions in stock:

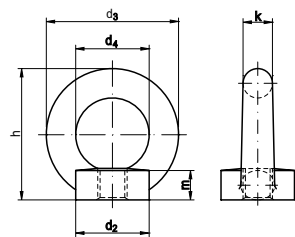
Steel/Steel coated: 391



Special forms

DIN 582

Lifting eye nuts



more information → [TI-148](#)

* not standardized,
geometry of the next higher dimension

Dimensions	M 6*	M 8	M 10	M 12	M 14*	M 16	M 18*	M 20	M 22*
d ₂	17	20	25	30	35	35	40	40	45
d ₃	28	36	45	54	63	63	72	72	81
d ₄	16	20	25	30	35	35	40	40	45
m	8.5	8.5	10	11	13	13	16	16	18
h	31	36	45	53	62	62	71	71	80.5
k	6	8	10	12	14	14	16	16	18

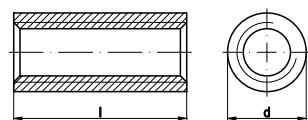
Dimensions	M 24	M 27*	M 30	M 33*	M 36	M 42	M 48	M 56	
d ₂	50	50	65	65	75	85	100	110	
d ₃	90	90	108	108	126	144	166	184	
d ₄	50	50	60	60	70	80	90	100	
m	20	20	25	25	30	35	40	45	
h	90	90	109	109	128	147	168	187	
k	20	20	24	24	28	32	38	42	

Dimensions in stock:

Steel/Steel coated: 95 | Stainless steel: 446

Article 88088

Round couplings with metric thread



Dimensions	M 6	M 8	M 10
d	10	11	13
l	20/25/30/40	20/25/30/40/45	25/30/40/50

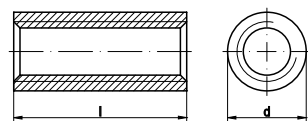
Dimensions	M 12	M 16	M 20
d	15	20	25
l	30/40/50	40	50

Dimensions in stock:

Steel/Steel coated: 391 | Stainless steel: 551

Article 88089

Round nuts with trapezoidal thread



Dimensions	TR 12x3	TR 14x4	TR 16x4	TR 18x4	TR 20x4	TR 22x5	TR 24x5
d	22	36	36	36	36	50	50
l	18	21	24	27	30	33	36

Dimensions	TR 26x5	TR 28x5	TR 30x6	TR 32x6	TR 36x6	TR 40x7	TR 44x7
d	50	60	60	60	75	75	75
l	39	42	45	48	54	60	66

Dimensions in stock:

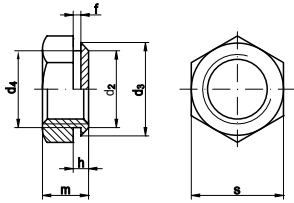
Steel/Steel coated: 392 | Stainless steel: 551



Special forms

Article 88106

Rivet nuts



Dimensions	M 3	M 4	M 5	M 6
d ₂ *	4.5	5.5	6.5	8
d ₃	4.7	5.7	6.75	8.3
d ₄	4.5	5.5	6.5	8
m	3	3.2	4	5
f	0.4	0.4	0.4	0.4
h	0.9	0.9	0.9	0.9
s	5.5	7	8	10

Dimensions	M 8	M 10	M 12	M 16
d ₂ *	10	12.5	14.5	18.5
d ₃	10.3	12.85	14.85	18.85
d ₄	10	12.5	14.5	18.5
m	6.5	8	10	13
f	0.9	0.9	1.3	1.5
h	1.9	1.9	2.9	2.4
s	13	15	17	22

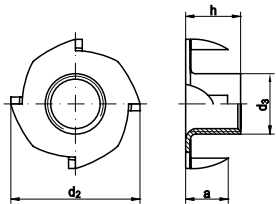
* corresponds to drill hole diameter with tol. H11

Dimensions in stock:

Steel/Steel coated: 408 | Stainless steel: 556

Article 88108

Tee nuts with prong



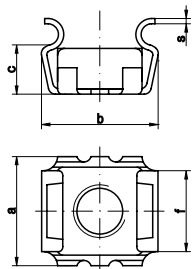
Dimensions	M 4	M 5	M 6	M 8	M 10
d ₂	15	17	19	22	25
d ₃	5	6.5	7.5	10	11.5
h	6	8	9/12	11/15	13
a	5	7	7	9	11

Dimensions in stock:

Steel/Steel coated: 409

Article 88109

Square caged nuts type SMG



Dimensions	M 4 - 8/9.5	M 5 - 8/9.5	M 6 - 6/9.5
s	0.5	0.5	0.5
c	4.6	6.3	6.4
b	13.5	13.7	13.9
a	13.1	13.1	13.4
f	8.7	8.8	8.8
f. sheet thicknesses	1.8 - 2.6	1.8 - 2.6	0.7 - 1.7

Dimensions	M 6 - 8/9.5	M 8 - 8/12.5	M 10 - 8/12.5
s	0.5	0.6	0.6
c	6.3	7.4	7.4
b	13.7	17.8	17.8
a	13.1	16.6	16.6
f	8.8	11.4	11.4
f. sheet thicknesses	1.8 - 2.6	1.8 - 2.6	1.8 - 2.6

Dimensions in stock:

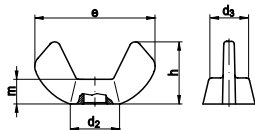
Steel/Steel coated: 409



Special forms

Article 88215

Wing nuts,
small type, edged wings



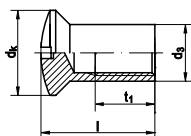
Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12
e	18.5	18.5	22	26.8	30.3	35.3	47.5
h	8.8	8.8	10.5	12.9	14.8	17.3	22.5
m	3	3	4	4.9	5.4	6.3	7.9
D	7.8	7.8	9.5	11.9	13.5	15.3	20.5

Dimensions in stock:

Steel/Steel coated: 75 | Stainless steel: 438

Article 88964

Sleeve nut
with raised countersunk head



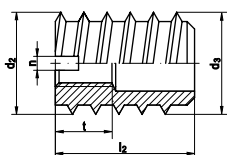
Dimensions	M 4	M 5	M 6	M 8
l	7/12/14/20	15	15/20	15/20
t ₁	3/7/8/13	9	9 /13	7/12
d ₃	5	6	7.5	10
d _k	7	9	10	15

Dimensions in stock:

Stainless steel: 564 | Non-ferrous materials: 598

DIN 7965

Screwed inserts "RAMPA"



Dimensions	M 3	M 4	M 5	M 6	M 8	M 10	M 12
d ₂	6	8	10	12	16	18.5	22
d ₃	4.5	5.5	7.5	9.5	12.5	15	18
l ₂	5	6	7	9	11	13	16
n	1	1.2	1.6	2	2.5	3	3
t	2	2	3	3	4	5	5
for drilling Ø	5.0	6.5	8.5	10.5	14.5	17	20

Dimensions in stock:

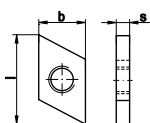
Steel/Steel coated: 330 | Non-ferrous materials: 594

Threaded plates

Article 88951

T-Head thread plates/slide nuts
type 28/15

for profiles 28/15, 28/12, 28/28, 26/26, 26/18



Dimensions	M 6	M 8	M 10
l	27.7	27.7	29.3
b	12.6	12.6	17.4
h	4	4	5

Dimensions in stock:

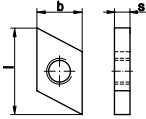
Steel/Steel coated: 424



Threaded plates

Article 88952

**T-Head thread plates/slide nuts
type 38/17**
for profiles 35/45, 38/17, 36/36, 36/20

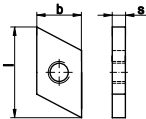


Dimensions	M 6	M 8	M 10	M 12
l	34	34	34	34
b	17.6	17.6	17.6	17.6
h	6.5	6.5	6.5	6.5

Dimensions in stock:
Steel/Steel coated: 424

Article 88953

**T-Head thread plates/slide nuts
type 50/40**
for profiles 50/40, 486

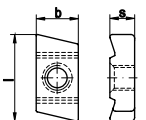


Dimensions	M 6	M 8	M 10	M 12	M 16
l	41.5	41.5	41.5	41.5	41.5
b	20.5	20.5	20.5	20.5	20.5
h	2.2	4	4	4	4

Dimensions in stock:
Steel/Steel coated: 425

Article 88954

**T-Head thread plates/slide nuts
type 40/22**
for profiles 40/22, 40/25, K422

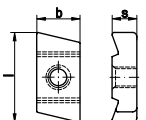


Dimensions	M 5	M 6	M 8	M 10	M 12
l	35	35	35	35	35
b	17	17	17	17	17
h	10	10	10	10	11.5

Dimensions in stock:
Steel/Steel coated: 425

Article 88955

**T-Head thread plates/slide nuts
type 50/30**
for profiles 54/33, 52/34, 50/40, 49/30, 486



Dimensions	M 8	M 10	M 12	M 16
l	42	42	42	42
b	21	21	21	21
h	12	12	12	13

Dimensions in stock:
Steel/Steel coated: 425

INDIVIDUAL RETAIL PACKAGING



RKP – REYHER Kitting & Packaging meets every customer need in picking fasteners and fixing technology for our customers in trade and industry. The type and structure of packaging is geared to customers' needs and their corporate image, everything customized.

We have a neutral package range, either with or without pouring lip, or packaging made according to customer's needs. The labels are designed specifically for the respective customers: with logos, images, barcodes, GTIN/EAN, product information, and customer material numbers.

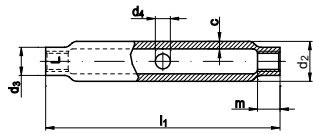
For more information, see www.reyher.de



Turnbuckles

DIN 1478

Turnbuckles
made from tubes or bars



Loadability only for turnbuckles with ÜZ

Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24	M 30	M 36
d ₂	17.2	17.2	21.3	25	30	33.7	42.4	51	63.5
d ₃	9	12	15	18	22.5	27	32	38	47.5
D	6	8	8	10	10	12	12	16	16
c	2.9	3.6	4	4	4.5	5	5.6	6.3	8
l ₁	110	110	125	125	170	200	255	255	295
m	7.5	10	12	15	20	24	29	36	43
adjustability	90	85	95	90	120	140	180	160	180
loadability [kN]	3.9	7.2	11	16	30	48	69	110	160

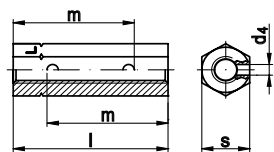
Dimensions in stock:

Steel/Steel coated: 202

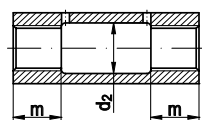
DIN 1479

Hexagon turnbuckles

≤ M 16



≥ M 20



Loadability only for turnbuckles with ÜZ

Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24	M 30	M 36
d ₂	–	–	–	–	–	21	26	32	38
d ₄	4	4	4	4	4	4	4	4	4
l	30	35	45	55	75	95	115	125	145
m	22.5	25	33	40	55	24	29	36	45
s	10	13	17	19	24	30	36	46	55
adjustability	15	15	21	25	35	47	57	53	70
loadability [kN]	3.9	7.2	11	16	30	48	69	110	160

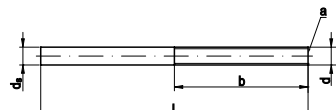
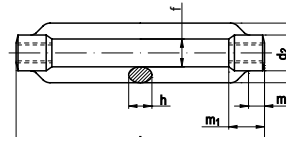
Dimensions in stock:

Steel/Steel coated: 203 | Stainless steel: 486

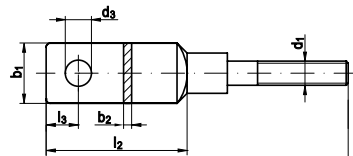
Turnbuckles

DIN 1480

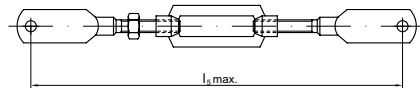
Forged turnbuckles



with welding studs (AE) acc. to DIN 34828
(ds ~ pitch diameter)



with flat leaf screw (BS)



* not standardized, reference values,
loadability only for turnbuckles with ÜZ
and the material S235JR

Dimensions	M 6	M 8	M 10	M 12	M 14*	M 16	M 20
d ₂	12	15	18	21	25	27	34
e	19	23	30	34	38	42	52
h _{min.}	6	8	9	11	10	14	17
l ₁	110	110	125	125	140	170	200
m ₁	12	15	18	21	24	27	34
m ₂	6	8	9	11	9	14	17
l	120	120	150	150	165	200	220
b	65	65	75	75	85	100	120
adjustability with AE**	80	75	85	80	92	110	130
loadability with AE [kN]**	5.7	10	16	24	32	44	69
d ₃ **	-	-	-	13.5	-	17.5	22
b ₁ **	-	-	-	45	-	55	70
l ₃ **	-	-	-	30	-	40	50
b ₂ **	-	-	-	6	-	7	9
l ₂ **	-	-	-	90	-	100	110
l ₄ **	-	-	-	200	-	230	260
l ₅ max.**	-	-	-	423	-	496	552
adjustability with BS**	-	-	-	87.2	-	112.2	154
loadability with AE [kN]**	-	-	-	9.3	-	11.2	14.8

Dimensions	M 22*	M 24	M 27*	M 30	M 36	M 42	M 48
d ₂	36	39	45	45	55	63	80
e	57	60	74	74	86	104	135
h _{min.}	16	20	20	23	28	32	40
l ₁	220	255	255	255	295	330	355
m ₁	37	39	42	45	55	63	78
m ₂	15	20	22	23	28	32	39
l	220	260	260	260	300	350	380
b	130	150	150	160	180	200	220
adjustability with AE**	146	170	171	160	180	200	195
loadability with AE [kN]**	85	100	129	158	160	-	-
d ₃ **	-	26	-	-	-	-	-
b ₁ **	-	80	-	-	-	-	-
l ₃ **	-	55	-	-	-	-	-
b ₂ **	-	11	-	-	-	-	-
l ₂ **	-	120	-	-	-	-	-
l ₄ **	-	320	-	-	-	-	-
l ₅ max.**	-	707	-	-	-	-	-
adjustability with BS**	-	220.5	-	-	-	-	-
loadability with AE [kN]**	-	27.6	-	-	-	-	-

Dimensions in stock:

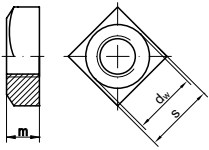
Steel/Steel coated: 204



Square nuts

DIN 557

Square nuts



Dimensions	M 5	M 6	M 8	M 10	M 12	M 16
$d_{w \min.}$	6.7	8.7	11.5	14.5/15.5	16.5/17.2	22
m	4	5	6.5	8	10	13
s	8	10	13	16/17	18/19	24

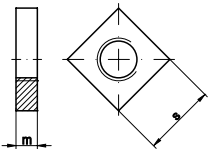
Dimensions in stock:

Steel/Steel coated: 91 | Stainless steel: 445

Square nuts

DIN 562

Square thin nuts



Dimensions	M 2	M 3	M 4	M 5	M 6	M 8	M 10
m	1.2	1.8	2.2	2.7	3.2	4	5
s	4	5.5	7	8	10	13	16/17*

* former DIN width across flats

Dimensions in stock:

Steel/Steel coated: 92 | Stainless steel: 445

CUSTOMER-SPECIFIC SETS & CONSTRUCTION KITS



Sets



Assembly kits



RKP®
REYHER KITTING & PACKAGING

Whether it is production, assembly or maintenance work – REYHER provides components as required, according to size, in sets or assembly kits. This saves not only the customer's own kitting work but also optimizes processes for example with pre-determined package sequencing.

Application-friendly sets or complex assembly kits are put together precisely according to customer specifications. This includes packaging and labelling. REYHER also offers pre-assembly of single components, and, on request adds assembly instructions, tools or other materials.

For more information, see www.reyher.de

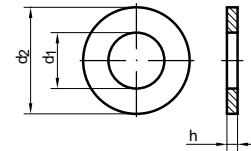


Plain washers (round)

Pk = product (tolerance) class
 A = medium
 C = coarse

Tolerances for washers acc. to ISO 4759-3 (DIN 522)

General overview of "plain washers for general use" → ISO 887



Nominal size = for screws		ISO 7089, 7090 (DIN 125-1 Pk A)			ISO 7091 (DIN 126 Pk C)			Art. 1/88100 (C) –			ISO 7092 (DIN 433 Pk A)			ISO 7094 (DIN 440 R Pk C)			DIN 6340 (Pk A) –					
M	Ww	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h			
1		1.1	3	0.3	In the ISO standards, the nominal sizes for screw diameters and the dimensions (d1/ d2/n) for some washers have been minimally adjusted. The functional compliance/exchangeability DIN:ISO washers are given. In this catalogue, the new dimensions are specified in dimension & price tables. Conversion to new dimensions is done according to the production conversion and sale of stock items.						1.1	2.5	0.3									
1.2		1.3	3.5	0.3							1.3	3	0.3									
1.4		1.5	4	0.3							1.5	3	0.3									
1.6		1.7	4	0.3							1.7	3.5	0.3									
*1.7		1.8	4.5	0.3																		
1.8		2.0	4.5	0.3							2.0	4	0.3									
2		2.2	5	0.3							2.2	4.5	0.3									
2.2		2.4	6	0.5							2.4	4.5	0.3									
2.5		2.7	6	0.5							2.7	5	0.5									
*2.6		2.8	7	0.5																		
3		3.2	7	0.5				3.2	8	0.5	3.2	6	0.5									
3.5		3.7	8	0.5				3.7	7	0.5												
4	*1/8"	4.3	9	0.8				4.3	10	0.8	4.3	8	0.5									
5	*3/16"	5.3	10	1	5.5	10	1	5.3	12	1	5.3	9	1				5.5	18	2			
6		6.4	12	1.6	6.6	12	1.6	6.5	13	1.25	6.4	11	1.6				6.6	22	2	6.4	17	3
7	*1/4"	7.4	14	1.6	7.6	14	1.6	8	16	1.25	7.4	12	1.6				7.6	24	2			
8	*5/16"	8.4	16	1.6	9	16	1.6	10	20	1.5	8.4	15	1.6				9	28	3	8.4	23	4
10	*3/8"	10.5	20	2	11	20	2	11.5	23	1.5	10.5	18	1.6				11	34	3	10.5	28	4
12	*7/16"	13	24	2.5	13.5	24	2.5	13	26	1.75	13	20	2				13.5	44	4	13	35	5
	*1/2"	13.5	24	2.5	13.5	24	2.5	14.5	29	1.75							13.5	44	4			
14		15	28	2.5	15.5	28	2.5	14.5	29	1.75	15	24	2.5	15.5	50	4						
	*9/16"							16	32	2												
16	*5/8"	17	30	3	17.5	30	3	17.5	35	2	17	28	2.5	17.5	56	5	17	45	6			
18		19	34	3	20	34	3	19.5	39	2.5	19	30	3	20	60	5						
20	*3/4"	21	37	3	22	37	3	21	42	2.5	21	34	3	22	72	6	21	50	6			
	*13/16"							23	46	3												
22	*7/8"	23	39	3	24	39	3	24.5	49	3	23	37	3	24	80	6						
24		25	44	4	26	44	4	27.5	55	3.5	25	39	4	26	85	6	25	60	8			
	*1"	27	50	4	26	44	4	27.5	55	3.5				26	85	6						
27		28	50	4	30	50	4	29	58	3.5	28	44	4	30	98	6						
30	*1 1/8"	31	56	4	33	56	4	31	62	3.5	31	50	4	33	105	6	31	68	10			
33	*1 1/4"	34	60	5	36	60	5	34	68	4	34	56	5	36	115	8						
	*1 3/8"							36	72	5												
36	*1 3/8"	37	66	5	39	66	5	40	80	5	37	60	5	39	125	8						
39	*1 1/2"	42 (40)	72	6	42	72	6	40	80	5				42	140	10						
42		45 (43)	78	8	45	78	8	43	85	5				*45	150	8						
45	*1 3/4"	48 (46)	85	8	48	85	8	46	90	5				*48	160	8						
48		52 (50)	92	8	52	92	8	50	97	6				*52	170	10						
52	*2"	56 (54)	98	8	56	98	8	54	105	7				*56	180	10						
56		62 (58)	105	10	62	105	10	58	110	8												
	*2 1/4"	60	110	9	62	105	10	Suitable combinations of plain washers for screws/nuts acc. to property and product classes (excerpt from ISO 887 informative Annex). For more exact information, see "Application area" of the corresponding washers product standard														
60		66 (62)	110	10.0	66	110	10															
64	*2 1/2"	70 (66)	115	10	70	115	10	Washers		Hardness class/product class		100 HV/C		200 HV/A		300 HV/A						
68		74 (70)	120	10	74	120	10	Screws/nuts		Property class		Product grade		Combination matching?								
72	*2 3/4"	78 (74)	125	10	78	125	10	Stahl		≤ 6.8/ 6		A, B		yes		yes		yes				
76	*3"	82 (78)	135	10	82	135	10			≤ 6.8/ 6		C		yes		no		no				
80		86 (82)	140	12	86	140	12			8.8/ 8		A, B		no		yes		yes				
90	*3 1/2"	96 (93)	160	12	96	160	12			10.9/10		A, B		no		no		no				
										12.9/12		A, B		no		no		no				
								A 1 – A 5		–50, –70, –80		A, B		–		yes		–				

* Not included in ISO product standards → ISO 887

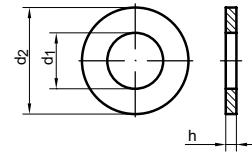


Plain washers (round)

Pk = product (tolerance) class
 A = medium
 C = coarse

Tolerances for washers acc. to ISO 4759-3 (DIN 522)

General overview of "plain washers for general use" → ISO 887



Nominal size = for screws		EN 14399-6 (Pk A) DIN 34820 (Pk A)*			DIN 7349 (Pk A) –			DIN 7989-1 (Pk C) DIN 7989-2 (Pk A)			ISO 7093-1.2 (DIN 9021 Pk A/Pk C)			ANSI B 18.22.1 Typ A					
M	Ww	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	N = narrow			W = wide		
		d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁ ①	d ₂ ①	h①	d ₁ ①	d ₂ ①	h①
3		* d ₁ and d ₂ conform to EN 14399-6 and DIN 34820:h dimensions DIN 34820 in			3.2	9	1				3.2	9	0.8						
3.5											3.7	11	0.8						
4	*1/8"				4.3	12	1.6				4.3	12	1						
5	*3/16"				5.3	15	2				5.3	15	1.2						
6					6.4	17	3				6.4	18	1.6						
7	*1/4"										7.4	22	2	0,281	0,625	0,065	0,312	0,734	0,065
8	*5/16"				8.4	21	4				8.4	24	2	0,344	0,688	0,065	0,375	0,875	0,083
10	*3/8"				10.5	25	4	11	20	8	10.5	30	2.5	0,406	0,812	0,065	0,438	1,000	0,083
12	*7/16"	13	24	3 (2.5)	13	30	6	13.5	24	8	13	37	3	0,469	0,922	0,065	0,500	1,250	0,083
	*1/2"													0,531	1,062	0,095	0,562	1,375	0,109
14					15	36	6				15	44	3						
	*9/16"													0,594	1,156	0,095	0,625	1,469	0,109
16	*5/8"	17	30	4 (3)	17	40	6	17.5	30	8	17	50	3	0,656	1,312	0,095	0,688	1,750	0,134
18					19	44	8				20	56	4						
20	*3/4"	21	37	4 (3)	21	44	8	22	37	8	22	60	4	0,812	1,469	0,134	0,812	2,000	0,148
22	*7/8"	23	39	4 (3)	23	50	8	24	39	8	23/24	66	5						
24		25	44	4 (4)	25	50	10	26	44	8	26	72	5						
27	*1"	28	50	5 (4)	28	60	10	30	50	8	30	85	6						
30	*1 1/8"	31	56	5 (4)	31	68	10	33	56	8	33	92	6						
33	*1 1/4"							36	60	8	36	105	6						
36	*1 3/8"	37	66	6 (5)				39	66	8	39	110	8						

① Dimensions in inch

Nominal size = screws/pins		DIN 1052 (Pk C) –			ISO 8738 (Pk A) (DIN 1440 (Pk A)) DIN 1441 (Pk C)			DIN 988 -S (Pk C) –			Art. 88104 (Pk C) –		
M/Ø	Ww	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h
3					d ₁ -dimensions DIN 1441 () d ₂ -dimensions DIN 1441 in ()			3	6	1	3.2	20	1.25
3.5													
4	*1/8"							4	8	1	4.3	15/20/25	1.25
5	*3/16"				5 (5.5)	10 (10)	0.8				5.3	20/25/30	1.5
6					6 (7)	12 (12)	1.6	6	12	1.2	6.4	20/25/30/35	1.5
7	*1/4"				7 (8)	– (14)	1.6						
8	*5/16"				8 (9)	15 (16)	2	8	14	1.2	8.4	20/25/30/35/40	1.5
10	*3/8"				10 (11)	18 (20)	2.5	10	13	1.2	10.5	25/30/35/40	1.5
12	*7/16"	14	58	6	12 (13)	20 (25)	3	12	18	1.2	12.5	30/35/40	1.5
14					14 (15)	22 (28)	3	14	20	1.5			
15								15	21	1.5			
16	*5/8"	18	68	6	16 (17)	24 (28)	3	16	22	1.5			
17								17	24	1.5			
18					18 (19)	– (30)	4	18	25	1.5			
20	*3/4"	23	80	8	20 (21)	30 (32)	4	20	28	2			
22	*7/8"	25	92	8	22 (23)	34 (34)	4	22	30/32	2			
24		27	105	8	24 (25)	37 (38)	4						
25								25	35/36	2			
26								26	37	2			
27	*1"				27 (28)	39 (40)	5						
28								28	40	2			
30	*1 1/8"				30 (31)	44 (45)	5	30	42	2.5			
33	*1 1/4"				33 (34)	47 (50)	5						

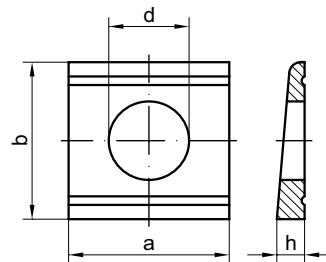
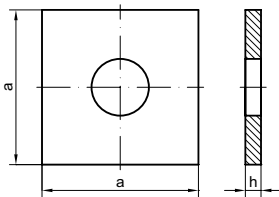
Continued → TI-86



Plain washers (round)

Nominal size = screws/pins		DIN 1052 (Pk C) –			DIN 1440 (Pk C) DIN 1441 (Pk C)*			DIN 988 –S (Pk C) –			Note
M/Ø	Ww	d ₁	d ₂	h	d ₁	d ₂	h	d ₁	d ₂	h	
35					35	52	6	35	45	2.5	Washers of special design – punched – turned – burned – in all sizes and materials on request
36	*1 3/8"				36 (37)	52	6				
37								37	47	2.5	
40					40 (41)	58	6	40	50	2.5	
45	*1 3/4"				45 (46)	62	7	45	55	3	
50					50 (51)	68	8	50	62/63	3	
55					55 (56)	75	9	55	68	3	
60					60 (62)	80	9	60	75	3	
63								63	80	3	
65					65 (68)	90	9	65	85	3.5	
70					70 (72)	95	10	70	90	3.5	
75					75 (78)	100	10	75	95	3.5	
80					80 (82)	110	12	80	100	3.5	
85					85 (86)	110	12	85	105	3.5	
90					90 (92)	115	12	90	110	3.5	
100					100 (102)	125	14	100	120/125	3.5	

Square washers/taper washers

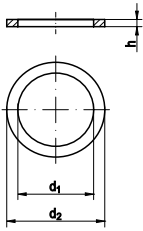


Nominal size = for screws		DIN 436 (Pk C) 0%			DIN 434 (Pk C) 8%			DIN 435 (Pk C) 14%			DIN 6917 (Pk C) 14%			DIN 6918 (Pk C) 8%		
M	Ww	d	a	h	d	a/b	h	d	a/b	h	d	a/b	h	d	a/b	h
8	5/16"				9	22/22	3.8/2	9	22/22	4.6/1.5						
10	3/8"	11	30	3	11	22/22	3.8/2	11	22/22	4.6/1.5	13	26/30	6.2/2	13	26/30	4.9/2.5
12	7/16"	13.5	40	4	13.5	26/30	4.9/2.5	13.5	26/30	6.2/2						
	1/2"	13.5	40	4	13.5	26/30	4.9/2.5	13.5	26/30	6.2/2						
14																
16	5/8"	17.5	50	5	17.5	32/36	5.9/3	17.5	32/36	7.5/2.5	17	32/36	7.5/2.5	17	32/36	5.9/3
18																
20	3/4"	22	60	5	22	40/44	7/3.5	22	40/44	9.2/3	21	40/44	9.2/3	21	40/44	7/3.5
22	7/8"	24	70	6	24	44/50	8/4	24	44/50	10/3	23	44/50	10/3	23	44/50	8/4
24		26	80	6	26	56/56	8.5/4	26	56/56	10.8/3	25	56/56	10.8/3	25*	56/56	8.5/4
	1"	26	80	6	26	56/56	8.5/4	26	56/56	10.8/3						
27		30	90	6	30	56/56	8.5/4	30	56/56	10.8/3	28	56/56	10.8/3	28*	56/56	8.5/4
30	1 1/8"	33	95	6	33	62/62	9/4	33	62/62	11.7/3	31	62/62	11.7/3	31*	62/62	9/4
33	1 1/4"	36	100	6												
36	1 3/8"	39	110	8							37	68/68	12.5/3	37*	68/68	9.4/4
39	1 1/2"	42	125	8							Marking: DIN Pitch Groove qty. 434 8% 2 435 14% 1 6917 14% 1 6918 8%/5% 2/0 – „Form A”					
42		45	135	8												
45	1 3/4"	48	140	8												
48		52	150	10												
52	2"	56	160	10												

Sealing washers (plain)

DIN 7603

Flat sealing rings



Dimensions	4x8	5x7.5	5x9*	6x10*	6.5x9.5	6.5x11*
d_1	4.2	5.2	5.2	6.2	6.7	6.7
d_2	7.9	7.4	8.9	9.9	9.4	10.9
h	1	1	1	1	1	1

Dimensions	8x11.5	8x12*	8x14	10x13.5	10x14*	10x15*
d_1	8.2	8.2	8.2	10.2	10.2	10.2
d_2	11.4	11.9	13.9	13.4	13.9	14.9
h	1	1/1.5	1	1	1/1.5	1

Dimensions	10x16	10x18	12x15.5	12x16	12x17*	12x18*
d_1	10.2	10.2	12.2	12.2	12.2	12.2
d_2	15.9	17.9	15.4	15.9	16.9	17.9
h	1	1.5	1.5	1.5	1.5	1.5

Dimensions	13x18*	14x18	14x20	15x19	16x20	16x22*
d_1	13.2	14.2	14.2	15.2	16.2	16.2
d_2	17.9	17.9	19.9	18.9	19.9	21.9
h	1.5	1.5	1.5	1.5	1.5	1.5

Dimensions	17x21	17x23*	18x22	18x24	20x24	20x26
d_1	17.2	17.2	18.2	18	20.2	20
d_2	20.9	22.9	21.9	24	23.9	26
h	1.5	1.5	1.5	1.5	1.5	1.5

Dimensions	21x26	22x27	22x29*	23x28	24x29	24x32
d_1	21.2	22.2	22.2	23.3	24.3	24.3
d_2	25.9	26.9	28.9	27.9	28.9	31.9
h	1.5	1.5	1.5	2	2	2

Dimensions	26x31	26x34*	27x32	28x33	30x36	32x38
d_1	26.3	26.3	27.3	28.3	30.3	32.3
d_2	30.9	33.9	31.9	32.9	35.9	37.9
h	2	2	2	2	2	2

Dimensions	33x38	33x41*	36x42	38x44	42x49	45x52
d_1	33.3	33.3	36.3	38.3	42.3	45.3
d_2	37.9	40.9	41.9	43.9	48.9	51.9
h	2	2	2	2	2	2

Dimensions	48x55*	60x68*				
d_1	48.3	60.5				
d_2	54.9	67.8				
h	2	2.5				

material: Al operating temperature: max. 200 °C

material: Cu operating temperature: max. 300 °C

* not standardized, reference values

Dimensions in stock:

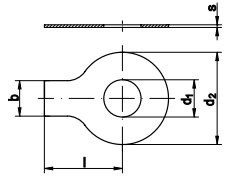
Non-ferrous materials: 593



Retaining/lock washers and rings

DIN 93

Tap washers with a long tap



d_1 = nominal size

Dimensions in stock:

Steel/Steel coated: 64 | Stainless steel: 432

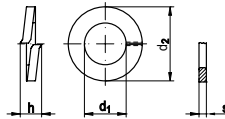
Dimensions	3.2	4.3	4.3	5.3	6.4	8.4	10.5	13
d_2	12	14	14	17	19	22	26	30
b	4	5	5	6	7	8	10	12
l	13	14	14	16	18	20	22	28
s	0.38	0.38	0.38	0.5	0.5	0.75	0.75	1
for thread $\varnothing$	3	4	4	5	6	8	10	12

Dimensions	15	17	19	21	23	25	28	31
d_2	33	36	40	42	50	50	58	63
b	12	15	18	18	20	20	23	26
l	28	32	36	36	42	42	48	52
s	1	1	1	1	1	1	1.6	1.6
for thread $\varnothing$	14	16	18	20	22	24	27	30

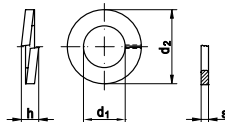
Dimensions	34	37	40	43	46	50	54
d_2	68	75	82	88	95	100	105
b	28	30	32	35	38	40	44
l	56	60	64	70	75	80	85
s	1.6	1.6	1.6	1.6	1.6	1.6	1.6
for thread $\varnothing$	33	36	39	42	45	48	52

DIN 127

Spring lock washers
with bent end or flat end



type A = bent end



type B = flat end

Dimensions	2	2.3	2.5	2.6 *	3	3.5	4	5	6
d_1	2.1	2.3	2.6	3	3.1	3.6	4.1	5.1	6.1
d_2	4.4	4.8	5.1	5.2	6.2	6.7	7.6	9.2	11.8
s	0.5	0.6	0.6	0.6	0.8	0.8	0.9	1.2	1.6
$h_{type A}$	-	-	-	-	1.9	1.9	2.1	2.7	3.6
$h_{type B}$	1.2	1.4	1.4	1.4	1.6	1.6	1.8	2.4	3.2

Dimensions	7	8	10	12	14	16	18	20	22
d_1	7.1	8.1	10.2	12.2	14.2	16.2	18.2	20.2	22.5
d_2	12.8	14.8	18.1	21.1	24.1	27.4	29.4	33.6	35.9
s	1.6	2	2.2	2.5	3	3.5	3.5	4	4
$h_{type A}$	3.6	4.6	5	5.8	6.8	7.8	7.8	8.8	8.8
$h_{type B}$	3.2	4	4.4	5	6	7	7	8	8

Dimensions	24	27	30	33	36	39	42	45	48
d_1	24.5	27.5	30.5	33.5	36.5	39.5	42.5	45.5	49
d_2	40	43	48.2	53.2	58.2	61.2	68.2	71.2	75
s	5	5	6	6	6	6	7	7	7
$h_{type A}$	11	11	13.6	13.6	13.6	13.6	15.6	15.6	15.6
$h_{type B}$	10	10	12	12	12	12	14	14	14

Dimensions	52	56	64	80	90	100			
d_1	53	57	65	81	91	101			
d_2	82	87	95	111	121	131			
s	8	8	8	8	8	8			
$h_{type A}$	18	18	18	18	18	18			
$h_{type B}$	16	16	16	16	16	16			

* not standardized, reference values

Dimensions in stock:

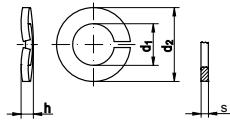
Steel/Steel coated: 70 | Stainless steel: 436 | Non-ferrous materials: 571



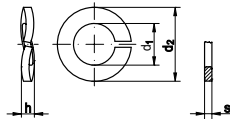
Retaining/lock washers and rings

DIN 128

Curved or waved spring lock washers



type A = curved



type B = waved

* not standardized, reference values

Dimensions	2.2 *	2.5	3	4	5	6
d ₁	2.4	2.6	3.1	4.1	5.1	6.1
d ₂	4.8	5.1	6.2	7.6	9.2	11.8
s	0.6	0.6	0.7	0.8	1	1.3
h	1	1.1	1.3	1.4	1.7	2.2

Dimensions	8	10	12	14	16	18
d ₁	8.1	10.2	12.2	14.2	16.2	18.2
d ₂	14.8	18.1	21.1	24.1	27.4	29.4
s	1.6	1.8	2.1	2.4	2.8	2.8
h	2.75	3.15	3.65	4.3	5.1	5.1

Dimensions	20	22	24	27	30	36
d ₁	20.2	22.5	24.5	27.5	30.5	35.5
d ₂	33.6	35.9	40	43	50.5	58.2
s	3.2	3.2	4	4	6	3
h	5.9	5.9	7.5	7.5	10.5	11.3

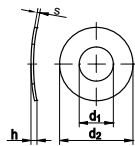
Dimensions in stock:

Steel/Steel coated: 72 | Stainless steel: 437

DIN 137

Spring washers

type A = curved



Dimensions	2	2.3	2.6	3	3.5	4
d ₁	2.2	2.5	2.8	3.2	3.7	4.3
d ₂	4.5	5	5.5	6	7	8
s	0.3	0.3	0.3	0.4	0.4	0.5
h	1	1	1.1	1.3	1.4	1.6

Dimensions	5	6	7	8	10	
d ₁	5.3	6.4	7.4	8.4	10.5	
d ₂	10	11	12	15	18	
s	0.5	0.5	0.5	0.5	0.8	
h	1.8	2.2	2.4	3.4	4	

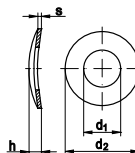
Dimensions in stock:

Steel/Steel coated: 73 | Stainless steel: 437

DIN 137

Spring washers

type B = waved



Dimensions	3	3.5	4	5	6	7	8
d ₁	3.2	3.7	4.3	5.3	6.4	7.4	8.4
d ₂	8	8	9	11	12	14	15
s	0.5	0.5	0.5	0.5	0.5	0.8	0.8
h	1.6	1.8	2	2.2	2.6	3	3

Dimensions	10	12	14	16	18	20	22
d ₁	10.5	13	15	17	19	21	23
d ₂	21	24	28	30	34	36	40
s	1	1.2	1.6	1.6	1.6	1.6	1.8
h	4.2	5	6	6.4	6.6	7.4	7.8

Dimensions	24	27	30	33	36		
d ₁	25	28	31	34	37		
d ₂	44	50	56	60	68		
s	1.8	2	2.2	2.2	2.5		
h	8.2	9.4	10	10.6	11.6		

Dimensions in stock:

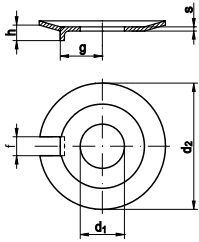
Steel/Steel coated: 73 | Stainless steel: 438



Retaining/lock washers and rings

DIN 432

Washers with external tap



Dimensions	4.3	5.3	6.4	8.4	10.5	13	15	17
d ₂	14	17	19	22	26	30	33	36
f	2.5	3.5	3.5	3.5	4.5	4.5	4.5	5.5
g	5.5	7	7.5	8.5	10	12	13	15
h ≈	2	2.5	3	4	4	4.5	4.5	4.5
s	0.4	0.75	0.75	1	1	1.2	1.2	1.2

Dimensions	19	21	23	25	28	31	34	37
d ₂	40	42	50	50	58	63	68	75
f	6.5	6.5	7.5	7.5	8.5	8.5	9.5	11
g	18	18	20	21	23	25	28	31
h ≈	4.5	4.5	6.5	6.5	9.5	9.5	9.5	9.5
s	1.2	1.6	1.6	1.6	1.6	1.6	1.6	2

Dimensions	40	43	46	50	54	58	66	
d ₂	82	88	95	100	105	112	125	
f	11	11	13	13	13	16	18	
g	33	36	38	40	42	45	52	
h ≈	11	11	12	13	13	14	13.5	
s	2	2	2	2	2	2.5	2.5	

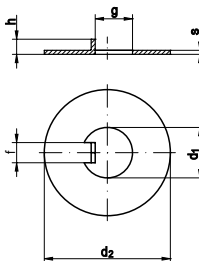
d₁ = nominal size

Dimensions in stock:

Steel/Steel coated: 77 | Stainless steel: 440

DIN 462

Internal tap washers



Dimensions	8	10	14	16	18	20	22	24
d ₂	20	25	30	32	34	36	40	42
s	0.8	0.8	0.8	11	1	1	1	1
f	3	4	5	5	6	6	6	6
g	5.9	7.4	11.4	13.5	15.4	17.5	19.5	21.6
h	2.5	3	3	3	4	4	4	4

Dimensions	28	30	32	35	38	40	42	45
d ₂	50	50	52	55	58	62	62	68
s	1	1.2	1.2	1.2	1.2	1.2	1.2	1.2
f	7	7	7	7	8	8	8	8
g	25.5	27.5	29.6	32.6	35.3	37.3	39.3	42.4
h	5	5	5	5	5	5	5	5

Dimensions	48	50	52	55	58	60	62	65
d ₂	75	75	80	80	90	90	95	95
s	1.2	1.2	1.2	1.2	1.5	1.5	1.5	1.5
f	8	8	10	10	10	10	10	10
g	45.4	47.4	49.3	52.3	55.3	57.3	59.3	62.4
h	5	5	6	6	6	6	6	6

Dimensions	70	72	75	80	85	95	100	
d ₂	100	110	110	115	120	135	145	
s	1.5	1.5	1.5	1.5	1.5	1.5	1.5	
f	10	10	10	10	10	12	12	
g	67.4	68.9	71.9	76.9	81.9	91.8	96.9	
h	6	7	7	7	7	8	8	

d₁ = nominal size

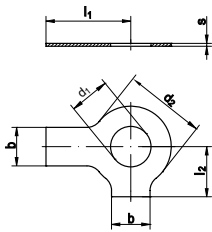
Dimensions in stock:

Steel/Steel coated: 83

Retaining/lock washers and rings

DIN 463

Washers with 2 taps



Dimensions	3.2	4.3	5.3	6.4	8.4	10.5	13
d ₂	7	9	10	12.5	17	21	24
b	4	5	6	7	8	10	12
l ₁	13	14	16	18	20	22	28
l ₂	5	6.5	8	9	11	13	15
s	0.38	0.38	0.5	0.5	0.75	0.75	1
for thread Ø	3	4	5	6	8	10	12

Dimensions	15	17	19	21	23	25	28
d ₂	28	30	34	37	39	44	50
b	12	15	18	18	20	20	23
l ₁	28	32	36	36	42	42	48
l ₂	16	18	20	21	23	25	29
s	1	1	1	1	1	1	1.6
for thread Ø	14	16	18	20	22	24	27

Dimensions	31	34	37	40	43	50	54
d ₂	56	60	66	72	78	92	98
b	26	28	30	32	35	40	44
l ₁	52	56	60	64	70	80	85
l ₂	32	34	38	41	44	50	53
s	1.6	1.6	1.6	1.6	1.6	1.6	1.6
for thread Ø	30	33	36	39	42	48	52

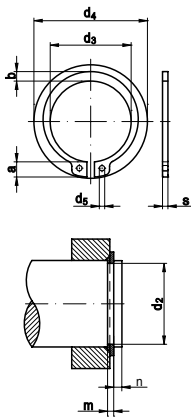
d₁ = nominal size

Dimensions in stock:

Steel/Steel coated: 83 | Stainless steel: 442 | Non-ferrous materials: 573

DIN 471

Retaining rings for shafts normal type



Dimensions	3	4	5	6	7	8	9	10	11	12
s	0.4	0.4	0.6	0.7	0.8	0.8	1	1	1	1
d ₃	2.7	3.7	4.7	5.6	6.5	7.4	8.4	9.3	10.2	11
a	1.9	2.2	2.5	2.7	3.1	3.2	3.3	3.3	3.3	3.3
b	0.8	0.9	1.1	1.3	1.4	1.5	1.7	1.8	1.8	1.8
d ₅	1	1	1	1.2	1.2	1.2	1.2	1.5	1.5	1.7
d ₂	2.8	3.8	4.8	5.7	6.7	7.6	8.6	9.6	10.5	11.5
m	0.5	0.5	0.7	0.8	0.9	0.9	1.1	1.1	1.1	1.1
n	0.3	0.3	0.3	0.5	0.5	0.6	0.6	0.6	0.8	0.8
d ₄	7	8.6	10.3	11.7	13.5	14.7	16	17	18	19

Dimensions	13	14	15	16	17	18	19	20	21	22
s	1	1	1	1	1	1.2	1.2	1.2	1.2	1.2
d ₃	11.9	12.9	13.8	14.7	15.7	16.5	17.5	18.5	19.5	20.5
a	3.4	3.5	3.6	3.7	3.8	3.9	3.9	4	4.1	4.2
b	2	2.1	2.2	2.2	2.3	2.4	2.5	2.6	2.7	2.8
d ₅	1.7	1.7	1.7	1.7	1.7	2	2	2	2	2
d ₂	12.4	13.4	14.3	15.2	16.2	17	18	19	20	21
m	1.1	1.1	1.1	1.1	1.1	1.3	1.3	1.3	1.3	1.3
n	0.9	0.9	1.1	1.2	1.2	1.5	1.5	1.5	1.5	1.5
d ₄	20.2	21.4	22.6	23.8	25	26.2	27.2	28.4	29.6	30.8

nominal size = for shafts Ø

* intermediate size not included in the standard

Dimensions in stock:

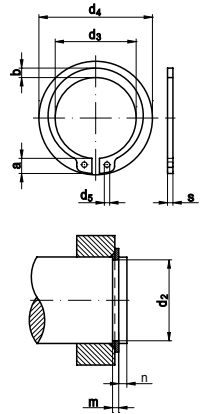
Steel/Steel coated: 85 | Stainless steel: 443



Retaining/lock washers and rings

DIN 471

Retaining rings for shafts
normal type



Dimensions	23*	24	25	26	27*	28	29	30	31*	32
s	1.2	1.2	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5
d ₃	21.5	22.2	23.2	24.2	24.9	25.9	26.9	27.9	28.6	29.6
a	4.3	4.4	4.4	4.5	4.6	4.7	4.8	5	5.1	5.2
b	2.9	3	3	3.1	3.1	3.2	3.4	3.5	3.5	3.6
d ₅	2	2	2	2	2	2	2	2	2.5	2.5
d ₂	22	22.9	23.9	24.9	25.6	26.6	27.6	28.6	29.3	30.3
m	1.3	1.3	1.3	1.3	1.3	1.6	1.6	1.6	1.6	1.6
n	1.5	1.7	1.7	1.7	2.1	2.1	2.1	2.1	2.6	2.6
d ₄	–	33.2	34.2	35.5	–	37.9	39.1	40.5	–	43

Dimensions	33*	34	35	36	37*	38	39*	40	41*	42
s	1.5	1.5	1.5	1.75	1.75	1.75	1.75	1.75	1.75	1.75
d ₃	30.5	31.5	32.2	33.2	34.2	35.2	36	36.5	37.5	38.5
a	5.2	5.4	5.6	5.6	5.7	5.8	5.9	6	6.2	6.5
b	3.7	3.8	3.9	4	4.1	4.2	4.3	4.4	4.5	4.5
d ₅	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d ₂	31.3	32.3	33	34	35	36	37	37.5	38.5	39.5
m	1.6	1.6	1.6	1.85	1.85	1.85	1.85	1.85	1.85	1.85
n	2.6	2.6	3	3	3	3	3	3.8	3.8	3.8
d ₄	–	45.4	46.8	47.8	–	50.2	–	52.6	–	55.7

Dimensions	44*	45	46*	47*	48	50	52	54*	55	56
s	1.75	1.75	1.75	1.75	1.75	2	2	2	2	2
d ₃	40.5	41.5	42.5	43.5	44.5	45.8	47.8	49.8	50.8	51.8
a	6.6	6.7	6.7	6.8	6.9	6.9	7	7.1	7.2	7.3
b	4.6	4.7	4.8	4.9	5	5.1	5.2	5.3	5.4	5.5
d ₅	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d ₂	41.5	42.5	43.5	44.5	45.5	47	49	51	52	53
m	1.85	1.85	1.85	1.85	1.85	2.15	2.15	2.15	2.15	2.15
n	3.8	3.8	3.8	3.8	3.8	4.5	4.5	4.5	4.5	4.5
d ₄	–	59.1	–	–	62.5	64.5	66.7	–	70.2	71.6

Dimensions	57*	58	60	62	63	65	67*	68	70	72
s	2	2	2	2	2	2.5	2.5	2.5	2.5	2.5
d ₃	52.8	53.8	55.8	57.8	58.8	60.8	62.5	63.5	65.5	67.5
a	7.3	7.3	7.4	7.5	7.6	7.8	7.9	8	8.1	8.2
b	5.5	5.6	5.8	6	6.2	6.3	6.4	6.5	6.6	6.8
d ₅	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3
d ₂	54	55	57	59	60	62	64	65	67	69
m	2.15	2.15	2.15	2.15	2.15	2.65	2.65	2.65	2.65	2.65
n	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
d ₄	–	73.6	75.6	77.8	79	81.4	–	84.8	87	89.2

Dimensions	75	77*	78	80	82	85	87*	88	90	92*
s	2.5	2.5	2.5	2.5	2.5	3	3	3	3	3
d ₃	70.5	72.5	73.5	74.5	76.5	79.5	81.5	82.5	84.5	86.5
a	8.4	8.5	8.6	8.6	8.7	8.7	8.8	8.8	8.8	9
b	7	7.2	7.3	7.4	7.6	7.8	7.9	8	8.2	8.4
d ₅	3	3	3	3	3	3.5	3.5	3.5	3.5	3.5
d ₂	72	74	75	76.5	78.5	81.5	83.5	84.5	86.5	88.5
m	2.65	2.65	2.65	2.65	2.65	3.15	3.15	3.15	3.15	3.15
n	4.5	4.5	4.5	5.3	5.3	5.3	5.3	5.3	5.3	5.3
d ₄	92.7	–	96.1	98.1	100.3	103.3	–	106.5	108.5	–

nominal size = for shafts $\varnothing$

* intermediate size not included in the standard

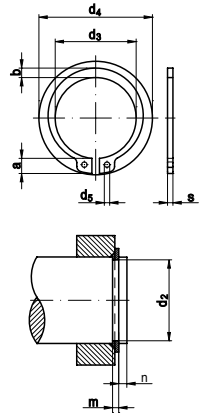
Dimensions in stock:

Steel/Steel coated: 85 | Stainless steel: 443

Retaining/lock washers and rings

DIN 471

Retaining rings for shafts
normal type



Dimensions	97*	98*	100	102*	105	107*	108*	110	112*	115	117*
s	3	3	3	4	4	4	4	4	4	4	4
d ₃	91.5	91.5	94.5	95	98	100	100	103	105	108	110
a	9.4	9.4	9.6	9.7	9.9	10	10	10.1	103	10.6	10.8
b	8.8	8.8	9	9.2	9.3	9.5	9.5	9.6	9.7	9.8	10
d ₅	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
d ₂	93.5	94.5	96.5	98	101	103	104	106	108	111	113
m	3.15	3.15	3.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	5.3	5.3	5.3	6	6	6	6	6	6	6	6
d ₄	–	–	120.2	–	125.8	–	–	131.2	–	137.3	–

Dimensions	118*	120	122*	125	127*	128*	130	132*	135	137*	138*
s	4	4	4	4	4	4	4	4	4	4	4
d ₃	110	113	115	118	120	120	123	125	128	130	130
a	10.8	11	11.2	11.4	11.4	11.4	11.6	11.7	11.8	11.9	11.9
b	10	10.2	10.3	10.4	10.5	10.5	10.7	10.8	11	11	11
d ₅	3.5	3.5	4	4	4	4	4	4	4	4	4
d ₂	114	116	118	121	123	124	126	128	131	133	134
m	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	6	6	6	6	6	6	6	6	6	6	6
d ₄	–	143.1	–	149	–	–	154.4	–	159.8	–	–

Dimensions	140	142*	145	147*	148*	150	155	160	165	168*	170
s	4	4	4	4	4	4	4	4	4	4	4
d ₃	133	135	138	140	140	142	146	151	155.5	157.5	160.5
a	12	12.1	12.2	12.3	12.3	13	13	13.3	13.5	13.5	13.5
b	11.2	11.3	11.5	11.6	11.6	11.8	12	12.2	12.5	12.9	12.9
d ₅	4	4	4	4	4	4	4	4	4	4	4
d ₂	136	138	141	143	144	145	150	155	160	163	165
m	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	6	6	6	6	6	7.5	7.5	7.5	7.5	7.5	7.5
d ₄	165.2	–	170.6	–	–	177.3	182.3	188	193.4	–	198.4

Dimensions	175	180	185	190	195	200	210	215*	220	230	240
s	4	4	4	4	4	4	5	5	5	5	5
d ₃	165.5	170.5	175.5	180.5	185.5	190.5	198	203	208	218	228
a	13.5	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
b	12.9	13.5	13.5	14	14	14	14	14	14	14	14
d ₅	4	4	4	4	4	4	4	4	4	4	4
d ₂	170	175	180	185	190	195	204	209	214	224	234
m	4.15	4.15	4.15	4.15	4.15	4.15	5.15	5.15	5.15	5.15	5.15
n	7.5	7.5	7.5	7.5	7.5	7.5	9	9	9	9	9
d ₄	203.4	210	215	220	225	230	240	–	250	260	270

Dimensions	250	255*	260	270	280	290	300				
s	5	5	5	5	5	5	5				
d ₃	238	240	245	255	265	275	285				
a	14.2	16.2	16.2	16.2	16.2	16.2	16.2				
b	14	16	16	16	16	16	16				
d ₅	4	5	5	5	5	5	5				
d ₂	244	247	252	262	272	282	292				
m	5.15	5.15	5.15	5.15	5.15	5.15	5.15				
n	9	12	12	12	12	12	12				
d ₄	280	–	294	304	314	324	334				

nominal size = for shafts Ø

* intermediate size not included in the standard

Dimensions in stock:

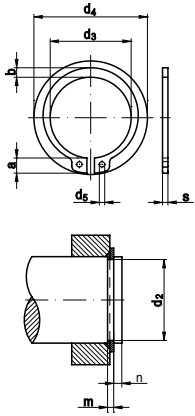
Steel/Steel coated: 85 | Stainless steel: 443



Retaining/lock washers and rings

DIN 471

Retaining rings for shafts
heavy type



nominal size = for shafts $\varnothing$

Dimensions in stock:

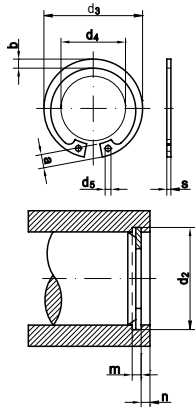
Steel/Steel coated: 85

Dimensions	15	16	20	25	30	35
s	1.5	1.5	1.75	2	2	2.5
d ₃	13.8	14.7	18.5	23.2	27.9	32.2
a	4.8	5	5.5	6.4	6.5	6.7
b	2.4	2.5	3	3.4	4.1	4.2
d ₅	2	2	2	2	2	2.5
d ₂	14.3	15.2	19	23.9	28.6	33
m	1.6	1.6	1.85	2.15	2.15	2.65
n	1.1	1.2	1.5	1.7	2.1	3
d ₄	25.1	26.5	31.6	38.5	43.7	49.1
Dimensions	40	45	50	55	60	
s	2.5	2.5	3	3	3	
d ₃	36.5	41.5	45.8	50.8	55.8	
a	7	7.5	8	8.5	9	
b	4.4	4.7	5.1	5.4	5.8	
d ₅	2.5	2.5	2.5	2.5	2.5	
d ₂	37.5	42.5	47	52	57	
m	2.65	2.65	3.15	3.15	3.15	
n	3.8	3.8	4.5	4.5	4.5	
d ₄	54.7	60.8	66.8	72.9	78.9	

Retaining/lock washers and rings

DIN 472

Retaining rings for bores
normal type



Dimensions	8	9	10	11	12	13	14	15
s	0.8	0.8	1	1	1	1	1	1
d ₃	8.7	9.8	10.8	11.8	13	14.1	15.1	16.2
a	2.4	2.5	3.2	3.3	3.4	3.6	3.7	3.7
b	1.1	1.3	1.4	1.5	1.7	1.8	1.9	2
d ₅	1	1	1.2	1.2	1.5	1.5	1.7	1.7
d ₂	8.4	9.4	10.4	11.4	12.5	13.6	14.6	15.7
m	0.9	0.9	1.1	1.1	1.1	1.1	1.1	1.1
n	0.6	0.6	0.6	0.6	0.8	0.9	0.9	1.1
d ₄	3	3.7	3.3	4.1	4.9	5.4	6.2	7.2

Dimensions	16	17	18	19	20	21	22	23*
s	1	1	1	1	1	1	1	1.2
d ₃	17.3	18.3	19.5	20.5	21.5	22.5	23.5	24.6
a	3.8	3.9	4.1	4.1	4.2	4.2	4.2	4.2
b	2	2.1	2.2	2.2	2.3	2.4	2.5	2.5
d ₅	1.7	1.7	2	2	2	2	2	2
d ₂	16.8	17.8	19	20	21	22	23	24.1
m	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.3
n	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.7
d ₄	8	8.8	9.4	10.4	11.2	12.2	13.2	–

Dimensions	24	25	26	27*	28	29*	30	31
s	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
d ₃	25.9	26.9	27.9	29.1	30.1	31.1	32.1	33.4
a	4.4	4.5	4.7	4.7	4.8	4.8	4.8	5.2
b	2.6	2.7	2.8	2.9	2.9	3	3	3.2
d ₅	2	2	2	2	2	2	2	2.5
d ₂	25.2	26.2	27.2	28.4	29.4	30.4	31.4	32.7
m	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
n	1.8	1.8	1.8	2.1	2.1	2.1	2.1	2.6
d ₄	14.8	15.5	16.1	–	17.9	–	19.9	20

Dimensions	32	33*	34	35	36	37	38	39*
s	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5
d ₃	34.4	35.5	36.5	37.8	38.8	39.8	40.8	42
a	5.4	5.4	5.4	5.4	5.4	5.5	5.5	5.6
b	3.2	3.3	3.3	3.4	3.5	3.6	3.7	3.8
d ₅	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d ₂	33.7	34.7	35.7	37	38	39	40	41
m	1.3	1.3	1.6	1.6	1.6	1.6	1.6	1.6
n	2.6	2.6	2.6	3	3	3	3	3
d ₄	20.6	–	22.6	23.6	24.6	25.4	26.4	–

Dimensions	40	41*	42	44*	45	46*	47	48
s	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
d ₃	43.5	44.5	45.5	47.5	48.5	49.5	50.5	51.5
a	5.8	5.9	5.9	6	6.2	6.3	6.4	6.4
b	3.9	4	4.1	4.2	4.3	4.4	4.4	4.5
d ₅	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d ₂	42.5	43.5	44.5	46.5	47.5	48.5	49.5	50.5
m	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
n	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
d ₄	27.8	–	29.6	–	32	–	33.5	34.5

nominal size = for shafts Ø

* intermediate size not included in the standard

Dimensions in stock:

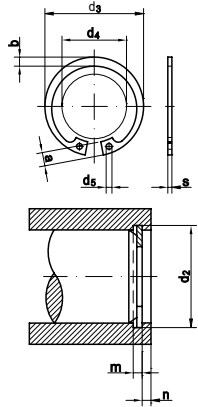
Steel/Steel coated: 86 | Stainless steel: 443



Retaining/lock washers and rings

DIN 472

Retaining rings for bores
normal type



Dimensions	50	51*	52	53*	54*	55	56	57*
s	2	2	2	2	2	2	2	2
d ₃	54.2	55.2	56.2	57.2	58.2	59.2	60.2	61.2
a	6.5	6.5	6.7	6.7	6.7	6.8	6.8	6.8
b	4.6	4.7	4.7	4.9	5	5	5.1	5.1
d ₅	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d ₂	53	54	55	56	57	58	59	60
m	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
n	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
d ₄	36.3	–	37.9	–	–	40.7	41.7	–

Dimensions	58	60	62	63	64*	65	67*	68
s	2	2	2	2	2	2.5	2.5	2.5
d ₃	62.2	64.2	66.2	67.2	68.2	69.2	71.5	72.5
a	6.9	7.3	7.3	7.3	7.4	7.6	7.7	7.8
b	5.2	5.4	5.5	5.6	5.7	5.8	6	6.1
d ₅	2.5	2.5	2.5	2.5	2.5	3	3	3
d ₂	61	63	65	66	67	68	70	71
m	2.15	2.15	2.15	2.15	2.15	2.65	2.65	2.65
n	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
d ₄	43.5	44.7	46.7	47.7	–	49	–	51.6

Dimensions	70	72	75	77*	78	80	82	85
s	2.5	2.5	2.5	2.5	2.5	2.5	2.5	3
d ₃	74.5	76.5	79.5	82.5	82.5	85.5	87.5	90.5
a	7.8	7.8	7.8	8.5	8.5	8.5	8.5	8.6
b	6.2	6.4	6.6	6.8	6.8	7	7	7.2
d ₅	3	3	3	3	3	3	3	3.5
d ₂	73	75	78	80	81	83.5	85.5	88.5
m	2.65	2.65	2.65	2.65	2.65	2.65	2.65	3.15
n	4.5	4.5	4.5	4.5	4.5	5.3	5.3	5.3
d ₄	53.6	55.6	58.6	–	60.1	62.1	64.1	66.9

Dimensions	88	90	92	95	97*	98	100	102
s	3	3	3	3	3	3	3	4
d ₃	93.5	95.5	97.5	100.5	103.5	103.5	105.5	108
a	8.6	8.6	8.7	8.8	9	9	9.2	9.5
b	7.4	7.6	7.8	8.1	8.3	8.3	8.4	8.5
d ₅	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
d ₂	91.5	93.5	95.5	98.5	100.5	101.5	103.5	106
m	3.15	3.15	3.15	3.15	3.15	3.15	3.15	4.15
n	5.3	5.3	5.3	5.3	5.3	5.3	5.3	6
d ₄	69.9	71.9	73.7	76.5	–	79	80.6	82

Dimensions	105	108	110	112	115	118*	120	122*
s	4	4	4	4	4	4	4	4
d ₃	112	115	117	119	122	125	127	129
a	9.5	9.5	10.4	10.5	10.5	10.7	11	11
b	8.7	8.9	9	9.1	9.3	9.6	9.7	9.8
d ₅	3.5	3.5	3.5	3.5	3.5	3.5	3.5	4
d ₂	109	112	114	116	119	122	124	126
m	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	6	6	6	6	6	6	6	6
d ₄	85	88	88.2	90	93	–	96.9	–

nominal size = for shafts Ø

* intermediate size not included in the standard

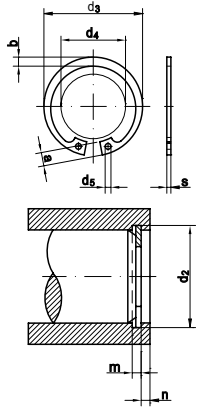
Dimensions in stock:

Steel/Steel coated: 86 | Stainless steel: 443

Retaining/lock washers and rings

DIN 472

Retaining rings for bores
normal type



Dimensions	125	128*	130	132*	135	138*	140	142*	145	148*
s	4	4	4	4	4	4	4	4	4	4
d ₃	132	135	137	139	142	145	147	149	152	155
a	11	11	11	11	11.2	11.2	11.2	11.3	11.4	11.8
b	10	10.2	10.2	10.3	10.5	10.6	10.7	10.8	10.9	11.1
d ₅	4	4	4	4	4	4	4	4	4	4
d ₂	129	132	134	136	139	142	144	146	149	152
m	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	6	6	6	6	6	6	6	6	6	6
d ₄	101.9	–	106.9	–	111.5	–	116.5	–	121	–

Dimensions	150	152*	155	160	165	168*	170	175	180	185
s	4	4	4	4	4	4	4	4	4	4
d ₃	158	161	164	169	174.5	177.5	179.5	184.5	189.5	194.5
a	12	12	12	13	13	13.5	13.5	13.5	14.2	14.2
b	11.2	11.3	11.4	11.6	11.8	12.1	12.2	12.7	13.2	13.7
d ₅	4	4	4	4	4	4	4	4	4	4
d ₂	155	157	160	165	170	173	175	180	185	190
m	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15
n	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
d ₄	124.8	–	129.8	132.7	137.7	–	141.6	146.6	150.2	155.2

Dimensions	190	195	200	205*	210	215*	220	225*	230	240
s	4	4	4	5	5	5	5	5	5	5
d ₃	199.5	204.5	209.5	217	222	227	232	237	242	252
a	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
b	13.8	13.8	14	14	14	14	14	14	14	14
d ₅	4	4	4	4	4	4	4	4	4	4
d ₂	195	200	205	211	216	221	226	231	236	246
m	4.15	4.15	4.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15
n	7.5	7.5	7.5	9	9	9	9	9	9	9
d ₄	160.2	165.2	170.2	–	180.2	–	190.2	–	200.2	210.2

Dimensions	245*	250	255*	260	265*	270	275*	280	285*	290
s	5	5	5	5	5	5	5	5	5	5
d ₃	257	262	270	275	280	285	290	295	300	305
a	14.2	14.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2
b	14	14	16	16	16	16	16	16	16	16
d ₅	4	4	5	5	5	5	5	5	5	5
d ₂	251	256	263	268	273	278	283	288	293	298
m	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15
n	9	9	12	12	12	12	12	12	12	12
d ₄	–	220.2	–	226	–	236	–	246	–	256

Dimensions	295*	300	310*	320*	340*	360*				
s	5	5	6	6	6	6				
d ₃	310	315	327	337	357	377				
a	16.2	16.2	–	–	–	–				
b	16	16	20	20	20	20				
d ₅	5	5	6	6	6	6				
d ₂	303	308	320	330	350	370				
m	5.15	5.15	3.2	6.2	6.2	6.2				
n	12	12	15	15	15	15				
d ₄	–	266	–	–	–	–				

nominal size = for shafts Ø

* intermediate size not included in the standard

Dimensions in stock:

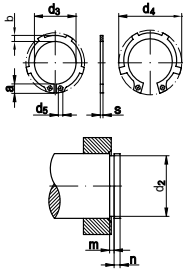
Steel/Steel coated: 86 | Stainless steel: 443



Retaining/lock washers and rings

DIN 983

Retaining rings with lugs for shafts
(retainer rings)



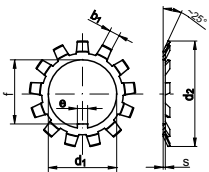
nominal size = for shafts Ø

Dimensions in stock:
Steel/Steel coated: 190

Dimensions	20	25	30	35	40	45	50
s	1.2	1.2	1.5	1.5	1.75	1.75	2
d ₃	18.5	23.2	27.9	32.2	36.5	41.5	45.8
a	3.8	4.3	4.7	5.2	7.2	7.2	8.2
b	2.6	3	3.5	3.9	4.4	4.7	5.1
d ₅	2	2	2	2.5	2.5	2.5	2.5
d ₂	19	23.9	28.6	33	37.5	42.5	47
m	1.3	1.3	1.6	1.6	1.85	1.85	2.15
n	1.5	1.7	2.1	3	3.8	3.8	4.5
d ₄	28	34	39.9	45.9	55.1	60.1	67.2

DIN 5406

Lockwashers/safety plates
for locknuts acc. to DIN 981



Dimensions	MB 0	MB 1	MB 2	MB 3	MB 4	MB 5	MB 6	MB 7
d ₁	10	12	15	17	20	25	30	35
d ₂	21	25	28	32	36	42	49	57
e	3	3	4	4	4	5	5	6
f	8.5	10.5	13.5	15.5	18.5	23	27.5	32.5
b ₁	3	3	4	4	4	5	5	5
s	1	1	1	1	1	1.25	1.25	1.25
for locknut DIN 981	KM 0	KM 1	KM 2	KM 3	KM 4	KM 5	KM 6	KM 7

Dimensions	MB 8	MB 9	MB 10	MB 11	MB 12	MB 13	MB 14	MB 15
d ₁	40	45	50	55	60	65	70	75
d ₂	62	69	74	81	86.4	92	98	104
e	6	6	6	8	8	8	8	8
f	37.5	42.5	47.5	52.5	57.5	62.5	66.5	71.5
b ₁	6	6	6	7	7	7	8	8
s	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5
for locknut DIN 981	KM 8	KM 9	KM 10	KM 11	KM 12	KM 13	KM 14	KM 15

Dimensions	MB 16	MB 17	MB 18	MB 19	MB 20	MB 21	MB 22	MB 23
d ₁	80	85	90	95	100	105	110	115
d ₂	112	119	126	133	142	145	154	159
e	10	10	10	10	12	12	12	12
f	76.5	81.5	86.5	91.5	96.5	100.5	105.5	110.5
b ₁	8	8	10	10	10	12	12	12
s	1.75	1.75	1.75	1.75	1.75	1.75	1.75	2
for locknut DIN 981	KM 16	KM 17	KM 18	KM 19	KM 20	KM 21	KM 22	KM 23

Dimensions	MB 24	MB 25	MB 26	MB 27	MB 28	MB 29	MB 30	
d ₁	120	125	130	135	140	145	150	
d ₂	164	170	175	185	192	202	205	
e	14	14	14	14	16	16	16	
f	115	120	125	130	135	140	145	
b ₁	12	12	12	14	14	14	14	
s	2	2	2	2	2	2	2	
for locknut DIN 981	KM 24	KM 25	KM 26	KM 27	KM 28	KM 29	KM 30	

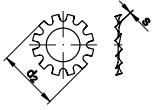
Dimensions in stock:
Steel/Steel coated: 288



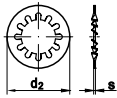
Retaining/lock washers and rings

DIN 6797

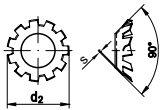
Toothed lock washers



type A = external teeth



type I = internal teeth



Type V = countersunk

* acc. to DIN 6797:1971

Dimensions in stock:

Steel/Steel coated: 293 | Stainless steel: 519

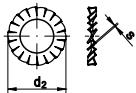
Dimensions	3.2	3.7	4.3	5.3	6.4	7.4
d_2 form A/I	6	7	8	10	11	12.5
d_2 type V	6	7	8	9.8	11.8	–
$s_{type A/I}$	0.4	0.5	0.5	0.6	0.7	0.8
$s_{type V}$	0.2	0.25	0.25	0.3	0.4	–
for thread $\varnothing$	3	3.5	4	5	6	7

Dimensions	8.4	10.5	12.5*	13	15	17
d_2 form A/I	15	18	20.5	20.5	24	26
d_2 type V	15.3	19	23	23	–	–
$s_{type A/I}$	0.8	0.9	1	1	1	1.2
$s_{type V}$	0.4	0.5	0.5	0.5	–	–
for thread $\varnothing$	8	10	12	12	14	16

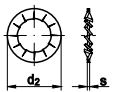
Dimensions	19	21	23	25	28	31
d_2 form A/I	30	33	36	38	44	48
d_2 type V	–	–	–	–	–	–
$s_{type A/I}$	1.4	1.4	1.5	1.5	1.6	1.6
$s_{type V}$	–	–	–	–	–	–
for thread $\varnothing$	18	20	22	24	27	30

DIN 6798

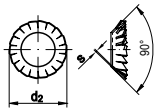
Serrated lock washers



type A = external teeth



type I = internal teeth



type V = countersunk

* acc. to DIN 6798:1971

Dimensions in stock:

Steel/Steel coated: 294 | Stainless steel: 519 | Non-ferrous materials: 591

Dimensions	2.2	2.5*	2.7	3.2	3.7	4.3	5.3
d_2 form A/I	4.5	5	5.5	6	7	8	10
d_2 type V	–	–	–	6	7	8	9.8
$s_{type A/I}$	0.3	0.4	0.4	0.4	0.5	0.5	0.6
$s_{type V}$	–	–	–	0.2	0.25	0.25	0.3
for thread $\varnothing$	2	2.3	2.5	3	3.5	4	5

Dimensions	6.4	7.4	8.4	10.5	13	15	17
d_2 form A/I	11	12.5	15	18	20.5	24	26
d_2 type V	11.8	–	15.3	19	23	–	–
$s_{type A/I}$	0.7	0.8	0.8	0.9	1	1	1.2
$s_{type V}$	0.4	–	0.4	0.5	0.5	–	–
for thread $\varnothing$	6	7	8	10	12	14	16

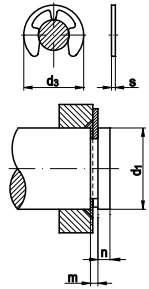
Dimensions	19	21	23	25	28	31
d_2 form A/I	30	33	36	38	44	48
d_2 type V	–	–	–	–	–	–
$s_{type A/I}$	1.4	1.4	1.5	1.5	1.6	1.6
$s_{type V}$	–	–	–	–	–	–
for thread $\varnothing$	18	20	22	24	27	30



Retaining/lock washers and rings

DIN 6799

Retaining rings for shafts



Dimensions	0.8	1.2	1.5	1.9	2.3	3.2
d ₃	2.25	3.25	4.25	4.8	6.3	7.3
s	0.2	0.3	0.4	0.5	0.6	0.6
for shafts Ø d ₁	1 – 1.4	1.4 – 2	2 – 2.5	2.5 – 3	3 – 4	4 – 5
m	0.24	0.34	0.44	0.54	0.64	0.64
n	0.4	0.6	0.8	1	1	1

Dimensions	4	5	6	7	8	9
d ₃	9.3	11.3	12.3	14.3	16.3	18.8
s	0.7	0.7	0.7	0.9	1	1.1
for shafts Ø d ₁	5 – 7	6 – 8	7 – 9	8 – 11	9 – 12	10 – 14
m	0.74	0.74	0.74	0.94	1.05	1.15
n	1.2	1.2	1.2	1.5	1.8	2

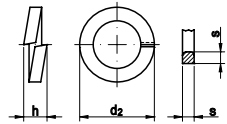
Dimensions	10	12	15	19	24	
d ₃	20.4	23.4	29.4	37.6	44.6	
s	1.2	1.3	1.5	1.75	2	
for shafts Ø d ₁	11 – 15	13 – 18	16 – 24	20 – 31	25 – 38	
m	1.25	1.35	1.55	1.80	2.05	
n	2	2.5	3	3.5	4	

Dimensions in stock:

Steel/Steel coated: 296 | Stainless steel: 520

DIN 7980

Spring lock washers for cheese head screws



Dimensions	3	4	5	6	8	10	12
d ₂	5.6	7	8.8	9.9	12.7	16	18
s	1	1.2	1.6	1.6	2	2.5	2.5
h	2	2.4	3.2	3.2	4	5	5
for thread Ø	3	4	5	6	8	10	12

Dimensions	14	16	18	20	22	24	27
d ₂	21.1	24.4	26.4	30.6	32.9	35.9	38.9
s	3	3.5	3.5	4.5	4.5	5	5
h	6	7	7	9	9	10	10
for thread Ø	14	16	18	20	22	24	27

Dimensions	30	33	36	42	48		
d ₂	44.1	47.1	52.2	60.2	67		
s	6	6	7	8	8		
h	12	12	14	16	16		
for thread Ø	30	33	36	42	48		

Dimensions in stock:

Steel/Steel coated: 335 | Stainless steel: 536

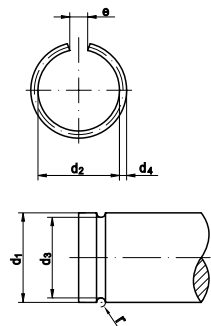


Retaining/lock washers and rings

DIN 7993

Snap rings

type A = for shafts



Dimensions	4	5	6	7	8	10	12	16	18
d ₂	3.1	4.1	5.1	6.1	7.1	9.1	10.8	14.2	16.2
d ₄	0.8	0.8	0.8	0.8	0.8	0.8	1	1.6	1.6
e	1	1	1	2	2	2	3	3	3
for shafts Ø d ₁	4	5	6	7	8	10	12	16	18
Ø d ₃	3.2	4.2	5.2	6.2	7.2	9.2	11	14.4	16.4
r	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.9	0.9

Dimensions	20	22	25	26	28	30	35	38	40
d ₂	17.7	19.7	22.7	23.7	25.7	27.7	32.1	35.1	37.1
d ₄	2	2	2	2	2	2	2.5	2.5	2.5
e	3	3	3	3	3	3	4	4	4
for shafts Ø d ₁	20	22	25	26	28	30	35	38	40
Ø d ₃	18	20	23	24	26	28	32.5	35.5	37.5
r	1.1	1.1	1.1	1.1	1.1	1.1	1.4	1.4	1.4

Dimensions	45	48	50	55	60	65	70		
d ₂	42	45	47	51.1	56.1	61.1	66		
d ₄	2.5	2.5	2.5	3.2	3.2	3.2	3.2		
e	4	4	4	4	4	4	5		
for shafts Ø d ₁	45	48	50	55	60	65	70		
Ø d ₃	42.5	45.5	47.5	51.8	56.8	61.8	66.8		
r	1.4	1.4	1.4	1.8	1.8	1.8	1.8		

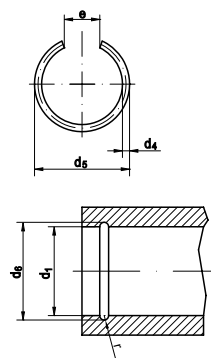
Dimensions in stock:

Steel/Steel coated: 346

DIN 7993

Snap rings

type B = for bores



Dimensions	7	8	10	12	16	18
d ₄	0.8	0.8	0.8	1	1.6	1.6
d ₅	7.9	8.9	10.9	13.2	17.8	19.8
e	4	4	4	6	8	8
for drilling Ø d ₁	7	8	10	12	16	18
Ø d ₆	7.8	8.8	10.8	13	17.6	19.6
r	0.5	0.5	0.5	0.6	0.9	0.9

Dimensions in stock:

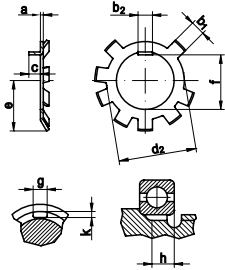
Steel/Steel coated: 346



Retaining/lock washers and rings

DIN 70952

Safety plates
for locknuts acc. to DIN 70852



Dimensions	10	12	14	16	18	20	22	24	26
a	0.75	0.75	0.75	1	1	1	1	1	1
b ₁	4	4	4	5	5	5	6	6	6
b ₂	4	4	5	5	5	5	6	6	6
c	3	3	3	3	4	4	4	4	5
d ₂	16	18	20	23	25	27	30	32	34
e	11	12	13	14.5	16.5	17.5	19	20	22
f	8.9	10.9	12.9	14.9	16.9	18.9	20.9	22.9	24.9
g _{shaft} *	4	4	5	5	5	5	6	6	6
h _{shaft}	3	3	3	3	4	4	4	4	5
k _{shaft}	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2

Dimensions	28	30	32	35	38	40	42	45	48
a	1	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
b ₁	6	6	6	6	6	6	7	7	7
b ₂	7	7	7	7	8	8	8	8	8
c	5	5	5	5	5	5	5	5	5
d ₂	36	38	41	43	47	49	52	54	57
e	23	24	25.5	26.5	28.5	29.5	31	32	33.5
f	26.9	28.9	30.9	33.9	36.6	38.6	40.6	43.6	46.7
g _{shaft} *	7	7	7	7	8	8	8	8	8
h _{shaft}	5	5	5	5	5	5	5	5	5
k _{shaft}	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

Dimensions	50	52	55	60	65	70	75	80	90
a	1.2	1.2	1.2	1.5	1.5	1.5	1.5	1.5	1.5
b ₁	7	7	7	10	10	10	10	10	10
b ₂	8	8	10	10	10	10	10	10	10
c	5	6	6	6	6	6	7	7	7
d ₂	60	62	67	71	76	81	86	91	103
e	35	37	39.5	41.5	44	46.5	50	52.5	58.5
f	48.7	50.7	53.7	58.7	63.7	68.7	73.2	78.2	88.2
g _{shaft} *	8	8	10	10	10	10	10	10	10
h _{shaft}	5	6	6	6	6	6	7	7	7
k _{shaft}	1.5	1.5	1.5	2	2	2	2	2	2

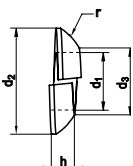
* tolerance C11 on the shaft

Dimensions in stock:

Steel/Steel coated: 384

DIN 74361

Spherical springwashers
type C



Dimensions	12.5	14.5	16.5	18.5	20.5	22.5
d ₂	23	26	26.5	29	34	34
d ₃	14.5	17	18	20	24	24
h	5	6	6.5	7	8	8
r	12	14	15	16	18	18

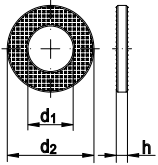
Dimensions in stock:

Steel/Steel coated: 385

Retaining/lock washers and rings

Article 88119

Locktix-washers



Dimensions	8	10	12	16
$d_{1 \text{ min.}}$	8.4	10.5	13	16.5
$d_{2 \text{ max.}}$	16	20	24	30
h	2.5	2.5	3	4

for screws with property class 8.8/10.9/12.9

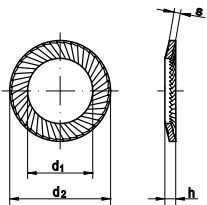
Dimensions in stock:

Steel/Steel coated: 412

Article 88120

SCHNORR safety washers

type S = standard



Dimensions	2	2.5	3	3.5	4	5	6
d_1	2.2	2.7	3.2	3.7	4.3	5.3	6.4
d_2	4	4.8	5.5	6	7	9	10
s	0.35	0.45	0.45	0.45	0.5	0.6	0.7
h	0.6	0.9	0.9	0.9	1	1.1	1.2
for inch thread $\varnothing$	–	–	1/8"	–	5/32"	3/16"	–

Dimensions	7	8	10	12	14	16	18
d_1	7.4	8.4	10.5	13	15	17	19
d_2	12	13	16	18	22	24	27
s	0.7	0.8	1	1.1	1.2	1.3	1.5
h	1.3	1.4	1.6	1.7	2	2.1	2.3
for inch thread $\varnothing$	–	5/16"	3/8"	–	9/16"	5/8"	–

Dimensions	20	22	24	27	30	36	
d_1	21	23	25.6	28.6	31.6	38	
d_2	30	33	36	39	45	54	
s	1.5	1.5	1.8	2	2	2.5	
h	2.5	2.7	2.9	3.1	3.6	4.2	
for inch thread $\varnothing$	–	7/8"	–	–	1 1/8"	1 3/8"	

for screws with property class ≤ 5.8

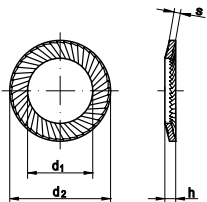
Dimensions in stock:

Steel/Steel coated: 409 | Stainless steel: 558

Article 88121

SCHNORR safety washers

type VS = extra strong



Dimensions	5	6	8	10	12	14	16
d_1^1	5.3	6.4	8.4	10.5	13	15	17
d_2^2	9	10	13	16	18	22	24
s	1	1	1.2	1.5	1.5	1.5	2
h	1.3	1.4	1.7	2	2.1	2.2	2.6
for inch thread $\varnothing$	3/16"	–	5/16"	3/8"	–	9/16"	5/8"

Dimensions	18	20	22	24	27	30	
d_1^1	19	21	23	25.6	28.6	31.6	
d_2^2	27	30	33	36	39	45	
s	2	2	2	2.5	2.5	2.5	
h	2.7	2.8	3	3.4	3.5	3.8	
for inch thread $\varnothing$	–	–	7/8"	–	–	1 1/8"	

for screws with property class 8.8/10.9

Dimensions in stock:

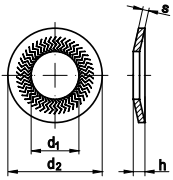
Steel/Steel coated: 409 | Stainless steel: 558



Retaining/lock washers and rings

Article 88123

TECKENTRUP lock washers
type S = standard



for screws with property class ≤ 5.8

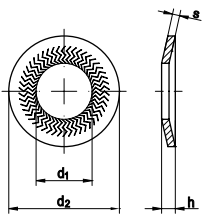
Dimensions in stock:

Steel/Steel coated: 411 | Stainless steel: 558

Dimensions	4	5	6	8	10	12
d ₁	4.1	5.1	6.1	8.2	10.2	12.4
d ₂	8.2	10.2	12.2	16.2	20.25	24.25
s	1	1	1.2	1.4	1.6	1.6
h	1.35	1.5	1.8	2.4	2.4	2.6

Article 88124

TECKENTRUP lock washers
type M = medium



for screws with property class ≤ 10.9

Dimensions in stock:

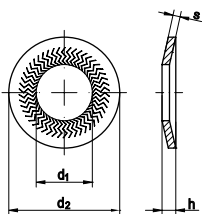
Steel/Steel coated: 411 | Stainless steel: 558

Dimensions	4	5	6	8	10
d ₁	4.1	5.1	6.1	8.2	10.2
d ₂	10.2	12.2	14.2	18.2	22.25
s	1	1.2	1.4	1.4	1.6
h	1.5	1.8	2.2	2.4	2.75

Dimensions	12	14	16	20	
d ₁	12.4	14.4	16.4	21	
d ₂	27.25	30.25	32.5	40	
s	1.8	2.4	2.5	3	
h	3.05	3.5	3.95	4.7	

Article 88125

TECKENTRUP lock washers
type B = wide



for screws with property class ≤ 10.9

Dimensions in stock:

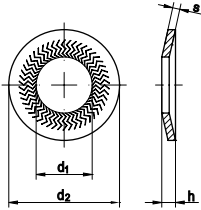
Steel/Steel coated: 411 | Stainless steel: 559

Dimensions	6	8	10	12
d ₁	6.1	8.2	10.2	12.4
d ₂	18.2	22.25	27.25	32.3
s	1.4	1.9	2.4	2.8
h	2.55	2.9	3.65	4.5

Retaining/lock washers and rings

Article 88126

TECKENTRUP lock washers
type Z = for cylindrical head screws



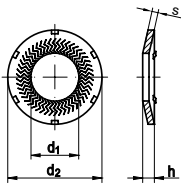
for cap screws with property class ≤ 10.9

Dimensions in stock:
Steel/Steel coated: 411

Dimensions	6	8	10	12	16
d ₁	6.1	8.2	10.2	12.4	16.4
d ₂	9.9	12.7	16.1	18.3	24.6
s	1.4	1.4	1.6	1.8	2.5
h	1.6	1.7	2	2.2	3.1

Article 88129

TECKENTRUP lock washers
type K = with contact serrations



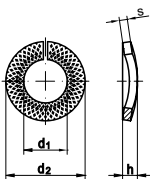
for screws with property class ≤ 5.8

Dimensions in stock:
Steel/Steel coated: 412 | Stainless steel: 559

Dimensions	4	5	6	8	10	12
d ₁	4.1	5.1	6.1	8.2	10.2	12.4
d ₂	8.2	10.2	12.2	16.2	20.25	24.25
s	1	1	1.2	1.4	1.6	1.6
h	1.35	1.5	1.8	2.4	2.6	2.6

Article 88130

Lock rings
type VSK = standard type



for screws with property class ≤ 8.8

Dimensions in stock:
Steel/Steel coated: 412 | Stainless steel: 559

Dimensions	4	5	6	8	10	12	14
d ₁	4.1	5.1	6.1	8.1	10.2	12.2	14.2
d ₂	7.6	9.2	11.8	14.8	18.1	21.1	24.1
s	0.8	1	1.3	1.6	1.8	2.1	2.4
h _{max.}	1.4	1.7	2.2	2.75	3.15	3.15	4.3

Dimensions	16	18	20	22	24	27	30
d ₁	16.2	18.2	20.2	22.5	24.5	27.5	30.5
d ₂	27.4	29.4	33.6	35.9	40	43	48.2
s	2.8	2.8	3.2	3.2	4	4	6
h _{max.}	5.1	5.1	5.9	5.9	7.5	7.5	10.5

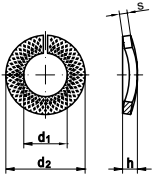


Retaining/lock washers and rings

Article 88131

Lock rings

type VSK-Z = for cylindrical head screws



for cap screws with property class ≤ 8.8

Dimensions in stock:

Steel/Steel coated: 412

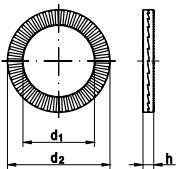
Dimensions	4	5	6	8
d ₁	4.1	5.1	6.1	8.1
d ₂	7	8.8	9.9	12.7
s	1.2	1.6	1.6	2
h	1.7	2.1	2.1	2.8

Dimensions	10	12	16	20
d ₁	10.2	12.2	16.2	20.2
d ₂	16.1	18.3	24.6	30.6
s	2.5	2.5	3.5	4.5
h	3.7	3.7	5.2	6.4

Article 88132

NORD-LOCK washers

standard type



for screws with property class ≤ 12.9

Dimensions in stock:

Steel/Steel coated: 412 | Stainless steel: 559

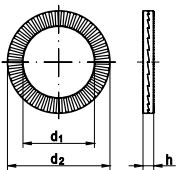
Dimensions	5	6	8	10	12	14	16	18
d ₁	5.4	6.5	8.7	10.7	13	15.2	17	19.5
d ₂	9	10.8	13.5	16.6	19.5	23	25.4	29
h	1.8	1.8	2.5	2.5	2.5	3.4	3.4	3.4
for inch thread Ø	No. 10	-	5/16"	-	-	9/16"	5/8"	-

Dimensions	20	22	24	27	30	33	36	
d ₁	21.4	23.4	25.3	28.4	31.4	34.4	37.4	
d ₂	30.7	34.5	39	42	47	48.5	55	
h	3.4	3.4	3.4	6.6	6.6	6.6	6.6	
for inch thread Ø	-	7/8"	-	-	1 1/8"	1 1/4"	1 3/8"	

Article 88132

NORD-LOCK washers

type SP = with enlarged outer diameter



for screws with property class ≤ 12.9

Dimensions in stock:

Steel/Steel coated: 412

Dimensions	3.5	4	5	6	8	10
d ₁	3.9	4.4	5.4	6.5	8.7	10.7
d ₂	9	9	10.8	13.5	16.6	21
h	2.2	2.2	1.8	2.5	2.5	2.5
for inch thread Ø	6	8	No. 10	-	5/16"	-

Dimensions	12	14	16	18	20	22
d ₁	13	15.2	17	19.5	21.4	23.4
d ₂	25.4	30.7	30.7	34.5	39	42
h	3.4	3.4	3.4	3.4	3.4	4.6
for inch thread Ø	-	9/16"	5/8"	-	-	7/8"

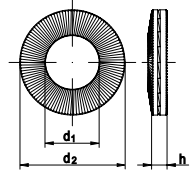
Dimensions	24	27	30	33	36	
d ₁	25.3	28.4	32.4	34.4	37.4	
d ₂	48.5	48.5	58.5	58.5	63	
h	4.6	6.6	6.6	6.6	6.6	
for inch thread Ø	-	-	1 1/8"	1 1/4"	1 3/8"	



Retaining/lock washers and rings

Article 88132

NORD-LOCK washers X-series
standard type



for screws with property class ≤ 12.9

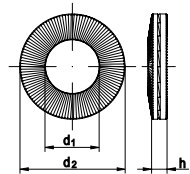
Dimensions in stock:
Steel/Steel coated: 413

Dimensions	6	8	10	11	12	14	16
d ₁	6.3	8.4	10.5	11.5	12.5	14.6	16.6
d ₂	10.8	13.5	16.6	18.5	19.5	23	25.4
h	1.77	2.29	2.95	3.24	3.5	4.03	4.74
for inch thread Ø	-	5/16"	-	7/16"	-	9/16"	5/8"

Dimensions	18	20	22	24	27	30	
d ₁	18.7	20.7	22.8	24.8	27.9	31	
d ₂	29	30.7	34.5	39	42	47	
h	5.36	6.01	6.8	7.19	8.28	9.06	
for inch thread Ø	-	-	7/8"	-	-	1 1/8"	

Article 88132

NORD-LOCK washers X-series
type SP = with enlarged outer diameter



for screws with property class ≤ 12.9

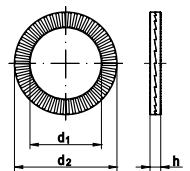
Dimensions in stock:
Steel/Steel coated: 413

Dimensions	6	8	10	12	14	16
d ₁	6.3	8.4	10.5	12.5	14.6	16.6
d ₂	13.5	16.6	21	25.4	29	30.7
h	1.77	2.29	2.95	3.5	4.03	4.74
for inch thread Ø	-	5/16"	-	-	9/16"	5/8"

Dimensions	18	20	22	24	27	30
d ₁	18.7	20.7	22.8	24.8	27.9	31
d ₂	34.5	39	42	47	51	55
h	5.36	6.01	6.8	7.19	8.28	9.06
for inch thread Ø	-	-	7/8"	-	-	1 1/8"

Article 88132

NORD-LOCK washers
type SC = for usage with HV assemblies
acc. to EN 14399-4



Dimensions in stock:
Steel/Steel coated: 413

Dimensions	12	16	20	22
d ₁	13.1	17.1	21.4	23.4
d ₂	23.7	29.7	36.7	38.7
h	4.64	4.6	4.6	4.6

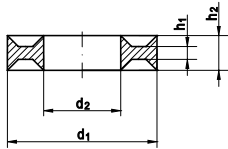
Dimensions	24	27	30	36
d ₁	25.3	28.4	31.4	37.4
d ₂	43.7	49.5	55.4	65.4
h	4.6	5.8	5.8	6



Retaining/lock washers and rings

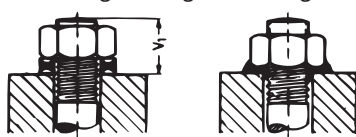
Article 88494

DUBO profile washers
for hexagon head screws

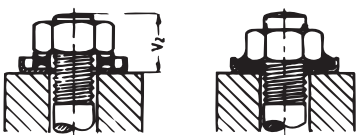


Examples:

without plate ring (V₁)
before tightening after tightening



with plate ring (V₂)
before tightening after tightening



Dimensions	198	199	200	201	202	203
for thread	M 3	M 4	M 5	M 6	M 7	M 8
d ₁	8	9.5	10.6	12.7	14.5	16.2
d ₂	3.2	4.15	5.15	6.2/6.5	7.1	8.1
h ₂	2.2	2.6	3	3.5	3.8	4
h ₁	0.8	1	1.2	1.4	1.5	1.6
V ₁	5	6	7	8.5	9	10.5
V ₂	–	–	–	9.25	9.75	11.5

Dimensions	205	207	209	211	213	215
for thread	M 10	M 12	M 14	M 16	M 18	M 20
d ₁	19.6	23.6	25.4	29.4	35.1	35.7
d ₂	10.2	12.2	14.2	16.2	18.2	20.3
h ₂	4.5	5	5.5	6	6.5	7
h ₁	1.8	2	2.1	2.2	2.3	2.4
V ₁	12.5	14.5	16.5	19	21.5	23
V ₂	13.5	16	18	20.75	23.25	24.75

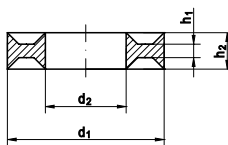
Dimensions	217	219	222	225	231	243
for thread	M 22	M 24	M 27	M 30	M 36	M 48
d ₁	41.6	41.6	47.3	53.1	63.5	86.5
d ₂	22.5	24.3	27.3	30.2	36.2	48.2
h ₂	7.5	8	8.5	8.5	10	17
h ₁	2.5	2.6	2.7	2.8	3.2	4.5
V ₁	24.5	26	28.5	30.5	38	55
V ₂	26.5	28	30.5	–	–	–

Dimensions in stock:

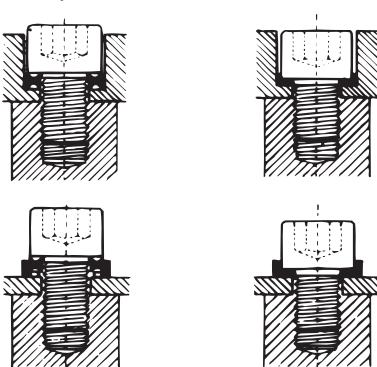
Non-ferrous materials: 597

Article 88495

DUBO profile washers
for hexagon socket cap screws



Examples:



Dimensions	299	300	301	303
for thread	M 4	M 5	M 6	M 8
d ₁	7.7	9.8	10.5	14
d ₂	4.1	5.15	6.1	8.1
h ₂	2	3	2.5	3.3
h ₁	0.8	2	1	1.5

Dimensions	305	307	311	315
for thread	M 10	M 12	M 16	M 20
d ₁	17	19	25	31.5
d ₂	10.2	12.2	16.2	20.2
h ₂	3.8	4.4	5.6	6.5
h ₁	1.5	2	2	2.5

Dimensions in stock:

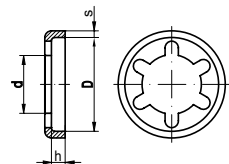
Non-ferrous materials: 597



Retaining/lock washers and rings

Article 88496

DUBO lock washers,
for DUBO profile washers



Dimensions	404	406	408	410	412
D	11.2	13.2	17.2	21.3	24.5
d	6.8	9	12	13.5	15.5
h	2.5	3.4	3.8	4.2	4.5
s	0.65	0.75	1	1.5	1.5
f. hexagon head screws	M 4/5 3/16"	M 6 1/4"	M 8 5/16"	M 10 3/8"	M 12 7/16"
f. cheese head screws	M 6 1/4"	-	M 10 3/8"	M 12 1/2"	M 14

Dimensions	414	416	417	418	419
D	27	31.25	33	37.5	39.5
d	17.5	21	23	26	27
h	4.8	5	5	5.5	5.5
s	1.5	1.75	1.75	1.75	2
f. hexagon head screws	1/2"	M 16	5/8"	M 18/20	3/4"
f. cheese head screws	M 16 5/8"	M 18	M 20	M 22 7/8"	M 24

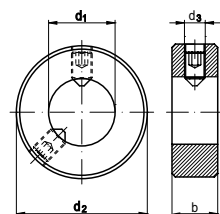
Dimensions	422	427	430	433	436
D	44	50.5	56	61	67
d	30.5	35	40	45	50
h	6	7	7.5	8	8.3
s	2	2	2.5	2.5	2.75
f. hexagon head screws	7/8"	M 27 1"	M 30 1 1/8"	M 33 1 1/4"	M 36 1 3/8"
f. cheese head screws	-	-	-	-	-

Dimensions in stock:
Steel/Steel coated: 597

Retaining/lock washers and rings

DIN 703

Adjusting rings



* $d_1 \leq 65$: one set screw with slot
 $d_1 \geq 68$: two set screws with hexagon socket

Dimensions	20	25	30	35	40	45
d_2	40	56	63	70	80	80
d_3	M 10	M 10	M 10	M 10	M 12	M 12
b	20	22	22	22	28	28
grub screw*	M 10x15	M 10x15	M 10x15	M 10x15	M 12x20	M 12x20

Dimensions	50	60	70	80	90	100
d_2	90	100	110	125	125	140
d_3	M 12	M 12	M 16	M 16	M 16	M 16
b	28	28	32	32	32	32
grub screw*	M 12x20	M 12x20	M 16x20	M 16x20	M 16x20	M 16x25

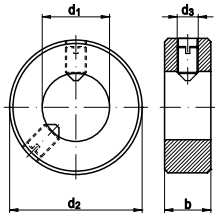
Dimensions in stock:
Steel/Steel coated: 106



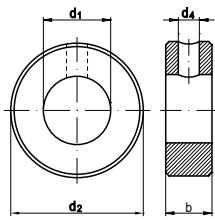
Retaining/lock washers and rings

DIN 705

Adjusting rings



type A = with set screws



type B = with drilling for grooved or taper pins

Dimensions	4	5	6	8	9	10	12	13	14
b	5	6	8	8	10	10	12	12	12
d ₂	8	10	12	16	18	20	22	22	25
d ₃	M 2.5	M 3	M 4	M 4	M 4	M 5	M 6	M 6	M 6
d ₄	1	1.5	1.5	2	2	3	4	4	4
A with pins ¹	M 2.5x4	M 3x4	M 4x5	M 4x6	M 4x6	M 5x8	M 6x8	M 6x8	M 6x8
B for pins ²	1x8	1.5x10	1.5x12	2x16	2x16	3x20	4x22	4x22	4x24

Dimensions	15	16	17	18	20	22	24	25	26
b	12	12	12	14	14	14	16	16	16
d ₂	25	28	28	32	32	36	40	40	40
d ₃	M 6	M 6	M 6	M 6	M 6	M 6	M 8	M 8	M 8
d ₄	4	4	4	5	5	5	6	6	6
A with pins ¹	M 6x8	M 6x8	M 6x8	M 6x8	M 6x8	M 6x10	M 8x12	M 10x16	M 10x16
B for pins ²	4x24	4x28	4x28	5x32	5x32	5x36	6x40	6x40	6x40

Dimensions	28	30	32	34	35	36	38	40	42
b	16	16	16	16	16	16	16	18	18
d ₂	45	45	50	50	56	56	56	63	63
d ₃	M 8	M 8	M 8	M 8	M 8	M 8	M 8	M 10	M 10
d ₄	6	6	8	8	8	8	8	8	8
A with pins ¹	M 8x12	M 8x10	M 8x12	M 8x12	M 8x12	M 8x12	M 8x12	M 10x16	M 10x16
B for pins ²	6x45	6x45	8x50	8x50	8x55	8x55	8x55	8x60	8x60

Dimensions	45	50	55	60	65	70	75	80	85
b	18	18	18	20	20	20	22	22	22
d ₂	70	80	80	90	100	100	110	110	125
d ₃	M 10	M 10	M 10	M 10	M 10	M 10	M 12	M 12	M 12
d ₄	8	10	10	10	10	10	10	10	12
A with pins ¹	M 10x16	M 10x16	M 10x16	M 10x16	M 10x20	M 10x20	M 12x20	M 12x20	M 12x25
B for pins ²	8x70	10x80	10x80	10x90	10x100	10x100	10x100	10x110	12x120

Dimensions	90	100	110	120	125	130	140		
b	22	25	25	25	28	28	28		
d ₂	125	140	160	160	180	180	200		
d ₃	M 12	M 12	M 12	M 12	M 16	M 16	M 16		
d ₄	12	12	12	12	16	16	16		
A with pins ¹	M 12x20	M 12x25	M 12x30	M 12x25	M 16x35	M 16x35	M 16x35		
B for pins ²	12x120	12x140	12x160	12x160	16x180	16x180	16x200		

¹ d₁ ≤ 70 one set screw with slot

² d₂ ≥ 75 one set screw with hexagon socket

Dimensions in stock:

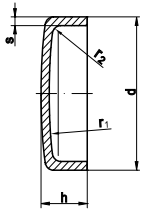
Steel/Steel coated: 106 | Stainless steel: 448



Special forms

DIN 443

Sealing push-in caps



d = nominal size

Dimensions in stock:

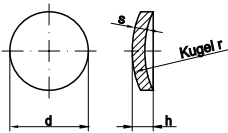
Steel/Steel coated: 81

Dimensions	8	10	12	14	16	18	20	22	25	28
h	3	3	4	5	5	6	6	7	8	9
r ₁	20	25	30	35	40	45	50	55	60	70
r ₂	1	1	1	1	1	1	1	1.6	1.6	1.6
s	0.75	0.75	1	1	1	1	1	1.6	1.6	1.6

Dimensions	30	32	36	38	40	42	45	50	56	
h	9	10	11	12	12	13	14	15	17	
r ₁	75	80	90	95	100	105	110	125	140	
r ₂	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2.5	
s	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	2	

DIN 470

Sealing discs



d = nominal size

Dimensions in stock:

Steel/Steel coated: 85

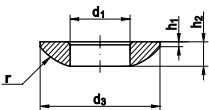
Dimensions	6	8	10	12	14	16	18	20	22	25
h	1.67	1.94	2.67	2.77	2.94	3.11	3.28	3.45	4.09	4.38
r	7	9	12	16	19	22	25	28	30	34
s	1	1	1.6	1.6	1.6	1.6	1.6	1.6	2	2

Dimensions	28	30	32	34	36	38	40	42	45	48
h	4.53	4.77	4.95	5.11	5.36	5.6	5.7	5.8	6.15	6.38
r	40	42	45	48	50	52	56	60	63	68
s	2	2	2	2	2	2	2	2	2	2

Dimensions	50	52	56	60	63	80	100	125		
h	6.62	6.66	7.06	7.47	7.7	10.41	12.23	14.2		
r	70	75	80	85	90	112	140	180		
s	2	2	2	2	2	3	3	3		

DIN 6319

Spherical washers
type C



d₁ = nominal size

Dimensions in stock:

Steel/Steel coated: 289

Dimensions	6.4	8.4	10.5	13	17	21
d ₃	12	17	21	24	30	36
h ₁	0.7	0.6	0.8	1.1	1.3	2
h ₂	2.3	3.2	4	4.6	5.3	6.3
r _{1b}	9	12	15	17	22	27

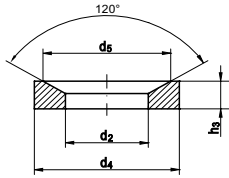
Dimensions	25	31	37	43	50
d ₃	44	56	68	78	92
h ₁	2.4	3.6	4.6	6.5	8
h ₂	8.2	11.2	14	17	21
r _{1b}	32	41	50	58	67



Special forms

DIN 6319

Conical seats
type D



d_2 = nominal size

Dimensions in stock:

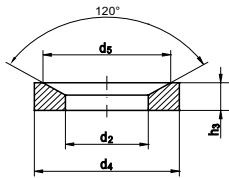
Steel/Steel coated: 290

Dimensions	7.1	9.6	12	14.2	19	23.2
d_4	12	17	21	24	30	36
d_5	11	14.5	18.5	20	26	31
h_3	2.8	3.5	4.2	5	6.2	7.5

Dimensions	28	35	42	49	56	
d_4	44	56	68	78	92	
d_5	37	49	60	70	82	
h_3	9.5	12	15	18	22	

DIN 6319

Conical seats
type G



d_2 = nominal size

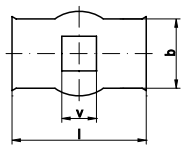
Dimensions in stock:

Steel/Steel coated: 290

Dimensions	12	14.2	19	23.2	28	35
d_4	30	36	44	50	60	68
d_5	18.5	20	26	31	37	49
h_3	5	6	7	8	10	12

Article 88102

Joint washers
to use with DIN 603



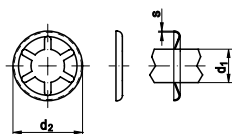
Dimensions	9	11
b	22	22
l	40	40
v	9	11
for screw	M 8	M 10

Dimensions in stock:

Steel/Steel coated: 408

Article 88122

Axle locking rings
quick fixing elements for shafts



d_1 = nominal size

Dimensions in stock:

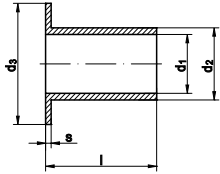
Steel/Steel coated: 411

Dimensions	3	4	5	6	8	10	12
d_2	11	11	11	15	15	18	21
d_3	1.3	1.3	1.3	1.6	1.6	2.1	3
s	0.2	0.2	0.2	0.25	0.25	0.3	0.4
F_a	200 N	400 N	600 N	800 N	1000 N	1100 N	2500 N

Special forms

Article 88498

KORREX Insulating tubes



Dimensions	M 4/10	M 4/15	M 4/20	M 5/10	M 5/15	M 5/20	M 6/10	M 6/15
for screw	M 4	M 4	M 4	M 5	M 5	M 5	M 6	M 6
l	10	15	20	10	15	20	10	15
d ₁	4.3	4.3	4.3	5.3	5.3	5.3	6.5	6.5
d ₂	5.8	5.8	5.8	6.8	6.8	6.8	8	8
d ₃	9.5	9.5	9.5	12	12	12	13	13
s	1	1	1	1	1	1	1	1

Dimensions	M 6/20	M 8/10	M 8/15	M 8/22	M 10/10	M 10/20	M 10/25	M 12/15
for screw	M 6	M 8	M 8	M 8	M 10	M 10	M 10	M 12
l	20	10	15	22	10	20	25	15
d ₁	6.5	8.2	8.2	8.2	10.2	10.2	10.2	12.3
d ₂	8	10.4	10.4	10.4	12.5	12.5	12.5	15
d ₃	13	18	18	18	21	21	21	24
s	1	1	1	1	1	1	1	1

Dimensions	M 12/25	M 16/10	M 16/15	M 16/20	M 16/25	M 20/15	M 20/20	M 20/25
for screw	M 12	M 16	M 16	M 16	M 16	M 20	M 20	M 20
l	25	10	15	20	25	15	20	25
d ₁	12.3	16.3	16.3	16.3	16.3	20.3	20.3	20.3
d ₂	15	19.3	19.3	19.3	19.3	23.3	23.3	23.3
d ₃	24	30	30	30	30	36	36	36
s	1	2	2	2	2	2	2	2

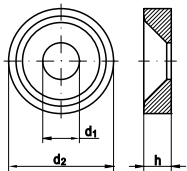
Dimensions in stock:

Non-ferrous materials: 598

Article 88499

KORREX rosettes

for countersunk heads

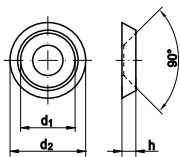


Dimensions	803	804	805	806	808
d ₁	3.1	4.1	5.2	6.3	8.2
d ₂	8.1	7.6	11.3	13.4	18
h	2.2	2	2.4	2.6	4
for screw	M 3	M 4	M 5	M 6	M 8

Dimensions in stock:

Non-ferrous materials: 598

Article 88965

Rosettes/finishing washers,
open connecting surface
for countersunk heads

hole Ø = nominal sizes

Dimensions	3	4.1	5	6	7	8.6
d ₁	7	6.5	9	10	12.5	13
d ₂	9.8	9	12.5	13	18	18
h	2.1	1.8	2.3	2.3	3.2	3
for screws acc. to DIN 95	3	3.5	4	5	6.0/7.0	6.0/7.0
for screws acc. to DIN 964	M 3	M 3.5	M 4	M 5	M 6	M 6/M 8
for screws acc. to DIN 7973	ST 2.9	ST 3.5	ST 3.9/4.2	ST 4.8	ST 5.5	ST 6.3

Dimensions in stock:

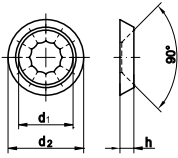
Non-ferrous materials: 598



Special forms

Article 88966

Rosettes/finishing washers
open connecting surface
for countersunk heads



Dimensions	4.8	5	6	7
d ₁	8.8	8	10.5	12
d ₂	12.7	11	13	15
h	2.7	2.4	3	3.4
for screws acc. to DIN 95	4	4.5	5	6
for screws acc. to DIN 964	M 4	M 4	M 5	M 6
for screws acc. to DIN 7973	ST 4.2	ST 4.2	ST 4.8	ST 5.5

Dimensions in stock:

Non-ferrous materials: 598

Parallel pins

ISO 2338

replaces DIN 7

Parallel pins



d = nominal size
tolerance m6

Dimensions	0.8	1	1.5	2	2.5	3	4	5	6
C _{max.} ISO	0.16	0.2	0.3	0.35	0.4	0.5	0.63	0.8	1.2
C _{max.} DIN	0.12	0.15	0.23	0.3	0.4	0.45	0.6	0.75	0.9
r	0.8	1	1.6	2	2.5	3	4	5	6

Dimensions	8	10	12	13	14	16	20	25	30
C _{max.} ISO	1.6	2	2.5	–	–	3	3.5	4	5
C _{max.} DIN	1.2	1.5	1.8	1.9	2	2.5	3	4	4.5
r	8	10	12	14	16	16	20	25	32

Dimensions in stock:

Steel/Steel coated: 216, 427 | Stainless steel: 492, 427

ISO 8734

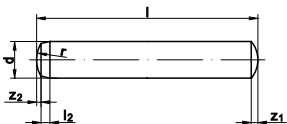
replaces DIN 6325

Parallel pins

type A = through hardened



ISO 8734



DIN 6325

d = nominal size

Dimensions	1	1.5	2	2.5	3	4	5
l ₂	0.4	0.5	0.6	0.7	0.8	1	1.2
r	1	1.5	2	2.5	3	4	5
z ₁	0.15	0.23	0.3	0.4	0.45	0.6	0.75
z ₂	0.08	0.12	0.18	0.25	0.3	0.4	0.5
c	0.2	0.3	0.35	0.4	0.5	0.63	0.98

Dimensions	6	8	10	12	14	16	20
l ₂	1.5	1.8	2	2.5	2.5	3	4
r	6	8	10	12	16	16	20
z ₁	0.9	1.2	1.5	1.8	2	2.5	3
z ₂	0.6	0.8	1	1.3	1.3	1.7	2
c	1.2	1.6	2	2.5	–	3	3.5

Dimensions in stock:

Steel/Steel coated: 352, 290

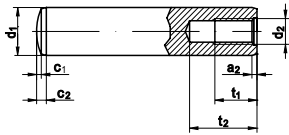


Parallel pins

ISO 8735

similar DIN 7979

Parallel pins
with internal thread
type D = hardened



d = nominal size

tolerance m6

* dimension not standardized,
standard values

Dimensions	4*	5*	6	8	10	12
a ₂	0.5	0.6	0.8	1	1.2	1.6
c ₁	0.4	0.5	0.6	0.8	1	1.2
c ₂	1.3	1.7	2.1	2.6	3	3.8
d ₂	(M 2)	(M 3)	M 4	M 5	M 6	M 6
t ₁	6	6	6	8	10	10
t _{2 min.}	7	7	10	12	16	16

Dimensions	14	16	20	25	30	40
a ₂	1.8	2	2.5	3	4	5
c ₁	1.4	1.6	2	2.5	3	4
c ₂	4	4.7	6	6	7	8
d ₂	M 8	M 8	M 10	M 16	M 20	M 20
t ₁	12	12	16	24	30	30
t _{2 min.}	20	20	25	34	42	42

Dimensions in stock:

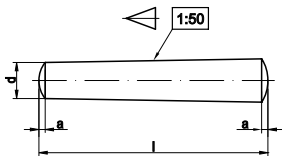
Steel/Steel coated: 334

Taper pins

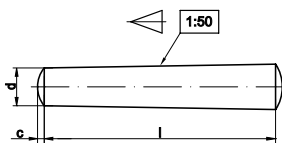
ISO 2339

replaces DIN 1

Taper pins
type B = turned



ISO 2339



DIN 1

* not standardized, reference values

Dimensions	1	1.5	2	2.5	3	4
a _{ISO}	0.12	0.2	0.25	0.3	0.4	0.5
c _{max. DIN}	0.15	0.23	0.3	0.4	0.45	0.6

Dimensions	5	6	6.5*	7*	8	10
a _{ISO}	0.63	0.8	0.8	0.9	1	1.2
c _{max. DIN}	0.75	0.9	1	1.1	1.2	1.5

Dimensions	12	13*	14	16	20	
a _{ISO}	1.6	1.7	1.8	2	2.5	
c _{max. DIN}	1.8	1.9	2	2.5	3	

Dimensions in stock:

Steel/Steel coated: 217, 59 | Stainless steel: 494, 427

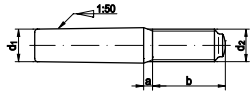


Taper pins

ISO 8737

similar DIN 7977

Taper pins with external thread
and constant threaded part



d_1 = nominal size

* not standardized, reference values

Dimensions in stock:

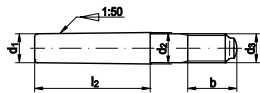
Steel/Steel coated: 353, 333

Dimensions	5	6	8	10	12
b	14	18	22	24	27
$a_{max.}$	2.4	3	4	4.5	5.3
d_2	M 5	M 6	M 8	M 10	M 12

Dimensions	13*	14	16	20	
b	27	30	35	35	
$a_{max.}$	5.3	6	6	6	
d_2	M 13	M 12	M 16	M 16	

DIN 258

Taper pins with thread ends
and constant taper lengths



d_1 = nominal size

Dimensions in stock:

Steel/Steel coated: 74

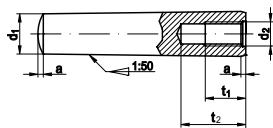
Dimensions	5	6	8	10
$b_{min.}$	14	18	22	24
d_2	5.5	6.6	8.8	10.9
d_3	M 5	M 6	M 8	M 10
l_2	25	30	40	45

Dimensions	12	16	20	25
$b_{min.}$	27	35	35	40
d_2	13.1	17.4	21.7	27
d_3	M 12	M 16	M 20	M 25
l_2	55	72	85	100

ISO 8736

similar DIN 7978

Taper pins with internal thread
type A = polished



d = nominal size

Dimensions in stock:

Steel/Steel coated: 353, 334

Dimensions	6	8	10
a	0.8	1	1.2
d_2	M 4	M 5	M 6
t_1	6	8	10
$t_{2 min.}$	10	12	16

Dimensions	12	16	20
a	1.6	2	2.5
d_2	M 8	M 10	M 12
t_1	12	16	18
$t_{2 min.}$	20	25	27



Grooved pins

ISO 8744

replaces DIN 1471

Grooved pins full-length taper grooved



¹ $\varnothing$ depends on the length

² minimum shear strength, double kN

Dimensions	1.5	2	2.5	3	4
d_2 ¹	1.60 – 1.63	2.10 – 2.15	2.60 – 2.70	3.20 – 3.30	4.15 – 4.30
c	0.2	0.25	0.3	0.4	0.5
shear strength ISO	1.6	2.84	4.4	6.4	11.3
shear strength ² DIN	1.6	2.85	4.25	6.15	10.6

Dimensions	5	6	8	10	12
d_2 ¹	5.15 – 5.30	6.15 – 6.35	8.20 – 8.40	10.20 – 10.45	12.25 – 12.50
c	0.63	0.85	1	1.2	1.6
shear strength ISO	17.6	25.4	45.2	70.4	101.8
shear strength ² DIN	16.5	22.8	40.5	63.2	91

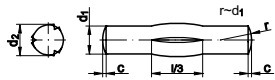
Dimensions in stock:

Steel/Steel coated: 356, 199 | Stainless steel: 544, 484

ISO 8742

replaces DIN 1475

Grooved pins, one-third-length centre grooved



¹ $\varnothing$ depends on the length

² minimum shear strength, double Kn

Dimensions	1.5	2	2.5	3	4
d_2 ¹	1.60 – 1.63	2.10 – 2.15	2.60 – 2.70	3.20 – 3.30	4.15 – 4.30
c	0.2	0.25	0.3	0.4	0.5
shear strength ISO	1.6	2.84	4.4	6.4	11.3
shear strength ² DIN	1.6	2.85	4.25	6.15	10.6

Dimensions	5	6	8	10	12
d_2 ¹	5.15 – 5.30	6.15 – 6.35	8.20 – 8.40	10.20 – 10.45	12.25 – 12.50
c	0.63	0.85	1	1.2	1.6
shear strength ISO	17.6	25.4	45.2	70.4	101.8
shear strength ² DIN	16.5	22.8	40.5	63.2	91

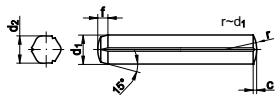
Dimensions in stock:

Steel/Steel coated: 355, 201 | Stainless steel: 485

ISO 8740

replaces DIN 1473

Grooved pins, full-length parallel-grooved, with chamfer



¹ $\varnothing$ depends on the length

² minimum shear strength, double kN

Dimensions	1.5	2	2.5	3	4
d_2 ¹	1.60 – 1.63	2.10 – 2.15	2.60 – 2.70	3.20 – 3.30	4.15 – 4.30
c	0.2	0.25	0.3	0.4	0.5
shear strength ISO	1.6	2.84	4.4	6.4	11.3
shear strength ² DIN	1.6	2.85	4.25	6.15	10.6

Dimensions	5	6	8	10	12
d_2 ¹	5.15 – 5.30	6.15 – 6.35	8.20 – 8.40	10.20 – 10.45	12.25 – 12.50
c	0.63	0.85	1	1.2	1.6
shear strength ISO	17.6	25.4	45.2	70.4	101.8
shear strength ² DIN	16.5	22.8	40.5	63.2	91

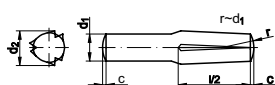
Dimensions in stock:

Steel/Steel coated: 354, 200 | Stainless steel: 544, 485

ISO 8741

replaces DIN 1474

Grooved pins, half-length reverse-taper grooved



¹ $\varnothing$ depends on the length

² minimum shear strength, double kN

Dimensions	1.5	2	2.5	3	4
d_2 ¹	1.60 – 1.63	2.10 – 2.15	2.60 – 2.70	3.20 – 3.30	4.15 – 4.30
c	0.2	0.25	0.3	0.4	0.5
shear strength ISO	1.6	2.84	4.4	6.4	11.3
shear strength ² DIN	1.6	2.85	4.25	6.15	10.6

Dimensions	5	6	8	10	12
d_2 ¹	5.15 – 5.30	6.15 – 6.35	8.20 – 8.40	10.20 – 10.45	12.25 – 12.50
c	0.63	0.85	1	1.2	1.6
shear strength ISO	17.6	25.4	45.2	70.4	101.8
shear strength ² DIN	16.5	22.8	40.5	63.2	91

Dimensions in stock:

Steel/Steel coated: 355, 201

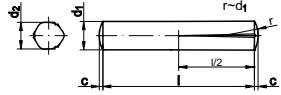


Grooved pins

ISO 8745

replaces DIN 1472

Grooved pins, half-length taper grooved



¹ Ø depends on the length

² minimum shear strength, double kN

Dimensions	1.5	2	2.5	3	4
d ₂ ¹	1.60 – 1.63	2.10 – 2.15	2.60 – 2.70	3.20 – 3.30	4.15 – 4.30
c	0.2	0.25	0.3	0.4	0.5
shear strength ISO	1.6	2.84	4.4	6.4	11.3
shear strength ² DIN	1.6	2.85	4.25	6.15	10.6

Dimensions	5	6	8	10	12
d ₂ ¹	5.15 – 5.30	6.15 – 6.35	8.20 – 8.40	10.20 – 10.45	12.25 – 12.50
c	0.63	0.85	1	1.2	1.6
shear strength ISO	17.6	25.4	45.2	70.4	101.8
shear strength ² DIN	16.5	22.8	40.5	63.2	91

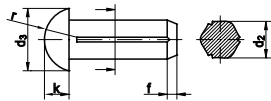
Dimensions in stock:

Steel/Steel coated: 356, 200 | Stainless steel: 545, 485

ISO 8746

similar DIN 1476

Grooved pins with round head
type A = with chamfer



* not standardized, reference values

Dimensions	1.4	1.6	2	2.3	2.5
d ₂	1.5	1.7	2.15	2.5	2.7
d ₃	2.4	2.8	3.5	4.0	4.4
k	0.8	1	1.2	1.4	1.5
r	1.4	1.6	1.9	2.1	2.4
f	0.5	0.5	0.5	0.7	0.7

Dimensions	3	4	5	6	
d ₂	3.2	4.25	5.25	6.3	
d ₃	5.2	7	8.8	10.5	
k	1.8	2.4	3	3.6	
r	2.8	3.8	4.6	5.7	
f	4	1.5	1.5	2	

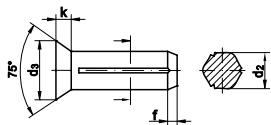
Dimensions in stock:

Steel/Steel coated: 357, 202 | Stainless steel: 545, 485 | Non-ferrous materials: 594, 584

ISO 8747

similar DIN 1477

Grooved pins with countersunk head
type A = with chamfer



Dimensions	2	3	4	5	6
d ₂	2.15	3.20	4.25	5.25	6.30
d ₃	3.5	5.2	7	8.8	10.5
k	1	1.4	2	2.5	3
f	0.5	1	1.15	1.15	2

Dimensions in stock:

Steel/Steel coated: 357, 202

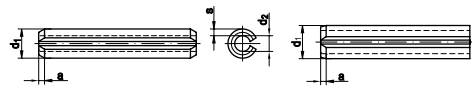


Spring-type straight pins

ISO 8752

replaces DIN 1481

Spring-type straight pins
slotted, heavy duty



Dimensions	1	1.5	2	2.5	3	3.5	4	4.5	5
$a_{ISO \min.}$	0.15	0.25	0.35	0.4	0.5	0.6	0.65	0.8	0.9
$d_{1 \max.}^1$	1.3	1.8	2.4	2.9	3.5	4	4.6	5.1	5.6
d_2^1	0.8	1.1	1.5	1.8	2.1	2.3	2.8	2.9	3.4
s	0.2	0.3	0.4	0.5	0.6	0.75	0.8	1	1
shear strength ²	0.7	1.58	2.82	4.38	6.32	9.06	11.24	15.36	17.54

Dimensions	6	7*	8	9*	10	12	13	14	16
$a_{ISO \min.}$	1.2	1.8	2	2	2	2	2	2	2
$d_{1 \max.}^1$	6.7	7.8	8.8	9.5	10.8	12.8	13.8	14.8	16.8
d_2^1	3.9	4	5.5	6	6.5	7.5	8.5	8.5	10.5
s	1.25	1.5	1.5	2	2	2.5	2.5	3	3
shear strength ²	26.04	–	42.76	–	70.16	104.1	115.12	144.7	171

Dimensions	18	20	21	25	28	30	35	40
$a_{ISO \min.}$	2	3	3	3	3	3	3	4
$d_{1 \max.}^1$	18.9	20.9	21.9	25.9	28.9	30.9	35.9	40.9
d_2^1	11.5	12.5	13.5	15.5	17.5	18.5	21.5	25.5
s	3.5	4	4	5	5.5	6	7	7.5
shear strength ²	222.5	280.6	298.2	438.5	542.6	631.4	859	1068

¹ dimensions before installation

² shear strength, double kN, only for spring steel

* not standardized, reference values

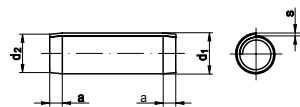
Dimensions in stock:

Steel/Steel coated: 358, 205 | Stainless steel: 546, 486

ISO 8750

similar DIN 7343

Spring-type straight pins
coiled, standard duty



Dimensions	1	1.5	2	2.5	3	3.5	4
a	0.3	0.5	0.7	0.8	1	1.2	1.3
s	0.08	0.13	0.17	0.21	0.25	0.29	0.33
d_1^1	1.1	1.62	2.15	2.65	3.15	3.67	4.2
d_2^1	0.95	1.4	1.9	2.35	2.85	3.35	3.8
shear strength ²	0.6	1.45	2.5	3.9	5.5	7.5	9.6

Dimensions	5	6	8	10	12	14	16
a	1.7	2	3	3	4	4.5	5
s	0.42	0.5	0.67	0.84	1	1.2	1.3
d_1^1	5.25	6.25	8.35	10.45	12.5	14.55	16.55
d_2^1	4.8	5.8	7.75	9.6	11.5	13.5	15.4
shear strength ²	15	22	39	62	89	120	155

¹ dimensions before installation

² shear strength, double kN, only for spring steel

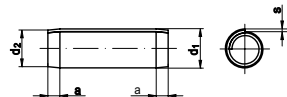
Dimensions in stock:

Steel/Steel coated: 358, 319 | Stainless steel: 545, 533

ISO 8748

similar DIN 7344

Spring-type straight pins
coiled, heavy duty



Dimensions	1.5	2	2.5	3
a	0.5	0.7	0.8	1
s	0.17	0.22	0.28	0.33
d_1^1	1.6	2.1	2.6	3.12
d_2^1	1.4	1.9	2.35	2.85
shear strength ²	1.9	3.5	5.5	7.6

Dimensions	4	5	6	8*
a	1.3	1.7	2	2
s	0.45	0.56	0.67	0.9
d_1^1	4.15	5.15	6.25	8.25
d_2^1	3.8	4.8	5.8	7.8
shear strength ²	13.5	20	30	53

¹ dimensions before installation

² shear strength, double kN, only for spring steel

* not standardized, reference values

Dimensions in stock:

Steel/Steel coated: 357, 319

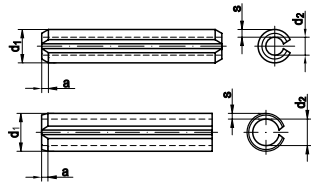


Spring-type straight pins

ISO 13337

similar DIN 7346

Spring-type straight pins
slotted, light duty



¹ dimensions before installation

² shear strength, double kN, only for spring steel

Dimensions	2	2.5	3	4	5	6
a	0.2	0.25	0.25	0.5	0.5	0.7
d ₁ ¹	2.3	2.8	3.3	4.4	5.4	6.4
d ₂ ¹	1.9	2.3	2.7	3.4	4.4	4.9
s	0.2	0.25	0.3	0.5	0.5	0.75
shear strength ²	1.5	2.4	3.5	8	10.4	18

Dimensions	8	10	12	13	16	21
a	1.5	2	2	2	2	2
d ₁ ¹	8.5	10.5	12.5	13.5	16.5	21.5
d ₂ ¹	7	8.5	10.5	11	13.5	17.5
s	0.75	1	1	1.25	1.5	2
shear strength ²	24	40	48	66	98	168

Dimensions in stock:

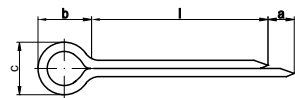
Steel/Steel coated: 371, 319

Linch pins/spring cotters/split pins

ISO 1234

similar DIN 94

Split pins



Dimensions	1	1.2	1.6	2	2.5	3.2	4
a _{min.}	0.8	1.25	1.25	1.25	1.25	1.6	2
b	3	3	3.2	4	5	6.4	8
c _{max.}	1.8	2	2.8	3.6	4.6	5.8	7.4
pin hole Ø	1	1.2	1.6	2	2.5	3.2	4
for screw Ø	3.5 - 4.5	4.5 - 5.5	5.5 - 7	7 - 9	9 - 11	11 - 14	14 - 20
for clevis pin Ø	3 - 4	4 - 5	5 - 6	6 - 8	8 - 9	9 - 12	12 - 17

Dimensions	5	5.5*	6.3	8	10	13	16
a _{min.}	2	2	2	2	3.2	3.2	3.2
b	10	12.6	12.6	16	20	26	32
c _{max.}	9.2	11	11.8	15	19	24.8	30.8
pin hole Ø	5	5.5	6.3	8	10	13	16
for screw Ø	20 - 27	21 - 27	27 - 39	39 - 56	56 - 80	80 - 120	120 - 170
for clevis pin Ø	17 - 23	18 - 23	23 - 29	29 - 44	44 - 69	69 - 110	110 - 160

* not standardized, reference values

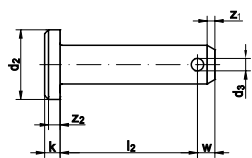
Dimensions in stock:

Steel/Steel coated: 196, 65 | Stainless steel: 483, 432 | Non-ferrous materials: 584, 566

ISO 2341

similar DIN 1444 B

Clevis pins with head
type B = with split pin hole



pin Ø with tolerance h11

Dimensions	8	10	12	16	18	20
d ₂	14	18	20	25	28	30
d ₃	2	3.2	3.2	4	5	5
k	3	4	4	4.5	5	5
w	3.5	4.5	5.5	6	7	8
z _{1 max.}	2	2	3	3	3	4
z ₂	1	1	1.6	1.6	1.6	2
for split pin Ø	2	3.2	3.2	4	5	5

Dimensions in stock:

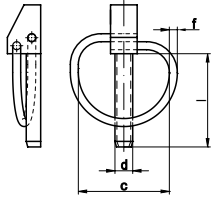
Steel/Steel coated: 199



Linch pins/spring cotters/split pins

~DIN 11023

Linch pins
light type



* specification:
shaft extension to the central drill point

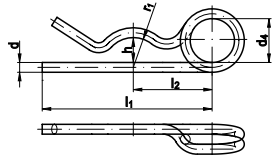
Dimensions	4.5	6	8	10
c	34	41	41	41
f	3	3.4	3.4	3.4
l	42	42	42	42
for shafts $\varnothing_{\max.}$	32	32	32	32
for drilling $\varnothing$	4.5	6	8	10
drill position*	8.5	10	12	14

Dimensions in stock:

Steel/Steel coated: 370

DIN 11024

Spring cotters of a bolt



nominal size = drilling $\varnothing$

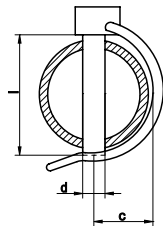
Dimensions	2.5	3.2	4	5	6.3	7	8
d ₃	2.25	2.8	3.6	4.5	5.6	6.3	7
d ₄	20	20	20	25	25	30	30
l ₁	42	48	64	80	97	125	150
l ₂	24	26	32	39	45	56	63
h	2.5	3	4.5	7	9	12.5	17.5
r ₁	5.6	7	10	13	17	22.5	28
for shafts $\varnothing$	9 - 11.2	11.2 - 14	14 - 20	20 - 26	26 - 34	34 - 45	45 - 56

Dimensions in stock:

Steel/Steel coated: 370 | Stainless steel: 549

Article 88023

Linch pins for tubes



d = nominal size

Dimensions	6	8	8
c	22	22	25
l	40	40	50

Dimensions	10	10	
c	25	32	
l	50	60	

Dimensions in stock:

Steel/Steel coated: 370

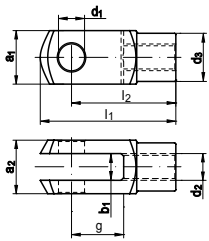


Linch pins/spring cotters/split pins

DIN 71752

Fork joints

type G = yokes,
matching spring flap bolts → article 88752



nominal size = drilling Ø

¹ not standardized, reference values

Dimensions	6	8	10	12	16	20 ¹
g	12/24	16/32	20/40	24/48	32/64	40
a ₁	12	16	20	24	32	40
a ₂	12	16	20	24	32	40
b ₁	6	8	10	12	16	20
d ₂	M 6	M 8	M 10	M 12	M 16	M 20
d ₃	10	14	18	20	26	34
l ₁	31/43	42/58	52/72	62/86	72/101	105
l ₂	24/36	32/48	40/60	48/72	64/96	80

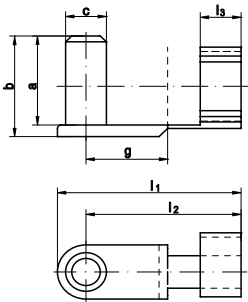
Dimensions in stock:

Steel/Steel coated: 385

Article 88752

Spring flap bolts ("ES bolts")

for fork joints → DIN 71752



c x g = nominal size

Dimensions	6x12	6x24	8x16	8x32	10x20	10x40
c	6	6	8	8	10	10
a	14	14	19	19	23	23
b	16	16	21.5	21.5	26	26
l ₁	28	40	37	52	45	65
l ₂	23	35	30	46	38	58
l ₃	6.5	6.5	8	8	10	10

Dimensions	12x24	12x48	16x32	16x64	20x40	
c	12	12	16	16	20	
a	28	28	34	34	44	
b	31	31	38	38	47	
l ₁	53	78	73	103	98	
l ₂	45	69	62	92	81	
l ₃	12	12	16	16	19	

Dimensions in stock:

Steel/Steel coated: 385

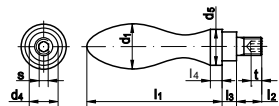


Grips

DIN 98

Rotatable ball handles

type E = with threaded shank and hexagon socket



Dimensions	M 6	M 8	M 10	M 12	M 16
d ₁	16	20	25	32	36
d ₄	10	13	16	20	22
d ₅	14	18	21	26	29
l ₁	49	61	75	96	106
l ₂	11	13	14	21	26
l ₃	5.5	6	8	10.5	11
l ₄	5	6	6.5	8	9
s	3	4	5	6	8
t	3.5	5	6	8	10

Dimensions in stock:

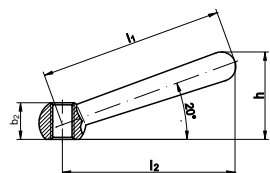
Steel/Steel coated: 67

DIN 99

Tapered handles

with handle bracket via thread

type N = tilted handle



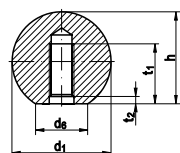
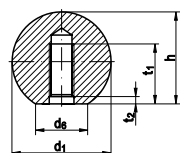
Dimensions	M 6	M 8	M 10	M 12	M 16	M 20	M 24
l ₁	50	63	80	100	125	160	200
b ₂	9.5	12.5	15	19	25	31	4
h	24	30.5	38	47	59.5	75.7	97
l ₂	38	60	76	95	119	152	190
l ₂	48	60	76	95	119	152	190

Dimensions in stock:

Steel/Steel coated: 67 | Stainless steel: 435

DIN 319

Ball knobs



type C = with thread

type E = with threaded bush

Dimensions	M 4	M 5	M 6	M 8	M 10	M 12
d ₁	16	20	25	32	40	50
d ₆	8	12	15	18	22	28
t ₃	6	7.5	9	12	15	18
h	15	18	22.5	29	37	46
t ₁	6	7.5	9	12	15	18
t ₂	1.2	1.6	2.0	2.5	3	3

Dimensions in stock:

Non-ferrous materials: 571

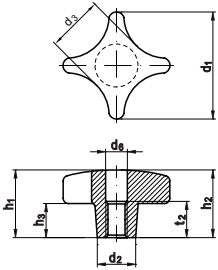


Grips

DIN 6335

Palm grips

type D = with continuous thread



Dimensions	M 6	M 8	M 10	M 12	M 16	M 20
d ₁	32	40	50	63	80	100
d ₂	12	14	18	20	25	32
d ₃	18	21	25	32	40	48
d ₆	6.4	8.4	10.5	13	17	21
h ₁	21	26	34	42	52	65
h ₃	10	14	20	25	30	38
t ₂	10	13	16	20	20	25

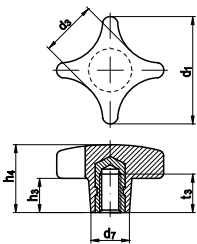
Dimensions in stock:

Steel/Steel coated: 292

DIN 6335

Palm grips

type K = with threaded bush



Dimensions	M 5	M 6	M 8	M 10	M 12	M 16	M 20*
d ₁	25	32	40	50	63	80	100
d ₃	15	18	21	25	32	40	50
d ₇	12	14	18	22	26	35	34
h ₃	8	10	13	20	25	30	38
h ₄	16	20	25	32	40	50	65
t _{3 min.}	9.5	12	14	18	22	30	30

* not standardized, reference values

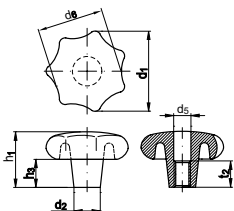
Dimensions in stock:

Non-ferrous materials: 591

DIN 6336

Star grips

type D = with continuous thread



Dimensions	M 6	M 8	M 8*	M 10	M 10*	M 12	M 12*	M 16
d ₁	32	40	50	50	63	63	80	80
d ₂	12	14	18	18	20	20	25	25
d ₅	6.4	8.4	8.4	10.5	10.5	13	13	17
d ₆	26	34	42	42	52	52	64	64
h ₁	21	26	32	34	40	42	50	52
h ₃	10	13	18	17	20	21	25	25
t ₂	10	13	16	16	20	20	20	20

* not standardized, reference values

Dimensions in stock:

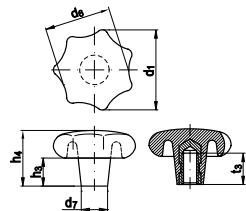
Steel/Steel coated: 292

Grips

DIN 6336

Star grips

type K = with threaded bush



* not standardized, reference values

Dimensions in stock:

Non-ferrous materials: 591

Dimensions	M 4	M 5	M 6	M 6*	M 8	M 8*
d ₁	20	25	32	40	40	50
d ₆	16	20	26	34	34	42
d ₇	10	12	14	18	18	21
h ₃	7	8	10	13	13	17
h ₄	13	16	20	25	25	32
t _{3 min.}	6.5	9.5	12	16	14	18

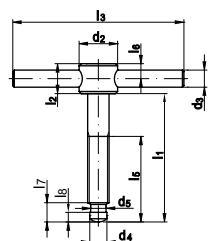
Dimensions	M 10	M 10*	M 12	M 12*	M 16	
d ₁	50	63	63	80	80	
d ₆	42	52	52	64	64	
d ₇	22	26	26	36	35	
h ₃	17	21	21	25	25	
h ₄	32	40	40	48	50	
t _{3 min.}	18	25	22	27	30	

Tommy screws/Tommy nuts

DIN 6304

Tommy screws with fixed clamping bolt

type E = without thrust pad



thrust pads → DIN 6311

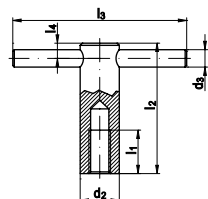
Dimensions in stock:

Steel/Steel coated: 289

Dimensions	M 6	M 8	M 10	M 12	M 16	M 20
l_1	40/50	50/60	60/70	70/80	75/90/100	75/90/100
d_2	12	14	18	20	24	30
d_3	5	6	8	10	12	16
d_4	4.5	6	8	8	12	15.5
d_5	4	5.4	7.2	7.2	11	14.4
l_2	10	12	14	18	20	28
l_3	50	60	80	100	120	140
l_5	30/40	35/45	40/50	50/60	55/70/90	55/70/90
l_6	5	5	7	9	10	14
l_7	6	7.5	9	10	12	14
l_8	2.5	3	4.5	4.5	5	5.5

DIN 6305

Tommy nuts with fixed clamping bolt



Dimensions in stock:

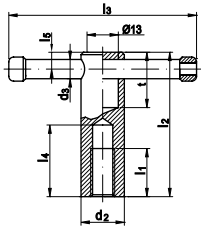
Steel/Steel coated: 289

Dimensions	M 10	M 12	M 16	M 20
d ₂	18	20	24	30
d ₃	8	10	12	16
l ₁	25	25	35	40
l ₂	60	70	85	95
l ₃	80	100	120	140
l ₄	7	9	11	14



Tommy screws/Tommy nuts

DIN 6307

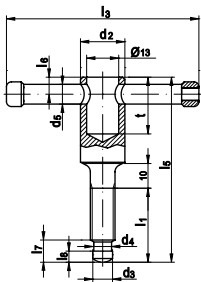
Tommy nuts with
movable clamping bolt

Dimensions	M 10	M 12	M 16	M 20
d ₂	18	20	24	30
d ₃	8	10	12	16
l ₁	25	25	35	40
l ₂	60	70	85	95
l ₃	80	100	120	140
l ₄	30	35	45	50
l ₅	7	9	11	14
t	23	26	28	34

Dimensions in stock:

Steel/Steel coated: 289

DIN 6306

Tommy screw with
movable clamping bolt
type D = without thrust pad

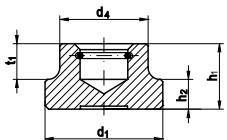
Dimensions	M 10	M 12	M 16	M 20
l ₁	40/50	50/60	55/70/90	55/70/90
d ₂	18	20	24	30
d ₃	8	8	12	15.5
d ₄	7.2	7.2	11	14.4
d ₅	8	10	13	16
l ₃	80	100	120	140
l ₅	72/82	85/95	95/110/130	100/115/135
l ₆	7	9	10	14
l ₇	9	10	12	14
l ₈	4.5	4.5	5	5.5
t	23	26	28	34

thrust pads → DIN 6311

Dimensions in stock:

Steel/Steel coated: 289

DIN 6311

Thrust pads
type S = with snap ring

Dimensions	12	16	20
b	0.7	1	1
d ₄	10	12	15
h ₁	7	9	11
h ₂	2.5	4	5
t ₁	4	5	6
snap ring ¹	5.1x0.6x2.5	7.0x0.8x2.5	8 ¹
grub screw ²	M 6	M 8	M 10

Dimensions	25	32	40
b	1	1.2	1.8
d ₄	18	22	28
h ₁	13	15	16
h ₂	6	7	9
t ₁	7	7.5	8
snap ring ¹	8 ¹	12 ¹	16 ¹
grub screw ²	M 12	M 16	M 20

¹ Snap rings - acc. to DIN 7993² for grub screws acc. to DIN 6332

Dimensions in stock:

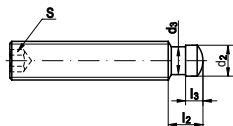
Steel/Steel coated: 289



Tommy screws/Tommy nuts

DIN 6332

Grub screws with thrust point
type IS = with hexagon socket



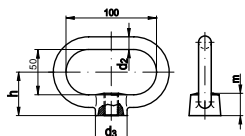
thrust pads → DIN 6311

Dimensions in stock:
Steel/Steel coated: 292

Dimensions	M 6	M 8	M 10	M 12	M 16	M 20
s	3	4	5	6	8	10
d ₂	4.5	6	8	8	12	15.5
d ₃	4	5.4	7.2	7.2	11	14.4
l ₂	6	7.5	9	10	12	14
l ₃	2.5	3	4.5	4.5	5	5.5

DIN 28129

Clamp nuts (lifting nuts)



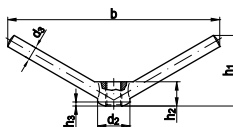
for container const. acc. to AD Regulation,
TÜV accepted

Dimensions in stock:
Steel/Steel coated: 384

Dimensions	M 16	M 20	M 24	M 27
d ₂	14	16	18	20
d ₃	35	40	45	50
h	48	50	55	58
m	25	28	32	35

DIN 80701

Butterfly nuts

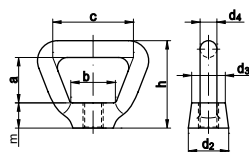


Dimensions in stock:
Non-ferrous materials: 595

Dimensions	M 16	M 20	M 24
b	200	240	280
d ₂	30	40	50
d ₃	12	16	20
h ₁	65	75	90
h ₂	20	25	32
h ₃	4	5	5

DIN 80704

Bow nuts



* not standardized, reference values

Dimensions in stock:
Stainless steel: 551 | Non-ferrous materials: 595

Dimensions	M 6*	M 8*	M 10*	M 12	M 16	M 20	M 22*	M 24
a	15	20	25	27	29	32	32	36
b	14	18	23	27	32	36	36	45
c	25	32	42	48	56	64	64	75
d ₂	14	18	23	24	30	36	36	45
d ₃	11.5	15	18	20	24	28	28	36
d ₄	5	6.5	8	10	12	13	13	14
h	28	36	50	52	59	66	66	75
m	8	10	12	15	18	21	21	25

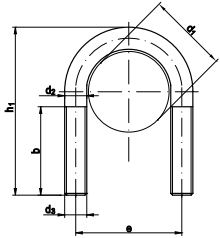


Stirrup bolts

DIN 3570

Steel strap

type A = double-sided fixing thread



Dimensions	23*	30	38	46	52
for pipe nominal width	15	20	25	32	40
d ₁	20 to 21	25 to 26.9	30 to 33.7	38 to 42.4	44.5 to 48.3
b ¹	30	40	40	50	50
d ₂	10	10	10	10	10
d ₃	M 10	M 10	M 10	M 10	M 10
e	33	40	48	56	62
h ₁ ¹	60	70	76	86	92

Dimensions	64	82	94	120	148
for pipe nominal width	50	65	80	100	125
d ₁	57 to 60.3	76.1	88.9	108 to 114.3	133 to 139.7
b ¹	50	50	50	60	60
d ₂	12	12	12	16	16
d ₃	M 12	M 12	M 12	M 16	M 16
e	76	94	106	136	164
h ₁ ¹	109	125	138	171	191

Dimensions	176	228	282	332	530
for pipe nominal width	150	200	250	300	500
d ₁	159 to 168.3	216 to 219.1	267 to 273	318 to 323.9	508 to 521
b ¹	60	70	70	70	70
d ₂	16	20	20	20	24
d ₃	M 16	M 20	M 20	M 20	M 24
e	192	248	302	352	554
h ₁ ¹	217	283	334	385	589

* not standardized, reference values

¹ are minimum dimensions and apply for a sheet thickness of 10mm

Dimensions in stock:

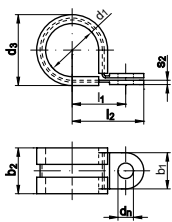
Steel/Steel coated: 224 | Stainless steel: 496

Hose clamps/pipe clamps

DIN 3016

Fastening clamps

type D1 = with rubber profile



Dimensions (d ₁)	4 to 20	4 to 25	5 to 14	15 to 45	10 to 25
b ₁	9	12	15	15	20
b ₂	13	15	19	19	25
d _n	4.3	5.3	6.4	6.4	8.4
d ₃	d ₁ + 5.2	d ₁ + 5.8	d ₁ + 7.4	d ₁ + 7.4	d ₁ + 9
l ₁	d ₁ /2 + 4.7	d ₁ /2 + 6.8	d ₁ /2 + 9.7	d ₁ /2 + 9.7	d ₁ /2 + 12.5
l ₂	d ₁ /2 + 9.2	d ₁ /2 + 13	d ₁ /2 + 17.2	d ₁ /2 + 17.2	d ₁ /2 + 22.5

Dimensions in stock:

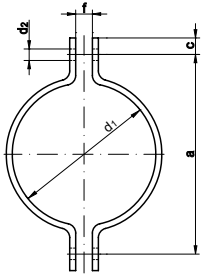
Steel/Steel coated: 221

Hose clamps/pipe clamps

DIN 3567

Pipe clamps

type A = equal sided



Dimensions	22	27	34	43	45	49
nominal diameter	15	20 ^{3/4"}	25 ^{1"}	32 ^{1¹/₄"}	40	40 ^{1¹/₂"}
a	59	66	72	82	84	88
c	15	15	15	15	15	15
d ₂	11.5	11.5	11.5	11.5	11.5	11.5
f	7	7	7	7	7	7
flat steel	30x5	30x5	30x5	30x5	30x5	30x5
screw	M 10x30	M 10x30	M 10x30	M 10x30	M 10x30	M 10x30

Dimensions	57	61	77	89	108	115
nominal diameter	50	50 ^{2"}	65 ^{2¹/₂"}	80 ^{3"}	100	100 ^{4"}
a	104	108	122	136	172	178
c	18	18	18	18	24	24
d ₂	14	14	14	14	18	18
f	9	9	9	9	11	11
flat steel	40x6	40x6	40x6	40x6	50x8	50x8
screw	M 12x35	M 12x35	M 12x35	M 12x35	M 16x45	M 16x45

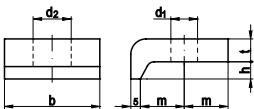
Dimensions	140	169	220	273	305	
nominal diameter	125	150	200	250	300	
a	204	232	284	348	379	
c	24	24	24	30	30	
d ₂	18	18	18	23	23	
f	11	11	11	14	14	
flat steel	50x8	50x8	50x8	60x8	60x8	
screw	M 16x45	M 16x45	M 16x45	M 20x50	M 20x50	

d¹ = nominal size

Dimensions in stock:

Steel/Steel coated: 222 | Stainless steel: 496

DIN 3568

Clamping plates for pipe fixings
for double-T carriers

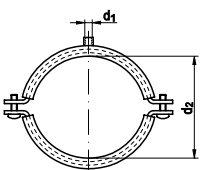
h = nominal size

Dimensions	10	12	14	16	18	20
b	60	60	60	60	60	60
d ₁	18	18	18	18	18	18
d ₂	24	24	24	24	24	24
m	35	35	35	35	35	35
t	18	18	18	18	18	18
for screw	M 16	M 16	M 16	M 16	M 16	M 16

Dimensions in stock:

Steel/Steel coated: 224

DIN 4109

screwed tubular clamps with
noise protection inlay ~DIN 4109

temperature resistance: -50 °C to +110 °C

* connection to stepped thread

Dimensions	1 ¹ / ₂ "	3 ¹ / ₄ "	1"	1 ¹ / ₄ "
clamping range	20 – 23	25 – 28	32 – 35	40 – 43
d ₁ *	M 8/M 10	M 8/M 10	M 8/M 10	M 8/M 10
d ₂	1.25 x 20	1.25 x 20	1.25 x 20	1.25 x 20
payload	1.2 kN	1.2 kN	1.2 kN	1.2 kN

Dimensions	1 ¹ / ₂ "	1 ¹ / ₂ "	2"	
clamping range	48 – 53	57 – 61	60 – 64	
d ₁ *	M 8/M 10	M 8/M 10	M 8/M 10	
d ₂	1.25 x 20	1.25 x 20	1.25 x 20	
payload	1.2 kN	1.2 kN	1.5 kN	

Dimensions in stock:

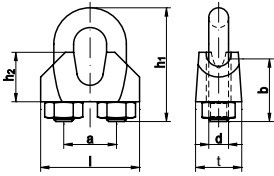
Steel/Steel coated: 269



Rope clips/thimble ropes/shackles

~DIN 741

U-bolt wire-rope grips
with two hexagon nuts

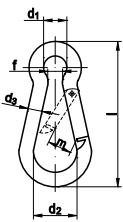


Dimensions	1/8"	3/16"	1/4"	5/16"	7/16"	1/2"	5/8"
for rope Ø	3	5	6.5	8	11	13	16
d ₁ *	M 4	M 5	M 5	M 6	M 8	M 10	M 12
h ₁	20	24	28	34	44	55	63
b	12	13	15	19	22	30	33
a	9	11	13	16	20	24	29
h ₂	10	10	11	15	18	21	26
l	21	23	26	30	36	42	50
t	10	11	12	14	19	23	26

Dimensions in stock:
Steel/Steel coated: 107

DIN 5299

Snap hooks
type C = pear-shaped

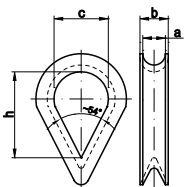


Dimensions	40x4	50x5	60x6	70x7	80x8	100x10
d ₁	6	8	9	10	12	15
d ₂ min.	14	15	17	19	23	29
d ₃	4	5	6	7	8	10
f	4	4	6	8	8	10
m	8	7	8	8	10	11
loadability	100 kg	120 kg	120 kg	180 kg	230 kg	350 kg

Dimensions in stock:
Steel/Steel coated: 288

DIN 6899

thimbles for fibre ropes
type BF = medium heavy, with deep groove



Dimensions	BF 3.5	BF 4	BF 5	BF 6
a	4	5	6	7
h	21	23	25	26
c	13	14	16	18

Dimensions	BF 7	BF 9	BF 11	
a	8	10	12	
h	32	38	45	
c	20	24	26	

Dimensions in stock:
Steel/Steel coated: 298

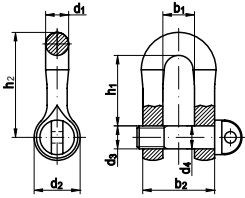


Rope clips/thimble ropes/shackles

DIN 82101

D-shackles

type A = forged



Dimensions	0.16	0.25	0.4	0.6	1
b ₁	8	11	14	17	21
b ₂	18	25	30	37	47
d ₁	5	7	8	10	13
d ₂	12	16	20	24	32
d ₃	M 6	M 8	M 10	M 12	M 16
d ₄	6	8	10	12	16
h ₁	18	24	30	36	49
h ₂	27	36	45	54	72
wrench size	–	–	–	–	24

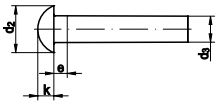
Dimensions in stock:

Steel/Steel coated: 385

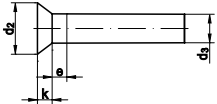
Rivets

DIN 660, 661

Rivets



DIN 660 = round head rivets



DIN 661 = countersunk head rivets

* dimensions acc. to DIN 124

Dimensions	1	2	2.5	3	4
d ₂	1.8	3.5	4.4	5.2	7
d ₃ min.	0.93	1.87	2.37	2.87	3.87
e _{max.}	0.5	1	1.25	1.5	2
k _{DIN 660}	0.6	1.2	1.5	1.8	2.4
k _{DIN 661}	0.5	1	1.2	1.4	2

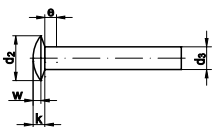
Dimensions	5	6	7	8	10 *
d ₂	8.8	10.5	12.2	14	16
d ₃ min.	4.82	5.82	6.82	7.76	9.4
e _{max.}	2.5	3	3.5	4	5
k _{DIN 660}	3	3.6	4.2	4.8	6.5
k _{DIN 661}	2.5	3	3.5	4	–

Dimensions in stock:

Steel/Steel coated: 105, 105 | Stainless steel: 448, 448 | Non-ferrous materials: 574, 575

DIN 662

Mushroom head rivets



Dimensions	2	2.5	3	3.5	4	5	6
d ₂	4	5	6	7	8	10	12
d ₃	1.87	2.37	2.87	3.37	3.87	4.82	5.82
e _{max.}	1	1.25	1.5	1.75	2	2.5	3
k	1	1.2	1.5	1.8	2.1	2.5	3
w	0.7	0.8	1	1.2	1.4	1.7	2

Dimensions in stock:

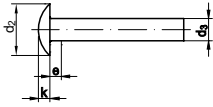
Steel/Steel coated: 106 | Non-ferrous materials: 576



Rivets

DIN 674

Flat round head rivets



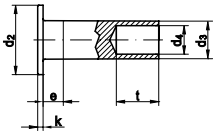
Dimensions	3	4	5
d_2	6.8	9	11.2
$d_3 \text{ min.}$	2.87	3.87	4.82
$e_{\text{max.}}$	1.5	2	2.5
k	1.5	2	2.5

Dimensions in stock:

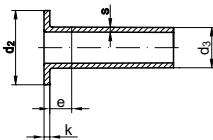
Steel/Steel coated: 106

DIN 7338

Rivets for brake linings and clutch linings



type B = semi-tubular rivet



type C = tubular rivet

Dimensions	3	4	5	6	8
d_2	5.5	7.5	9.5	11.5	15.5
$d_3 \text{ min.}$	2.85	3.8	4.8	5.8	7.75
d_4	1.7	2.7	3.5	4.2	6
$e_{\text{max.}}$	1.5	2	2.5	3	4
k	0.8	1	1	1.2	1.2
$r_{\text{max.}}$	0.2	0.3	0.3	0.4	0.4
s	0.5	0.5	0.6	0.75	1.2

Dimensions in stock:

Steel/Steel coated: 593, 593

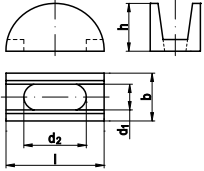


Cam segments and washers for diagonal-pull tensions

Article 88060

Cam segments

for tension anchors for diagonal-pull tension



usage only with adjusting washers article 88061

Dimensions in stock:

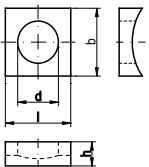
Fixing systems: 636

Dimensions	M 12	M 20	M 24
l	59	64	77
b	30	41	53
d ₁	17	22	31
d ₂	30	45	47
h	30	32	31

Article 88061

Adjusting washer for cam segments

for tension anchors for diagonal-pull tension



usage only with cam segments article 88060

Dimensions in stock:

Fixing systems: 636

Dimensions	M 12	M 16	M 20	M 24	M 27	M 30
l	30	30	41	51	51	51
b	30	30	41	51	51	51
d	13	17	22	25	28	31
h	10	10	11	18	18	18



Hooks

Article 88135

Hooks

s-hooks typ 45



Dimensions	2.3	2.8	3.8	4.7	5.8	6.8	7.6
w	8	9	11	16	18	20	22
L	25	30	40	50	60	70	80
F max.	5 kg	7.5 kg	10 kg	15 kg	30 kg	50 kg	70 kg

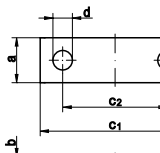
Dimensions in stock:

Steel/Steel coated: 413

Axle holders

DIN 15058

Axle holder (for lifting appliances)



a x b = nominal size

Dimensions	20x5	25x6	30x8	40x10	50x12
c ₁	60	80	100	140	190
c ₂	36	50	70	100	140
d	9	11	13	17	21
for axis Ø	16 – 25	25 – 40	40 – 63	63 – 100	100 – 160

Dimensions in stock:

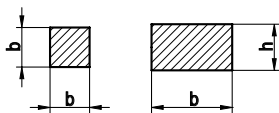
Steel/Steel coated: 383

Parallel keys

DIN 6880

Key steel

length 1000 mm



Dimensions	3x3	4x4	5x5	6x6	8x7	10x8	12x8	14x9
for DIN 6884								
for DIN 6885/6886	3x3	4x4	5x5	6x6	8x7	10x8	12x8	14x4
for DIN 6887							8x7	
for DIN 6889						10x4	12x4	14x4.5

Dimensions	16x10	18x11	20x12	22x14	25x14	28x16	32x18	36x20
for DIN 6884		18x7	20x8	22x9	25x9	28x10	32x11	36x12
for DIN 6885/6886	16x10	18x11	20x12	22x14	25x14	28x16	32x18	36x20
for DIN 6887								
for DIN 6889		18x5						

Dimensions in stock:

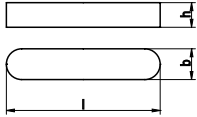
Steel/Steel coated: 296



Parallel keys

DIN 6885

Parallel keys, deep pattern
type A = round-ended without holes



b = nominal size

Dimensions	2	3	4	5	6	8	10
h	2	3	4	5	6	8	10
for shafts $\varnothing d/d_1$	6 - 8	8 - 10	10 - 12	12 - 17	17 - 22	22 - 30	30 - 38

Dimensions	12	14	16	18	20	22	25
h	12	14	16	18	20	22	25
for shafts $\varnothing d/d_1$	38 - 44	44 - 50	50 - 58	58 - 65	65 - 75	75 - 85	85 - 95

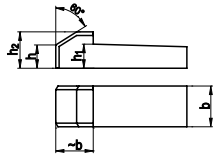
Dimensions	28	32	36	40	45		
h	28	32	36	40	45		
for shafts $\varnothing d/d_1$	95 - 110	110 - 130	130 - 150	150 - 170	170 - 200		

Dimensions in stock:

Steel/Steel coated: 296 | Stainless steel: 520

DIN 6887

Taper keys with gib head



b = nominal size

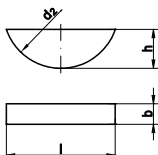
Dimensions	6	8	10	12	14	16
h	6	7	8	8	9	10
h ₁	6.1	7.2	8.2	8.2	9.2	10.2
h ₂	10	11	12	12	14	16
for shafts $\varnothing d/d_1$	17 - 22	22 - 30	30 - 38	38 - 44	44 - 50	50 - 58

Dimensions in stock:

Steel/Steel coated: 297

DIN 6888

Woodruff keys



b = nominal size

¹ for use as a parallel key DIN 6887

² for use when determining the position

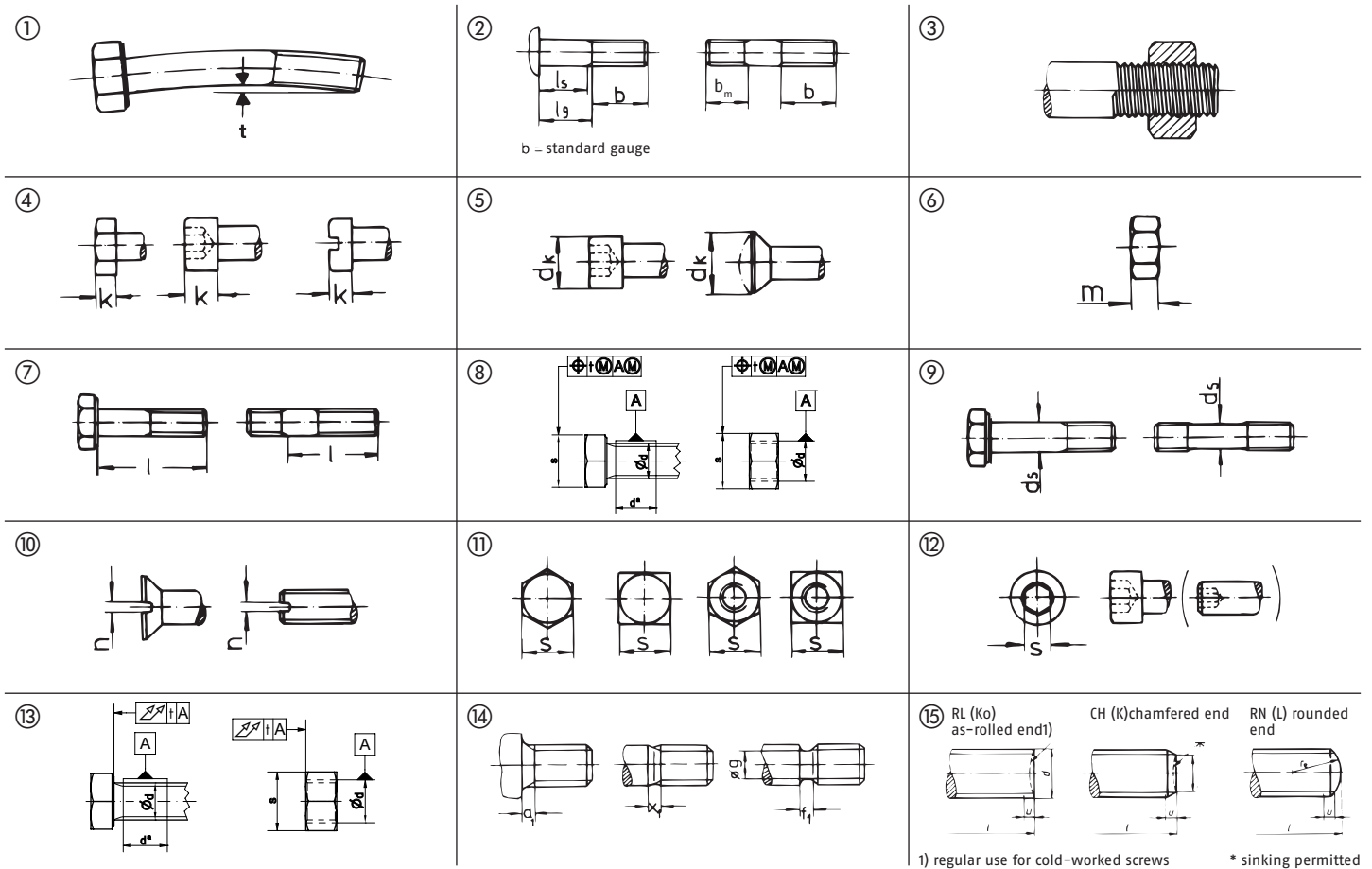
Dimensions	2	2	2.5	3	3	3	4
h	2.6	3.7	3.7	3.7	5	6.5	5
d ₂	7	10	10	10	13	16	13
l	6.76	9.66	9.66	9.66	12.65	15.72	12.65
for shafts $\varnothing d/d_1^{1)}$	6 - 8	6 - 8	8 - 10	8 - 10	8 - 10	-	10 - 12
for shafts $\varnothing d/d_1$	10 - 12	10 - 12	12 - 17	12 - 17	12 - 17	12 - 17	17 - 22

Dimensions	4	4	5	5	5	6	6
h	6.5	7.5	6.5	7.5	9	7.5	9
d ₂	16	19	16	19	22	19	22
l							
for shafts $\varnothing d/d_1^{1)}$	10 - 12	-	12 - 17	12 - 17	-	17 - 22	17 - 22
for shafts $\varnothing d/d_1^{2)}$	17 - 12	17 - 22	22 - 30	22 - 30	22 - 30	30 - 38	30 - 38

Dimensions	6	8	8	8	10	10	10
h	11	9	11	13	11	13	16
d ₂	28	22	28	32	28	32	45
l	27.35	21.63	27.35	31.43	27.35	31.43	43.08
for shafts $\varnothing d/d_1^{1)}$	-	22 - 30	22 - 30	-	30 - 38	30 - 38	-
for shafts $\varnothing d/d_1^{2)}$	30 - 38	>38	>38	>38	>38	>38	>38

Dimensions in stock:

Steel/Steel coated: 298



Characteristic			Dimension range	Product class A	Product class B	Product class C
① Straightness	t	l = nominal length	$d \leq 8$	$0.0020 l + 0.05$		$2 \times (0.0020 l + 0.05)$
		b = thread length	$d > 8$	$0.0025 l + 0.05$		$2 \times (0.0025 l + 0.05)$
② Thread length	b			0 bis + 2 P	0 bis + 2 P	0 bis + 2 P
③ Thread dimension	b _m	Stud		js 16	js 17	js 17
		Nut		6 H	6 H	7 H
④ Head height	k	External drive	$k < 10$	js 14	js 15	js 16
			$k \geq 10$			js 17
	k	Internal drive	$\leq M 5$	h 13	–	–
			$\leq M 5$	h 14	–	–
⑤ Diameter of head	d _k			h 13 (slotted screw h 14)	–	–
⑥ Nut height	m		$\leq M 12$	h 14	h 14	h 17
			$> M 12 \leq M 18$	h 15	h 15	h 17
			$> M 18$	h 16	h 16	h 17
⑦ Nominal length	l		$l \leq 150$	js 15 (slotted screws $l > 50$ js 16)	js 17	js 17
			$l > 150$		js 17	2 js 17
⑧ Tolerances of position (screws)	s:d	(Reference dimension for „t“)	(s)	2 IT 13	2 IT 14	2 IT 15
	d _k :d		(d _k)	2 IT 13	2 IT 14	2 IT 15
	n:d		(d)	2 IT 12	2 IT 13	2 IT 14
	s:d (core)		(s)	2 IT 13	2 IT 14	2 IT 15
	n:d (core)		(d)	2 IT 13	2 IT 14	2 IT 15

Excerpts from ISO 3508, 4755 (DIN 76) – ISO 4753 (DIN 78) – ISO 7378, 8991 (DIN 962/34803) und ISO 4759-1



Characteristic		Dimension range	Product class A	Product class B	Product class C
⑨ Shank diameter	ds		h 13	h 14	± IT 15
			Reduced shank: shank diameter ~ pitch diameter		
⑩ Slot width	n	n ≤ 1	+0.20 to +0.06	–	–
		n > 1 ≤ 3	+0.31 to +0.06		
		n > 3 ≤ 6	+0.37 to +0.07		
⑪ Wrench size	External drive	s	s ≤ 32 = h 13 s > 32 = h 14	s ≤ 19 = h 14/s > 19 ≤ 60 = h 15 s > 60 ≤ 180 = h 16/s > 180 = h 17	
⑫ Wrench size	Internal drive	s	s Tol. 0.7 EF8 0.9 FS9 1.3 K9 1.5–3 D11 4 E11 5–14 E12 > 14 D12	–	–
⑬ Tolerance of total run-out t ^b (= angularity) acc. to ISO 4759–1 article 3.2.2.3 (for screws) 4.2.2.2 (for nuts)	⌵	≤ M 39	(± 1°) ^a	(± 1°) ^a	(± 2°) ^a
		> M 39	(± 1/2°) ^a	(± 1/2°) ^a	(± 1°) ^a

a) Tolerances of total run-out is conform to angular deviation of...

b) Values for t see ISO 4759-1

⑭						⑮		
External thread		a ₁	x ₁	g ₁ (f ₁)	g ₂ (f ₂)	u 2 p	z ₁ +	z ₂ +
Nominal Ø M	Pitch P	max.	max.	min.	max.	max.	IT 14	IT 14
3	0.5	1.5	1.25	1.1	1.75	1	0.75	1.5
4	0.7	2.1	1.75	1.5	2.45	1.4	1	2
5	0.8	2.4	2	1.7	2.8	1.6	1.25	2.5
6	1	3	2.5	2.1	3.5	2	1.5	3
8	1.25	3.75	3.2	2.7	4.4	2.5	2	4
10	1.5	4.5	3.8	3.2	5.2	3	2.5	5
12	1.75	5.25	4.3	3.9	6.1	3.5	3	6
14	2	6	5	4.5	7	4	3.5	7
16	2	6	5	4.5	7	4	4	8
18	2.5	7.5	6.3	5.6	8.7	5	4.5	9

⑭ = Excerpt from ISO 3508/4755 (DIN 76)

a₁ = Distance of the last full threadturn from the contact surface (for parts with threads to the head)

x₁ = Thread run-out general use

g (f) = Thread undercut general use (Type A)

⑭						⑮		
External thread		a ₁	x ₁	g ₁ (f ₁)	g ₂ (f ₂)	u 2 p	z ₁ +	z ₂ +
Nominal Ø M	Pitch P	max.	max.	min.	max.	max.	IT 14	IT 14
20	2.5	7.5	6.3	5.6	8.7	5	5	10
22	2.5	7.5	6.3	5.6	8.7	5	5.5	11
24	3	9	7.5	6.7	10.5	6	6.7	12
27	3	9	7.5	6.7	10.5	6	6.7	13.5
30	3.5	10.5	9	7.7	12	7	7.5	15
33	3.5	10.5	9	7.7	12	7	8.2	16.5
36	4	12	10	9	14	8	9	18
39	4	12	10	9	14	8	9.7	19.5
42	4.5	13.5	11	10.5	16	9	10.5	21
45	4.5	13.5	11	10.5	16	9		22.5

⑮ = Excerpt from ISO 4753 (DIN 78)

u = Incomplete thread at screw ends
(general use for screws with rolled threading)

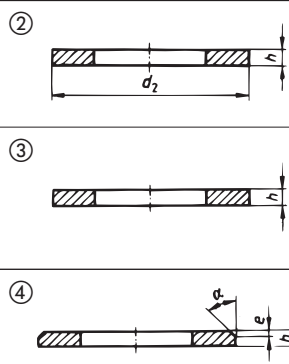
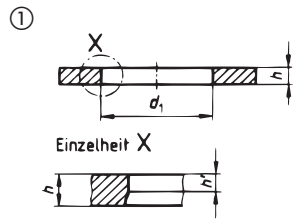
z₁ = Length of dog point in ISD (Ka) finish

z₂ = Length of dog point in LD (Za) finish

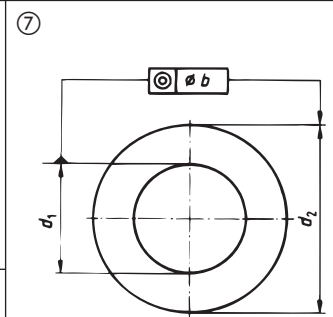
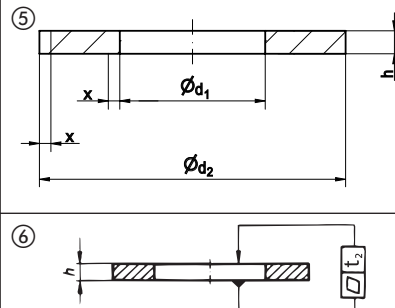
Surface roughness (acc. to DIN 267-2, not regulated by ISO-standard)			R _z		nach DIN 4768 Teil 1
			P < 2,5 I _m = 0,4 λ _c = 0,08	P ≥ 2,5 I _m = 1,25 λ _c = 0,25	
Thread flank	Screws	rolled	6,3	10	–
		cut	16	25	–
Connecting surface	Nuts		25	40	–
	Cold forging		16	25	–
Shank (screws)	Warm forging		25	40	–
	Cold forging		–	–	50
Visible surface	Warm forging		–	–	100
			10	–	–

Excerpts from ISO 3508, 4755 (DIN 76) – ISO 4753 (DIN 78) – ISO 7378, 8991 (DIN 962/34803), ISO 4759-1 and DIN 267-2.

Dimensions tolerances



Form and position tolerances



The washers shown are just examples. The specifications are also valid correspondingly for other standardised and non-standardised washer types.

In the following tables, only the specifications for commercially available product classes A and C are listed.

The reference value is the individual value specified in the corresponding product standards.
For dimensions without a tolerance specification ISO 2768 (DIN 7168) m for product class A is valid, ISO 2768 (DIN 7168) g for product class C.

Dimensions tolerances				
Characteristic	Nominal size		Product class	
	>	≤	A (m)	C (g)
① Clearance hole d_1	h		d_1^*	
	–	4	H 13	H 14
	4	–	H 14	H 15
	h		$(h') \text{ min}$	
	–	4	$\geq 0.5 h$	
	4	–	$\geq 0.3 h$	
② Outside diameter d_2	h		d_2	
	–	4	h 14	h 16
	4	–	h 15	h 16
③ Washer thickness h	h		Tol. mm	
	–	0.5	± 0.05	± 0.10
	0.5	1.0	± 0.10	± 0.20
	1.0	2.5	± 0.20	± 0.30
	2.5	4.0	± 0.30	± 0.60
	4.0	6.0	± 0.60	± 1.00
	6.0	10	± 1.00	± 1.20
	10	20	± 1.20	± 1.60
④ Chamfer	α		30–45°	
	$e_{\min}$ $e_{\max}$		0.25 h 0.50 h	

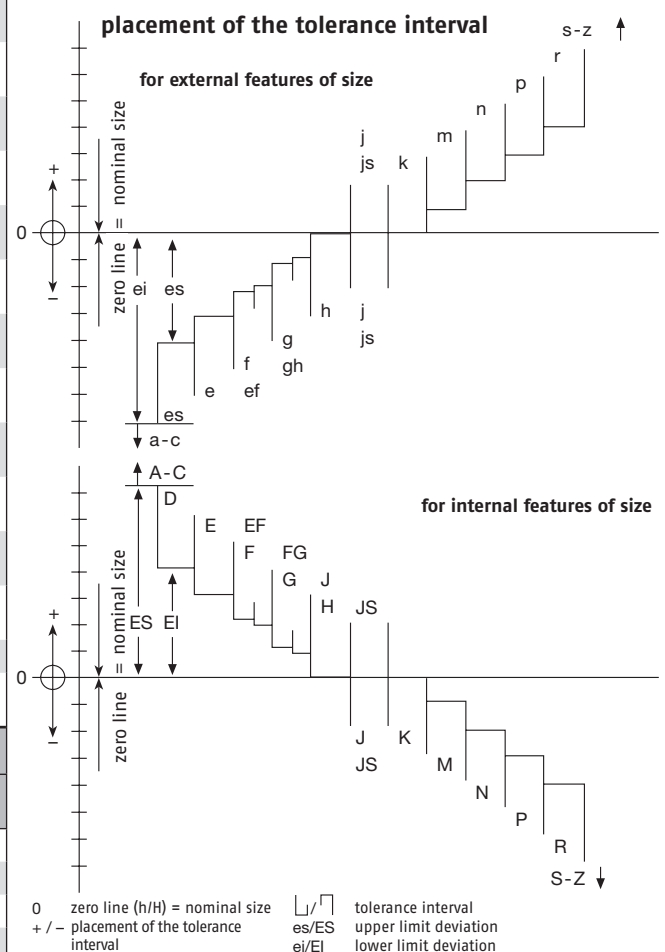
Excerpt from ISO 4759-3 (DIN 522)

Form and position tolerances				
Characteristic	Nominal size		Product class	
	>	≤	A (m)	C (g)
⑤ Thickness variation on the same part * Requirements for Δh apply at a distance of $x = 0,1 (d_2 - d_1)$ from the edge of the hole and the outer edge: i.e. only 60% of the ring width	h		Δh^*	
	–	0.5	0.025	–
	0.5	1.0	0.05	
	1.0	2.5	0.10	
	2.5	4.0	0.15	
	4.0	6.0	0.20	
	6.0	10	0.30	
	10	20	0.40	
⑥ Flatness * Tolerance c t_2 is always independent of the thickness tolerance for h. For washers from stainless steel	h		t_2 (c)*	
	stainless steel excepted			
	–	0.5	0.10	–
	0.5	1.0	0.15	
	1.0	2.5	0.20	
	2.5	4.0	0.30	
	4.0	6.0	0.40	
	6.0	10	0.60	
	stainless steel			
	–	0.5	0.15	–
	0.5	1	0.22	
	1	2.5	0.30	
	2.5	4	0.45	
	4	6	0.60	
	6	10	0.90	
	10	20	1.5	
⑦ Coaxiality b (dependent on d_2)	d_2		b (t_1)	
	50	–	50	2 IT 12
		–	2 IT 13	2 IT 16



Tolerances		Nominal dimensions												
		≤ 3	> 3 ≤ 6	> 6 ≤ 10	> 10 ≤ 18	> 18 ≤ 30	> 30 ≤ 50 (40)	> 50 ≤ 80	> 80 ≤ 120	> 120 ≤ 180	> 180 ≤ 250	> 250 ≤ 315	> 315 ≤ 400	> 400 ≤ 500
IT values in mm standard tolerances	IT 12	0,10	0,12	0,15	0,18	0,21	0,25	0,30	0,35	0,40	0,46	0,52	0,57	0,63
	IT 13	0,14	0,18	0,22	0,27	0,33	0,39	0,46	0,54	0,63	0,72	0,81	0,89	0,97
	IT 14	0,25	0,30	0,36	0,43	0,52	0,62	0,74	0,87	1,00	1,15	1,30	1,40	1,55
	IT 15	0,40	0,48	0,58	0,70	0,84	1,00	1,20	1,40	1,60	1,85	2,10	2,30	2,50
	IT 16	0,60	0,75	0,90	1,10	1,30	1,60	1,90	2,20	2,60	2,90	3,20	3,60	4,00
	IT 17	1,00	1,20	1,50	1,80	2,10	2,50	3,00	3,50	4,00	4,60	5,20	5,70	6,30
for external features of size in mm	a 11	- 0,270 - 0,330	- 0,270 - 0,345	- 0,280 - 0,370	- 0,290 - 0,400	- 0,300 - 0,430	- 0,310 - 0,470							
	c 11	- 0,060 - 0,120	- 0,070 - 0,145	- 0,080 - 0,170	- 0,095 - 0,205	- 0,110 - 0,240	- 0,120 - 0,280							
	f 8	- 0,006 - 0,020	- 0,010 - 0,028	- 0,013 - 0,035	- 0,016 - 0,043	- 0,020 - 0,053	- 0,025 - 0,064	- 0,030 - 0,076	- 0,036 - 0,090	- 0,043 - 0,106	- 0,050 - 0,122	- 0,056 - 0,137	- 0,062 - 0,151	- 0,068 - 0,165
	h 8	0/- 0,014	0/- 0,018	0/- 0,022	0/- 0,027	0/- 0,033	0/- 0,039	0/- 0,046	0/- 0,054	0/- 0,063	0/- 0,072	0/- 0,081	0/- 0,089	0/- 0,097
	h 9	0/- 0,025	0/- 0,030	0/- 0,036	0/- 0,043	0/- 0,052	0/- 0,062	0/- 0,074	0/- 0,087	0/- 0,100	0/- 0,115	0/- 0,130	0/- 0,140	0/- 0,155
	h 10	0/- 0,040	0/- 0,048	0/- 0,058	0/- 0,070	0/- 0,084	0/- 0,100	0/- 0,120	0/- 0,140	0/- 0,160	0/- 0,185	0/- 0,210	0/- 0,230	0/- 0,250
	h 11	0/- 0,060	0/- 0,075	0/- 0,090	0/- 0,110	0/- 0,130	0/- 0,160	0/- 0,190	0/- 0,220	0/- 0,250	0/- 0,290	0/- 0,320	0/- 0,360	0/- 0,400
	h 13	0/- 0,14	0/- 0,18	0/- 0,22	0/- 0,27	0/- 0,33	0/- 0,39	0/- 0,46	0/- 0,54	0/- 0,63	0/- 0,72	0/- 0,81	0/- 0,89	0/- 0,97
	h 14	0/- 0,25	0/- 0,30	0/- 0,36	0/- 0,43	0/- 0,52	0/- 0,62	0/- 0,74	0/- 0,87	0/- 1,00	0/- 1,15	0/- 1,30	0/- 1,40	0/- 1,55
	h 15	0/- 0,40	0/- 0,48	0/- 0,58	0/- 0,70	0/- 0,84	0/- 1,00	0/- 1,20	0/- 1,40	0/- 1,60	0/- 1,85	0/- 2,10	0/- 2,30	0/- 2,50
	h 16	0/- 0,60	0/- 0,75	0/- 0,90	0/- 1,10	0/- 1,30	0/- 1,60	0/- 1,90	0/- 2,20	0/- 2,50	0/- 2,90	0/- 3,20	0/- 3,60	0/- 4,00
	h 17	0/- 1,00	0/- 1,20	0/- 1,50	0/- 1,80	0/- 2,10	0/- 2,50	0/- 3,00	0/- 3,50	0/- 4,00	0/- 4,60	0/- 5,20	0/- 5,70	0/- 6,30
	js 14	± 0,125	± 0,150	± 0,180	± 0,215	± 0,260	± 0,310	± 0,370	± 0,435	± 0,500	± 0,575	± 0,650	± 0,700	± 0,775
	js 15	± 0,200	± 0,240	± 0,290	± 0,350	± 0,420	± 0,500	± 0,600	± 0,700	± 0,800	± 0,925	± 1,050	± 1,150	± 1,250
	js 16	± 0,300	± 0,375	± 0,450	± 0,550	± 0,650	± 0,800	± 0,950	± 1,100	± 1,250	± 1,450	± 1,600	± 1,800	± 2,000
	js 17	± 0,500	± 0,600	± 0,750	± 0,900	± 1,050	± 1,250	± 1,500	± 1,750	± 2,000	± 2,300	± 2,600	± 2,850	± 3,150
	k 6	+ 0,006 0	+ 0,009 + 0,001	+ 0,010 + 0,001	+ 0,012 + 0,001	+ 0,015 + 0,002	+ 0,018 + 0,002							
	m 6	+ 0,008 + 0,002	+ 0,012 + 0,004	+ 0,015 + 0,006	+ 0,018 + 0,007	+ 0,021 + 0,008	+ 0,025 + 0,009							
inside dimension in mm	D 9	+ 0,045 + 0,020	+ 0,060 + 0,030	+ 0,076 + 0,040	+ 0,093 + 0,050	+ 0,117 + 0,065	+ 0,142 + 0,080							
	D 10	+ 0,060 + 0,020	+ 0,078 + 0,030	+ 0,098 + 0,040	+ 0,120 + 0,050	+ 0,149 + 0,065	+ 0,180 + 0,080							
	D 11	+ 0,080 + 0,020	+ 0,105 + 0,030	+ 0,130 + 0,040	+ 0,160 + 0,050	+ 0,195 + 0,065	+ 0,240 + 0,080							
	D 12	+ 0,120 + 0,020	+ 0,150 + 0,030	+ 0,190 + 0,040	+ 0,230 + 0,050	+ 0,275 + 0,065	+ 0,330 + 0,080							
	E 11	+ 0,074 + 0,014	+ 0,095 + 0,020	+ 0,115 + 0,025	+ 0,142 + 0,032	-	-							
	E 12	+ 0,100 + 0,014	+ 0,140 + 0,020	+ 0,175 + 0,025	+ 0,212 + 0,032	-	-							
	EF 8	+ 0,024 + 0,010	+ 0,032 + 0,014	+ 0,040 + 0,018	-	-	-							
	H 9	+ 0,025 0	+ 0,030 0	+ 0,036 0	+ 0,043 0	+ 0,052 0	+ 0,062 0							
	H 11	+ 0,060 0	+ 0,075 0	+ 0,090 0	+ 0,110 0	+ 0,130 0	+ 0,160 0							
	H 13	+ 0,140 0	+ 0,180 0	+ 0,220 0	+ 0,270 0	+ 0,330 0	+ 0,390 0							
	H 14	+ 0,250 0	+ 0,300 0	+ 0,360 0	+ 0,430 0	+ 0,520 0	+ 0,620 0							
	H 15	+ 0,400 0	+ 0,480 0	+ 0,580 0	+ 0,700 0	+ 0,840 0	+ 1,000 0							
	JS 9	± 0,0125	± 0,015	± 0,018	± 0,0215	± 0,026	± 0,031							
	K 9	0 - 0,025	0 - 0,030	0 - 0,036	-	-	-							
General tolerance for linear dimensions														
Tolerance class		≥ 0,5 ≤ 3	> 3 ≤ 6	> 6 ≤ 30	> 30 ≤ 120	> 120 ≤ 400	> 400 ≤ 1000							
f (fine)		± 0,050	± 0,050	± 0,100	± 0,150	± 0,200	± 0,300							
m (medium)		± 0,100	± 0,100	± 0,200	± 0,300	± 0,500	± 0,800							
g (coarse)		± 0,150	± 0,200	± 0,500	± 0,800	± 1,200	± 2,000							
sg (very coarse)		-	± 0,500	± 1,000	± 1,500	± 2,000	± 3,000							

Excerpts from ISO 286, 965, 4759 (DIN 267-2, 7160, 7161, 7168)



Standard and special parts according to drawings can be delivered for different applications in all necessary special materials – in any amount required.

The table shows some examples of frequently requested special materials, roughly ordered according to application area:

Material group Particular properties/areas of application		Material no. (AISI)	Material designation (previous)	Standard/ Material data sheet
Stainless steels – ¹⁾ a) ferritic (F) and martensitic (C) Greater mechanical properties with less corrosion-resistance	F 1	1.4016	X6Cr17 (X8Cr17)	EN 10088 (DIN 17440)
	C 1	1.4006 (410)	X10Cr13	ISO 3506 (DIN 267-11)
	C 1	1.4021 (420)	X20Cr13	
	C 3	1.4057 (431)	X20CrNi172 (X20CrNi17)	
C 4	1.4104 (430 F)	X12CrMoS17		
		1.4034 (420)	X46Cr13 (X40Cr13)	
b) austenitic (A) Increased corrosion resistance, rust and acid- resistant, tough at sub-zero temperatures	A 3	1.4541* (321)	X6CrNiTi1810	EN 10088 (DIN 17440)
	A 4	1.4436 (319)	X5CrNiMo17133 (X5CrNiMo1812)	ISO 3506 (DIN 267-11) * DIN 267-13
	A 5	1.4571* (316 Ti)	X6CrNiMoTi1722	
	A 4	1.4580 (316 Cb)	X6CrNiMoNb17122 (X10CrNiMoNb1810)	** SEW 400
		1.4310** (301)	X12CrNi177	
Rust and acid-resistant steel For particular corrosion media e.g. for use in indoor swimming pools	Uranus B 6	1.4539	X1NiCrMoCu 25 20 5	ISO 3506-1, E1 (especially resistant against chloride-induced stress corrosion)
	Austenitic	1.4439	X2CrNiMoN 17 13 5	
	Austenitic	1.4529	X1NiCrMoCuN 25 20 7	
	Austen./ferritic	1.4462	X2CrNiMoN 22 5 3	
Steels tough at sub-zero temperatures Increasing strength and stretch limit behaviour and high toughness at temperatures as low as – 195 °C (SEW) or – 253 °C (AD)	Marking KA	1.7219	26CrMo4	DIN 267-13 SEW 680/70
	Marking KB	1.5680	12Ni19	
	Marking KC	1.6900	X12CrNi189	
	Marking KD	1.6903	X10CrNiTi1810	
	A 2	1.4301 (304)	X5CrNi1810	ISO 3506 (DIN 267-11) DIN 267-13 EN 10088 (DIN 17440) ADW 2/ADW 10
	A 2	1.4303 (305)	X5CrNi1812	
	A 3	1.4541 (321)	X6CrNiTi1810	
	A 4	1.4401 (316)	X5CrNiMo17122	
	A 5	1.4571 (316 Ti)	X6CrNiMoTi17122	
Highly heat-resisting and heat-resistant steels Good temperature-resistance with medium to lower mechanical properties		1.1181	C35E	DIN 267-13 EN 10269
		1.7218	25CrMo4	
		1.7709	21CrMoV5-7	
	Nimonic 80 A	2.4631/2.4952	NiCr20TiAl	EN 10269 (DIN 17240, DIN 17480 DIN 17225)
	Nimonic 90	2.4632/2.4969	NiCr20Co18Ti	
	Nimonic 105	2.4634	NiCo20Cr15MoAlTi	
	(Sicromal 8)	1.4713	X10CrAl7	SEW 470/76
		1.4724	X10CrAl13	
	(Sicromal 10)	1.4742	X10CrAl18	
	(Sicromal 12)	1.4762	X10CrAl24	
		1.4821	X20CrNiSi254	
		1.4828 (309)	X15CrNiSi2012	
		1.4841 (310)	X15CrNiSi2520	
		1.4845 (310 S)	X12CrNi2521	
	1.4864 (330)	X12NiCrSi3616		
Non-magnetisable steels – ¹⁾ Mechanical properties (tensile strength, stretch limit, toughness) are dependent on the processing state – e.g. quenched, hot/cold-shaped, fully hardened	Amanox 182M 9	1.3805	X35Mn18	SEW 390/61
		1.3813	X40MnCrN19	
		1.3817	X40MnCr18	
		1.3819	X50MnCrV2014	
		1.3952	X4CrNiMoN1814	
		1.3960	X45MnNiCrV1376	
		1.3965	X8CrMnNi188	
		1.3967	X50CrMnNi229	
Nickel, nickel alloys High corrosion resistance, saltwater-proof, very high to highest resistance against aggressive chemical agents, higher oxidation resistance, high to optimum mechanical properties and fatigue strength – also at higher temperatures	Nickel 99.6	2.4060	Ni 99.6	EN 10088 (DIN 17740)
	Nickel 99.2	2.4066	Ni 99.2	
	Nickel 99	2.4068	LC-Ni 99	
	Hastelloy B	2.4617	NiMo28	DIN 17744
	Hastelloy C	2.4610	NiMo16Cr16Ti	
	Monel 400/Silverin	2.4360*	NiCu30Fe	DIN 17743 * ASTM B 164 Class A
	K-Monel/Silverin Al	2.4375	NiCu30Al	
	Inconel 600/625	2.4816/2.4856	NiCr15Fe	DIN 17742 DIN 17744 * EN 10269 (DIN 17240) * DIN 267-13
	Nicrofer 7216		NiCr15Ti7Al/NiCr20TiAl	
	Inconel X 750/ Nimonic 80 A	2.4952*		
Incolloy 825/ Nicrofer 4221	2.4858	NiCr21Mo		
Titanium, titanium alloys Low specific weight, high corrosion resistance, salt-water proof, anti-magnetic	Titan 992 (Grade 4)	3.7065	Ti 99.2	DIN 17850 DIN 17860 DIN 17862 DIN 17863 DIN 17864 * ISO 8839 (DIN 267-18)
	Titan 993 (Grade 3)	3.7055	Ti 99.3	
	Titan 994 (Grade 2)	3.7035	Ti 99.4	
	Titan 995 (Grade 1)	3.7025*	Ti 99.5	
	Ti 1			
	Titan Al 6V4	3.7164	TiAl6V4	DIN 17851 WL-sheets * ISO 8839 (DIN 267-18)
Titan Grade 5/Ti 2	3.7165*			

1) further austenitic materials, see "Parts made from stainless steels" → TI-224



Table 1: Drive features

Slot		Hexalobular socket		Triangle	
Phillips cross recess H		Triple square socket		Hexalobular	
Pozidriv cross recess Z		12 point socket		Triple square	
Supradriv cross recess		Torque set		Hexagon with slot	
Cross recess combi H+		Tri – Wing		Theft resistant drives	
Cross recess combi Z+		Hi torque			
Square socket		Hexagon			
Hexagon socket		Square			

Table 2: Ends of externally threaded fasteners

Description	New name	Old name	Picture (example)	Description example	Description	New name	Old name	Picture (example)	Description example
Short dog point with rounded end (DIN 962)	Ak	Ak		ISO* – M 12 x 50 – Ak – 8.8	Pilot point, flat (ISO 4753)	PF	PF		ISO* – M 12 x 50 – PF – 8.8
Chamfered end (ISO 4753)	CH	K		ISO* – M 12 x 50 – CH – 8.8	Thread undercut (DIN 76-1)	Ri	Ri		ISO* – M 12 x 50 – Ri – 8.8
Cone point (ISO 4753)	CN	–		ISO* – M 12 x 50 – CN – 8.8	as-rolled end (ISO 4753)	RL	Ko		ISO* – M 12 x 50 – RL – 8.8
Cup point (ISO 4753)	CP	Rs		ISO* – M 12 x 50 – CP – 8.8	rounded end (ISO 4753)	RN	L		ISO* – M 12 x 50 – RN – 8.8
Flat point (ISO 4753)	FL	Ks		ISO* – M 12 x 50 – FL – 8.8	Split pin hole (DIN 962/34803)	S	S		ISO* – M 12 x 50 – S – 8.8
Long dog point (ISO 4753)	LD	Za		ISO* – M 12 x 50 – LD – 8.8	Scrape point (ISO 4753)	SC	Sb		ISO* – M 12 x 50 – SC – 8.8
Pilot point with truncated cone (ISO 4753)	PC	PC		ISO* – M 12 x 50 – PC – 8.8	Short dog point (ISO 4753)	SD	Ka		ISO* – M 12 x 50 – SD – 8.8
Short dog point with truncated cone (DIN 962)	Asp	Asp		ISO* – M 12 x 50 – Asp – 8.8	Wire hole (DIN 962/34803)	SK	SK		ISO* – M 12 x 50 – SK – 8.8
					Truncated cone point (ISO 4753)	TC	Sp		ISO* – M 12 x 50 – TC – 8.8

* product standard

Table 3: Dimensions for split pin holes (S) and wire holes (SK)

Gewinde-Ø M		3	4	5	6	7	8	10	12	14	16	18	20	22	24	27	30	33	36
Pin holes S* (DIN 962/34803)	d ₁	0.8	1	1.2	1.6	1.6	2	2.5	3.2	3.2	4	4	4	5	5	5	6.3	6.3	6.3
	l _e	2	2.2	2.6	3.3	3.3	4	5	6	6.5	7	7.7	7.7	8.7	10	10	11.3	11.3	12.5
Wire holes SK* (DIN 962/34803)	d ₁	–	1.2	1.2	1.6	1.6	2	2	2	2	3	3	3	3	3	3	3	4	4
		* Position tolerance t = 2 IT13 (PK A), 2 IT14 (PK B), 2 IT15 (PK C)																	
Dimensions for slots**	~	0.8	1	1.2	1.6	1.6	2	2.5	3	3	4	** The position of the slot at the corners of the hexagon or square is optional							

According to DIN 2092 and DIN 2093, disc springs are cone-shaped discs which can be stressed along the axis. Compared to other spring-types, these fully concentric bending springs with symmetric-rotation cross section have low spring deflection with high spring power. The characteristic line of the disc springs depends to a large extent on the relationship of the free spring height [h_0] to the flatness and disc thickness [t]. This is why the characteristic line is split into three series.

Each series is split into three groups according to their thickness. These groups differentiate themselves from each other with various production processes.

Table 1: Names

D_e	Outside diameter
D_i	Inside diameter
t	Thickness of the individual disc
l_0	Construction height of the unstressed individual disc
s	Spring deflection of the individual disc
h_0	Information parameter (spring deflection up to the height for disc springs without bearing surface); $h_0 = l_0 - t$



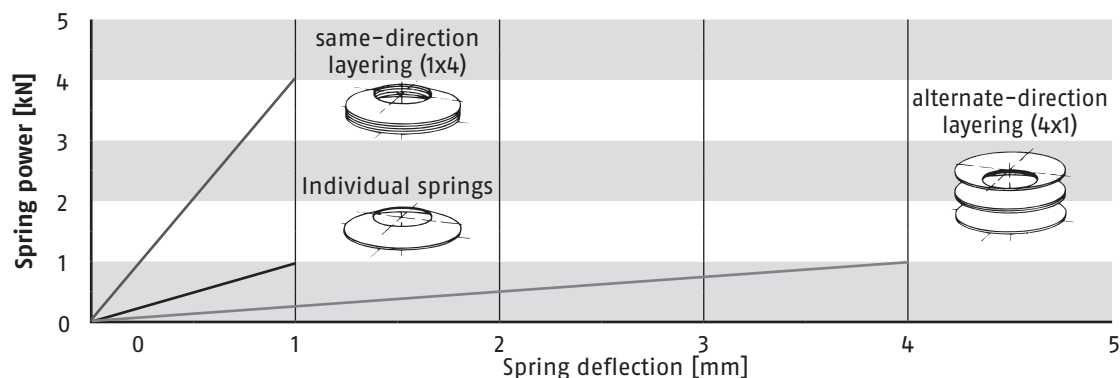
Table 2: Difference according to series

Series	Factor from	
	$\frac{D_e}{t}$	$\frac{h_0}{t}$
A	~ 18	~ 0.4
B	~ 28	~ 0.75
C	~ 40	~ 1.3

Table 3: Difference according to groups

Group	Thickness t	Manufacture/Processing
1	< 1.25 mm	cold-formed (punched), edges rounded, without bearing surface,
2	1.25 – 6 mm	cold-formed finely cut, D_e and D_i turned, without bearing surface
3	> 6 mm	cold or hot-formed, turned on all sides, with bearing surface,

Same-direction layering, alternate-direction layering or a combination of the two let disc springs be formed into columns with freely configurable characteristics. If, for example, a spring column is made up of four alternate-direction individual disc springs with the same geometry, the spring deflection increases fourfold in comparison with individual springs. With a spring packet of four same-direction layering springs, the spring power increases fourfold in relation to individual springs.



The materials named in EN 10083, EN 10089 and EN 10132-4 are permitted for disc springs (standard is the material 1.8159 – 51 CrV 4), C steels, however, only for Group 1 disc springs.

The disc springs are delivered hardened and tempered with a hardness of 42–52 HRC (Group 1 disc springs: 425 HV10 to 510 HV10). The standard surface is coated in phosphate and oiled. Many additional surfaces for increasing corrosion-resistance, like for example, mechanical galvanization or zinc-flake coating, are possible.

Stainless steels are also used as disc spring material. Compared with the standard, these special springs can have different, but always lower spring power.

Disc springs DIN 2093 – in stock



- from Cr/CrV alloy stainless steels (REYHER catalogue → green pages 215)
- from stainless steels 1.4310/ 1.4568 (REYHER catalogue → blue pages 492)

Disc springs – available on request

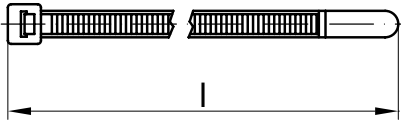


- Disc springs in special dimensions
- Disc springs in special materials
- Disc springs with special coatings

Cable ties

R 82500 – 82515

Cable ties, inside serration
T-series



Dimensions	2.3	2.5			2.8		3.5		
l	83	100	140	205	240	330	150	190	290
Bundle Ø _{max}	16	22	35	55	65	95	35	50	80
min. tensile strength (N)	80	80	80	80	80	110	110	135	135
Type	T18S	T18R	T18I	T18L	T25L	T25LL	T30R	T30L	T30LL

Dimensions	4.0		4.6		4.7			7.6	
l	175	365	150	300	210	300	390	225	
Bundle Ø _{max}	40	105	35	85	55	85	110	55	
min. tensile strength (N)	135	180	225	225	355	355	355	535	
Type	T40R	T40L	T50S	T50I	T80R	T80I	T80L	T120S	

Dimensions	7.5				8.9		
l	387	460	760	365	530	820	1095
Bundle Ø _{max}	105	130	225	100	150	245	330
min. tensile strength (N)	535	535	535	670	780	780	780
Type	T120R	T120M	T120 L	T150R(H)	T150M	T150L	T150XL

Version	T (R 82500)
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform
Colour	NA = natural
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h) ⁴⁾

Version	T- HS (R 82505)
Material	Polyamide 6.6 heat stabilised (PA66HS), HF = halogen free, RoHS conform
Colour	NA = natural/BK = black
Properties	Operating temperature: -40 °C to 105 °C, short-term 145 °C (500 h) ⁴⁾

Version	T- W (R 82510)
Material	Polyamide 6.6 UV-stabilised (PA66W), HF = halogen free, RoHS conform
Colour	BK = black
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h) ⁴⁾

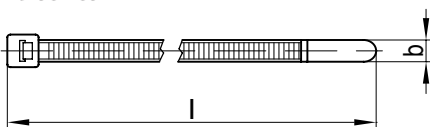
Version	T- HR (R 82515)
Material	Polyamide 4.6 for high temperature (PA46), HF = halogen free, RoHS conform
Colour	NA = natural
Properties	Operating temperature: -40 °C to +150 °C, short-term up to +195 °C (500 h) ⁴⁾



cable tie width = nominal size

R 82520

Cable ties, inside serration
LK-series



Dimensions	2.3	13.2
l	120	535
Bundle Ø _{max}	28	150
Tensile strength (N)	135	1.115
Type	LK2	LK5

Version	PA66
Material	Polyamide 6.6, HF = halogen free, RoHS conform
Colour	NA = natural
Properties	Operating temperature: -40 °C bis 85 °C, short-term 105 °C (500 h)

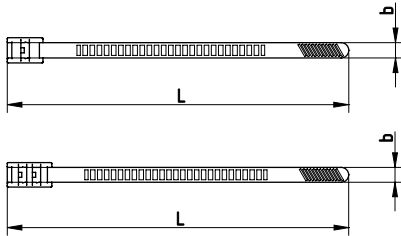


cable tie width = nominal size

Cable ties

R 82516

Cable ties, outside serrated,
with flat head
Robusto series



fire protection
UL94 HB

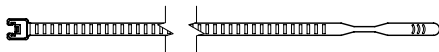
cable tie width = nominal size

Dimension	9.0		
I	180	260	355
Bundle $\varnothing_{\max}$	42	62	92
Tensile strength (N)	360	530	530
Type	LPH942	LPH962	LPH992

Version	PA11
Material	Polyamide 11, HF = halogen free; RoHS conform
Colour	BK = black
Properties	Operating temperature: -40 °C bis 85 °C, short-term 105 °C (500 h)

R 82517

Cable ties Q-tie, inside serrated,
with open head and
pre-locking functionality



fire protection
UL94 V2

cable tie width = nominal size

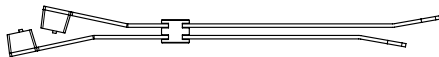
Dimension	2.6	3.6	4.7	7.7
I	105	160	210	420
Bundle $\varnothing_{\max}$	24	38	50	110
Tensile strength (N)	80	130	220	530
Type	Q18R	Q30R	Q50R	Q120R

Version	PA11
Material	Polyamide 6.6, UV-stabilised, HF = halogen free, RoHS conform
Colour	BK = black
Properties	Operating temperature: -40 °C bis 85 °C, short-term 105 °C (500 h)

Cable ties with fixing elements

R 82518

2-piece fixing ties
for parallel separation



fire protection
UL94 HB

cable tie width = nominal size

Cable tie width	4.6	7.6
I	200	380
Bundle $\varnothing_{\max}$	50	100
Tensile strength (N)	225	535
Type	T50RCOUPLER	T120RCOUPLER

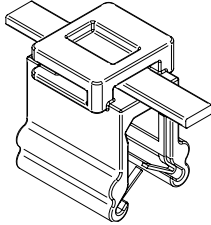
Version	Cable tie PA66HIR(S)	Food part PA66HIRHS
Material	Polyamide 6.6, impact resistant, RoHS conform	Polyamide 6.6, impact resistant, RoHS conform
Colour	BK = black	BK = black
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h)	Operating temperature: -40 °C to 105 °C (500 h)

(R = REYHER article numbers)

Cable ties with fixing elements

R 82521

fixing ties for edges, 2 pieces,
edge width 1–3 mm,
tie channel top-axial

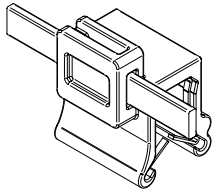


fire protection
UL94 V2

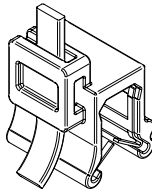
Cable tie width	4.6
l	200
Bundle $\varnothing_{\max}$	45
Tensile strength (N)	225
Type	T50R0SEC4A-W
Version	PA66W
Material	Polyamide 6.6, UV-stabilised, HF = halogen free, RoHS conform
Colour	BK = black
Properties	Operating temperature: –40 °C to 85 °C, short-term 105 °C (500 h)

R 82522

fixing ties for edges, 2 pieces,
edge width 1–3 mm



S-A = tie channel
lateral-axial



S-Q = tie channel
lateral-cross

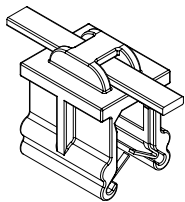
Cable tie width	3.6 S-Q	4.6 S-Q	4.6 S-A	
l	150	150	150	200
Bundle $\varnothing_{\max}$	33	45	31	45
Tensile strength (N)	135	225	225	225
Type	T30REC5A	T50R0SEC5A	T50S0SEC5B	T50R0SEC5B
Version	Cable tie PA66HS		Food part PA66HIRHS	
Material	Polyamide 6.6, heat stabilised, RoHS conform		Polyamide 6.6, impact resistant, RoHS conform	
Colour	BK = black		BK = black	
Properties	Operating temperature: –40 °C to 105 °C		Operating temperature: –40 °C to 105 °C (500 h)	

fire protection
UL94 V2

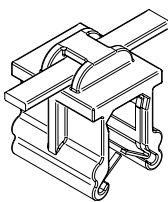
fire protection
UL94 HB

R 82523

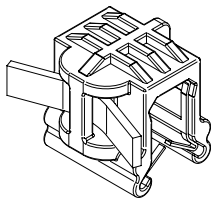
fixing ties for edges, 2 pieces,
edge width 3–6 mm



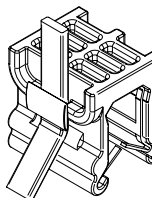
0-A = tie channel
top-axis



0-Q = tie channel
top-cross



S-A = tie channel
lateral-axial



S-Q = tie channel
lateral-cross

Cable tie width	4.6 0-A	4.6 S-Q		4.6 S-A	4.6 S-Q
l	200	150	200	200	200
Bundle $\varnothing_{\max}$	45	35	45	45	45
Tensile strength (N)	225	225	225	225	225
Type	T50R0SEC19	T50S0SEC20	T50R0SEC20	T50R0SEC23	T50R0SEC24
Version	Kabelbinder PA66HS			Fußteil PA66HIRHS	
Material	Polyamide 6.6, heat stabilised, RoHS conform			Polyamide 6.6, impact resistant, RoHS conform	
Colour	BK = black			BK = black	
Properties	Operating temperature: –40 °C to 105 °C			Operating temperature: –40 °C to 105 °C (500 h)	

fire protection
UL94 V2

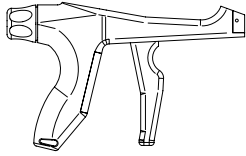
fire protection
UL94 HB

(R = REYHER article numbers)

Application tools for cable ties

R 82535

Man. application tool E0V7

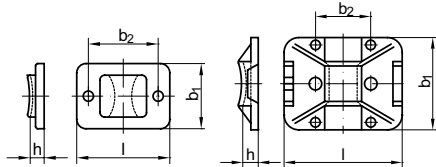


Tie width max.	Tie thickness max.	Weight	Comment
4.8	1.5	275 g	- Ergonomic, slip-proof handle for a comfortable and secure grip - Extremely low maintenance - Fast and precise application with minimum effort (TLC mechanism) - Convenient and simple tension adjustment - Extended, slim nose for use in narrow spaces - Housing made of resilient and lightweight glass fibre-reinforced polyester - Standard grip span (90 mm) and short grip span (80 mm) available

Fixings for cable ties

R 82540

Cable tie mounts, type TY-G1, self adhesive

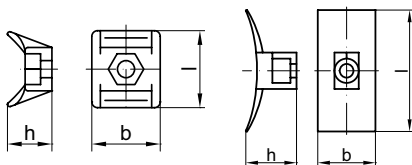


fire protection
UL94 V2

Cable tie width	4.0	8.0
l	20	32
b ₁	14	25
h	3.7	5.2
b ₂	15	15
Fastening-Ø	2.2	3.2
Type	TY3G1S	TY8G1S
Version	TY-G1	
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform	
Colour	NA = natural	
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h)	
Fastening	self-adhesive and screw mounting	

R 82543/82546

cable tie mounts, type NY/LKC, screw mounting

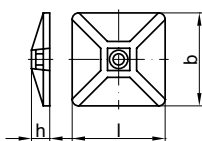


fire protection
UL94 V2

Cable tie width	8.0	8.0
l	13.5	40
b	12.0	19.0
h	7.8	16.8
Fastening -Ø	3.0	5.5
Type	NY3256	LKC
Version	NY und LKC	
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform	
Colour	NA = natural	
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h)	
Fastening	screw mounting	

R 82550

Cable tie mounts, type MB-CA, self adhesive



fire protection
UL94 V2

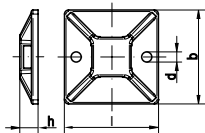
Cable tie width	5.4
l	29
b	29
h	5.7
Fastening -Ø	4.2
Type	MB4CAS ²⁾
Version	PA66
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform
Colour	NA = natural
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h)
Fastening	Self adhesive

(R = REYHER article numbers)

Fixings for cable ties

R 82553

Cable tie mounts, type MB-A,
screw mounting and adhesive

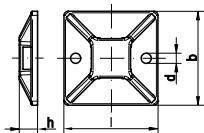


fire protection
UL94 V2

Cable tie width	5.4
l	28
b ₁	28
h	4.7
b ₂	20.2
Fastening-Ø	4.0
Type	MB4A
Version	PA66
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform
Colour	NA = natural
Properties	Operating temperature: -40 °C to 85 °C, short-term 105 °C (500 h)
Fastening	Self-adhesive and screw mounting

R 82554

Cable tie mounts with special glue,
SolidTack series

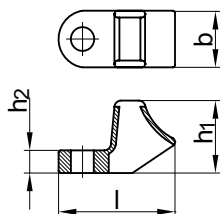


fire protection
UL94 V2

Cable tie width	8.0	8.0
l	13.5	40
b	12.0	19.0
h	7.8	16.8
Fastening-Ø	3.0	5.5
Type	NY3256	LKC
Version	NY und LKC	
Material	Polyamide 6.6 (PA66), HF = halogen free, RoHS conform	
Colour	NA = natural/BK = black	
Properties	Operating temperature: -40 °C bis 85 °C, short-term 105 °C (500 h)	
Fastening	Self-adhesive with special glue (acrylat) and screw mounting	

R 82560

Cable tie mounts,
Typ CL8, screw mounting



fire protection
UL94 V2

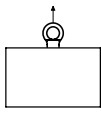
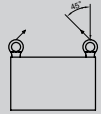
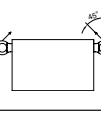
Cable tie width	8.0
l	27.3
b	12.5
h ₁	16.0
h ₂	5.0
Fastening-Ø	6.5
Type	CL8
Version	CL8
Material	Polyamide 6.6 (PA66), HF = halogen free
Colour	NA = natural
Properties	Operating temperature: -40 °C bis 85 °C, short-term 105 °C (500 h)
Fastening	screw mounting

Taking into account a high safety factor in relation to the minimum breaking strength, the ring bolts according to DIN 580 and the ring nuts according to DIN 582 have the load-bearing capacities as indicated in table 1. The load-bearing values apply for steel C15 E and stainless steel A2/A4 without restriction in a temperature range of -20 °C to +200 °C.

Ring bolts and ring nuts are valid according to the 2006/42/EC Machinery Directive as load-carrying equipment and are subject to CE labelling. Furthermore, they must show a specification of the minimum carrying force (WLL) as well as the specification of the material if required for safe usage. The version of DIN 580-2010 and DIN 582-2010 not yet published at the time of printing of this catalogue also prescribes that a marking of an arrow be present in the direction of the axis (picture 1) so that the user can tell that the WWL specified on the product only applies in the direction of the axis.

Subsequent colour-coded marking of ring bolts and nuts (especially in red) is to be avoided so that they are not mistaken for high-strength suspension points.

Table 1

Thread (d1)		M 8	M 10	M 12	M 16	M 20	M 24	M 30	M 36	M 42	M 48	M 56	M 64	M 72x6	M 80x6	M 100x6
capacity axial (WLL) for each eye bolt/nut kg		140	230	340	700	1200	1800	3200	4600	6300	8600	11500	16000	20000	28000	40000
capacity up to max. 45° for each eye bolt/nut kg		100	170	240	500	860	1290	2300	3300	4500	6100	8200	11000	14000	20000	29000
capacity under max. 90° for each eye bolt/nut kg		70	115	170	350	600	900	1600	2300	3150	4300	5750	8000	10000	14000	20000

User information for lifting eye bolts DIN 580

Eye bolts conforming to this standard are primarily intended as permanent attachments on equipment such as motors, control cabinets, gear boxes, etc. When used as temporary attachments on larger objects such as large tools for transportation only, the next largest thread size should be used.

The safe working load values given in table 1 are based on the following assumptions:

- the eye bolt is firmly screwed down
- the collar sits evenly on the contact surface,
- the material of the equipment is capable of accommodating the stresses induced without any deformation liable to impair safety,
- tapped holes have a threaded length sufficient to ensure that the eye bolt shank is fully engaged and the collar fully seated.

The capacity specified in the second line of table 1 applies up to an inclination angle of 45°. The capacity specified in the third line applies for laterally inserted eye bolts up to an inclination angle of 45° in all directions in regard to the ring level. Lateral pull should not be applied (see picture 2). Before being used, eye bolts should be checked for correct seating and apparent damage (e.g. corrosion, deformation). Deformed eye bolts should be discarded. In eye bolt assemblies with clearance hole, a washer and nut (not thin nut) should be used.

User information for lifting eye nuts DIN 582

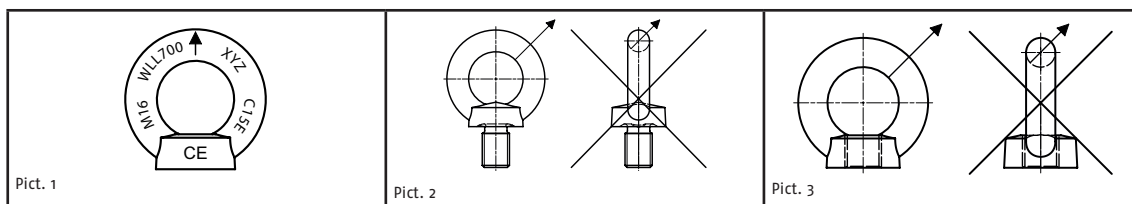
Eye nuts conforming to this standard are primarily intended as permanent attachments on equipment such as motors, control cabinets, gear boxes, etc. When used as temporary attachments on larger objects such as large tools for transportation only, the next largest thread size should be used.

The safe working load values given in table 1 are based on the following assumptions:

- the eye nut is firmly screwed down and the collar sits evenly on the contact surface
- the length of the bolt thread is sufficient to ensure that the eye nut is fully engaged
- the material of the bolt on which the eye nut is to be screwed is of adequate strength

In eye nut assemblies with clearance hole, a washer should be used.

The capacity specified in the second line of table 1 applies up to an inclination angle of 45°. The capacity specified in the third line applies for laterally inserted eye nuts up to an inclination angle of 45° in all directions in regard to the ring level. Lateral pull should not be applied (see picture 3). Before being used, eye nuts should be checked for correct seating and apparent damage (e.g. corrosion, deformation). Deformed eye nuts should be discarded.



1. Standards

The following standards apply for "wire thread inserts for the metric ISO thread"

- DIN 8140-1 dimensions, technical specifications
- DIN 8140-2 helical coil threads for inserts, thread tolerances
- DIN 8140-3 gauges and gauge sizes

These standards apply for ISO metric coarse pitch threads and fine pitch threads.

Details for additional deliverable thread types (BSW/BSF, UNC/UNJC/UNF/UNJF, GAZ, BSP) are available upon request.

2. Field of application/materials/properties

- Initial use: for heavy-duty and long-lasting inside threads partly from metallic and non-metallic materials
- Use during repairs/follow-up work: as a replacement for unusable threads (= damaged/worn).

The particular properties of wire thread inserts are

- reduced inclination for cold welding with screwed fastenings
- mostly constant friction coefficient
- good temperature and corrosion resistance
- with profile B "locking" (→ 4) additional resistance against independent loosening of the screwed fastenings thanks to increased frictional locking in the thread.

Beyond the standard material in stock "Stainless steel 18.8 (A 2)", wire thread inserts from special materials are deliverable for particular usage requirements → Table 1.

Tabelle 1: Materials for various fields of application

Material	Max. temperature	Options for coatings	Applications
Standard material Stainless steel 18.8 (A 2)	425 °C (short-term)	Dry lubrication Cadmium plating Silver plating Zinc plating Tin plating	All standard applications for all materials
AISI 304 (1.4301) AISI 302 (1.4310)	315 °C (longer periods)		Special use – resistant to acid, rust, high temperatures, non-magnetic
Special stainless steel AISI 304L, 316, 316L, 316Ti, 321	Up to 400 °C over longer periods		
Phosphorous bronze	300 °C (short-term) 250 °C (longer period)	Cadmium plating	Copper parts – resistant to certain elec- trolytic processes
Inconel x 750 Nc 15 Fe Nba	750 °C (short-term)	Silver plating	Thermal power stations Astronautics Aviation Turbo compressor
Nimonic 90 Nc 20 C 18 Ti	538 °C (longer periods)		

3. Manufacture

The thread inserts are manufactured from a wire with rhombus-shaped cross-section. After the winding process, they have two threaded profiles, one outside for the insertion into the tool's receiving thread according to DIN 8140-2 and one inside (after insertion) for receiving a screw thread.

4. Types

According to DIN 8140-1, the profiles are differentiated according to:

- Type A = cylindrical shape* for coarse and fine threads.
- Type B = "locking" (like type A, but with centrally positioned, polygon, elastic windings (→ 2)
(type B thread inserts are identifiable by their red colour).

* The new generation of the "Type SR" AMECOIL thread inserts is designed in such a way that insertion is now easier and safer, thus increasing productivity.

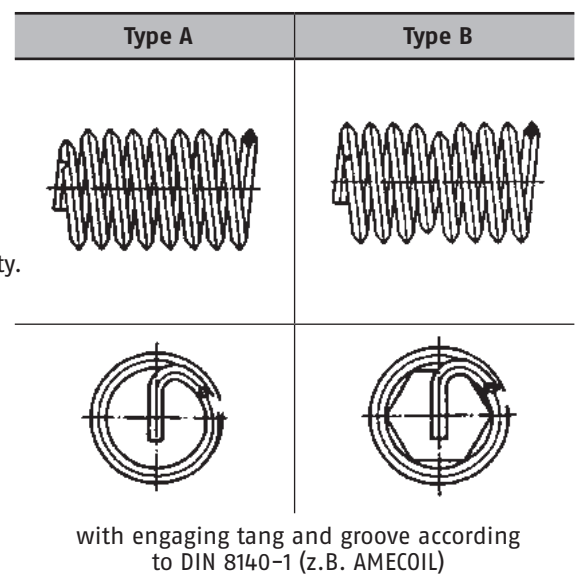
5. Drive systems for insertion

DIN 8140-1 shows an engaging tang as the drive system, which is to be removed at the groove using a tang breaker after insertion. AMECOIL thread inserts, for example, have this drive system.

6. Determining the nominal length

The nominal lengths of the threaded inserts to be chosen are,

- dependent on the tool material and,
- dependent on the strength class of the screw
(recommended nominal lengths → DIN 8140-1, Table 1).



7. Dimensions/Measuring techniques during acceptance inspection

In the order text, the following dimensions are to be specified (example M 10x15):

- the use/inside thread required after insertion – e.g. M 10
- the chosen nominal length according to DIN 8140-1, Table 1, l_1 – e.g. 15 (= 1.5 d).

In as-delivered condition, only the outside diameter and the number of windings are measurable during acceptance inspection (→ Table 2) – the nominal length l_1 is first determinable in inserted condition.

Tabelle 2: Dimensions – outside Ø and winding count in as delivered condition

Characteristics		for coarse pitch threads with nominal size use/inside thread															
		M 2	M 2.5	M 3	M 4	M 5	M 6	M 7	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24
Outside-Ø	min.	2.6	3.3	3.8	5.15	6.35	7.6	8.65	9.85	12.1	14.4	16.8	19.0	21.5	23.7	26.3	28.6
	max.	2.8	3.5	4.0	5.35	6.6	7.85	8.9	10.1	12.5	14.8	17.2	19.4	22.0	24.2	26.8	29.1
Drill-Ø	mm	2.1	2.6	3.2	4.2	5.2	6.3	7.3	8.4	10.5	12.5	14.5	16.5	18.75	20.75	22.75	24.75
Winding count AW* at nominal length d/mm	1d = mm	2	2.5	3	4	5	6	7	8	10	12	14	16	18	20	22	24
	AW	2.9	3.5	3.9	3.7	4.3	4.2	5.3	4.7	5.0	5.2	5.6	6.5	5.6	6.3	6.9	6.2
	1.5d = mm	3	3.75	4.5	6	7.5	9	10.5	12	15	18	21	24	27	30	33	36
	AW	4.9	5.9	6.3	6.1	6.9	6.9	8.2	7.4	8.1	8.4	8.8	10.1	9.0	10.0	10.9	10.0
	2d = mm	4	5	6	8	10	12	14	16	20	24	28	32	36	40	44	48
	AW	6.9	8.1	8.7	8.4	9.7	9.6	11.1	10.6	11.2	11.7	12.0	13.8	12.3	13.7	15.1	14.0
(*Tol. -0.25)	2.5d = mm	5	6.25	7.5	10	12.5	15	17.5	20	25	30	35	40	45	–	–	–
	AW	8.9	10.5	11.1	10.9	12.3	12.3	14.3	13.5	14.2	14.7	15.2	17.5	15.5	–	–	–

Characteristics		for fine pitch threads with nominal size use/inside thread											
		M 8x1	M 10x1	M 10x1.25	M 12x1	M 12x1.25	M 14x1.5	M 14x1.25	M 16x1.5	M 20x1.5	M 20x2	M 24x1.5	M 24x2
Outside-Ø	min.	9.85	12.1	12.1	14.4	14.4	16.8	16.8	19.0	23.7	23.7	28.6	28.6
	max.	10.1	12.5	12.5	14.8	14.8	17.2	17.2	19.4	24.2	24.2	29.1	29.1
Drill-Ø	mm	8.3	10.25	10.4	12.3	12.4	14.5	14.4	16.5	20.5	20.5	24.5	24.5
Winding count AW* at nominal length d/mm	1d = mm	8	10	10	12	12	14	8.4 ①	16	20	20	24	24
	AW	6.1	7.6	6.0	9.3	7.4	7.4	(15.2)	8.7	10.7	8.0	12.9	9.6
	1.5d = mm	12	15	15	18	18	21	12.4 ①	24	30	30	36	36
	AW	9.5	12.1	9.7	14.5	11.6	11.6	(18.2)	13.4	16.7	12.5	19.8	15.0
	2d = mm	16	20	20	24	24	28	14.4 ①	32	40	40	48	48
	AW	12.9	16.3	13.1	19.5	15.9	15.7	(19.4)	18.1	22.4	16.8	26.6	20.2
(*Tol. -0.25)	2.5d = mm	20	25	–	–	–	35	16.4 ①	40	① ignition plug threads with special d-dimensions			
	AW	16.5	20.7	–	–	–	19.9	(10.6)	22.9				

Tabelle 3: Overview: Tools, accessories and REYHER article number

Tool/Accessory	REYHER art. no.	
	Coarse pitch thread SR	Fine pitch thread
Thread insert article number	R 88330	R 88331
Drill for tapping hole-Ø	R 88988, R 88989	
Roughing tap	R 88339 from M 18	–
Finish tap	R 88338	R 88338
Assembly tools		
• Multidim. hand fitting tool	–	R 88333 fine
• Mandrel and threaded nose	–	R 88334 fine
• Specific hand fitting tool	R 88333 SR	–
• Threaded mandrel	R 88334 SR	–
• Unidim. hand fitting tool	R 88335 SR from M 18	R 88335 fine ab M 20
Tang breaker	R 88336	
Extractor	R 88337	
Assortment boxes with tools	R 88342, R 88344	

Dimensions/tools in stock: → steel pq.: 561-563

Fitting principle



Drilling



Tapping



Fitting
with classic range
tool



Fitting
with SR range
tools



Breaking the
engaging tang

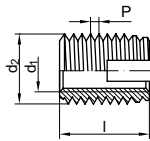


Thread insert fitted

Dimensions for self tapping Ensat® thread inserts

Article 88302

Ensats® 302



Dimensions	M 2.5	M 3	M 4	M 5	M 6	M 8
d ₂	4.5	5	6.5	8	10	12
P	0.5	0.5	0.75	1	1.5	1.5
L	6	6	8	10	14	15
blind hole depth min.	8	8	10	13	17	18

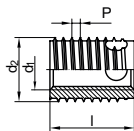
Dimensions	M 10	M 12	M 14	M 16	M 18	M 20
d ₂	14	16	18	20	22	26
P	1.5	1.5	1.5	1.5	1.5	1.5
L	18	22	24	22	24	27
blind hole depth min.	22	26	28	27	29	32

Dimensions	M 22	M 24	M 27	M 30		
d ₂	26	30	34	36		
P	1.5	1.5	1.5	1.5		
L	30	30	30	40		
blind hole depth min.	36	36	36	46		

d₁ = nominal size

Article 88307

Ensats® 307

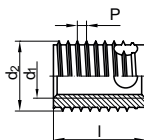


Dimensions	M 4	M 5	M 6	M 8	M 10	M 12
d ₂	6.5	8	10	12	14	16
P	0.8	1	1.25	1.5	1.5	1.75
L	6	7	8	9	10	12
blind hole depth min.	8	9	10	11	13	15

d₁ = nominal size

Article 88308

Ensats® 308



Dimensions	M 4	M 5	M 6	M 8	M 10	M 12
d ₂	6.5	8	10	12	14	16
P	0.8	1	1.25	1.5	1.5	1.75
L	8	10	12	14	18	22
blind hole depth min.	10	13	15	17	22	26

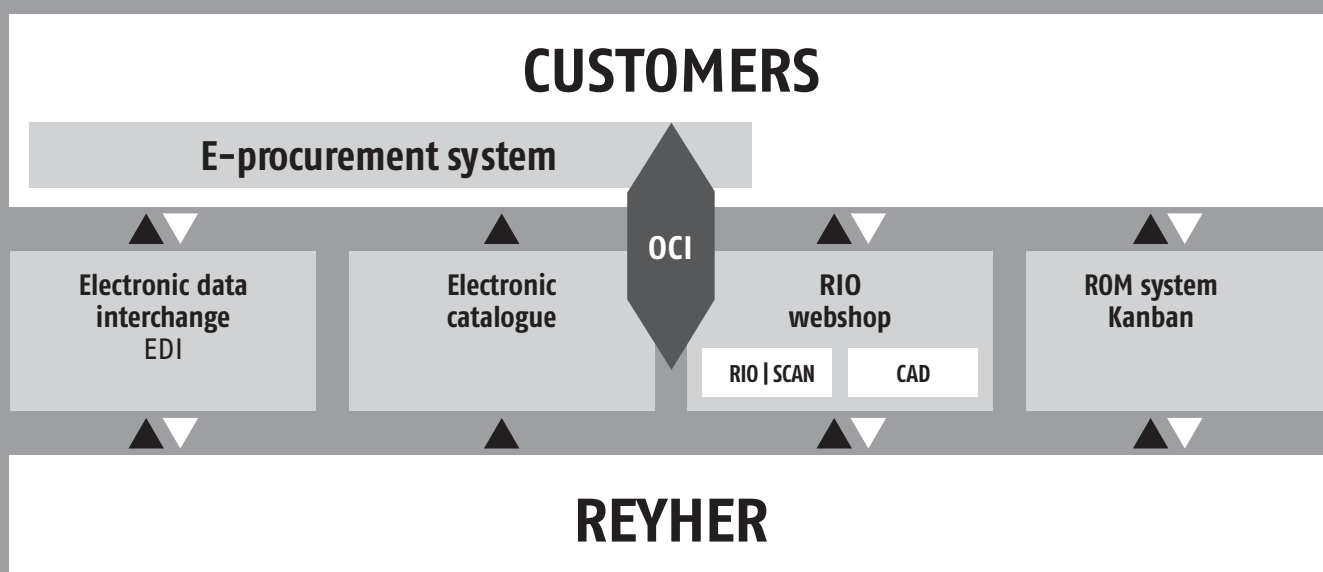
d₁ = nominal size

Table 4: Standard values for borehole diameter

Borehole-Ø [mm]		R 88302 (Ensats® 302)				R 88307/R 88308 (Ensats® 307/308)			
Workpieces material	Aluminium alloys R _m = tensile strength [N/mm²]	R _m < 250				R _m < 300			
		R _m < 300				R _m < 350			
		R _m < 350				R _m < 350			
		R _m > 350				R _m > 350			
	Brass, bronze, non-ferrous metal	R _m > 350				R _m > 350			
	Cast iron HB = brinell hardness	< 150 HB				< 150 HB			
< 200 HB				< 200 HB					
> 200 HB				> 200 HB					
Thread flank overlap approx.		60%	50%	40%	30%	80%	70%	60%	50%
Ensats® internal thread	M 2/M 2.5	-	4.1	4.2	4.3	-	-	-	-
	M 3	-	4.6	4.7	4.8	4.6	4.7	4.7	4.8
	M 3.5	5.4	5.5	5.6	5.7	5.5	5.6	5.7	-
	M 4	5.9	6.0	6.1	6.2	6.0	6.1	6.2	-
	M 5	7.2	7.3	7.5	7.6	7.4	7.5	7.6	7.7
	M 6	8.8	9.0	9.2	9.4	9.3	9.4	9.5	9.6
	M 8	10.8	11.0	11.2	11.4	11.1	11.2	11.3	11.5
	M 10	12.8	13.0	13.2	13.4	13.1	13.2	13.3	13.5
	M 12	14.8	15.0	15.2	15.4	15.0	15.1	15.2	15.4
	M 14	16.8	17.0	17.2	17.4	17.0	17.1	17.2	17.4
	M 16	18.8	19.0	19.2	19.4	19.0	19.1	19.2	19.4
	M 18	21.0	21.0	21.2	21.4	-	-	-	-
	M 20/M 22	25.0	25.0	25.2	25.4	-	-	-	-
	M 24	29.0	29.2	29.2	29.4	-	-	-	-
M 27	33.0	33.2	33.2	33.4	-	-	-	-	
M 30	35.0	35.0	35.2	35.4	-	-	-	-	

Dimensions in stock → steel pq.: 417, stainless pq.: 561

COMPREHENSIVE E-BUSINESS SOLUTIONS



RIO – REYHER Internet Order webshop meets requirements via barcode, electronic catalogues, as well as direct data exchange via EDI (Electronic Data Interchange). We offer a comprehensive service, working with you to optimize your ordering

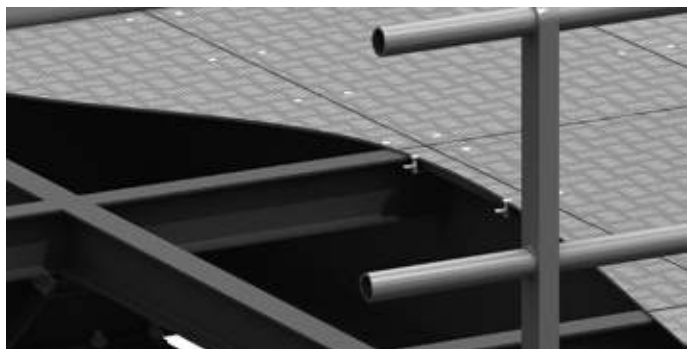
process. REYHER e-business solutions simplify procurement and speed up the ordering process. Automatic data processing also reduces manual checking, improving data quality and avoiding errors.

For more information, see www.reyher.de

Areas of application

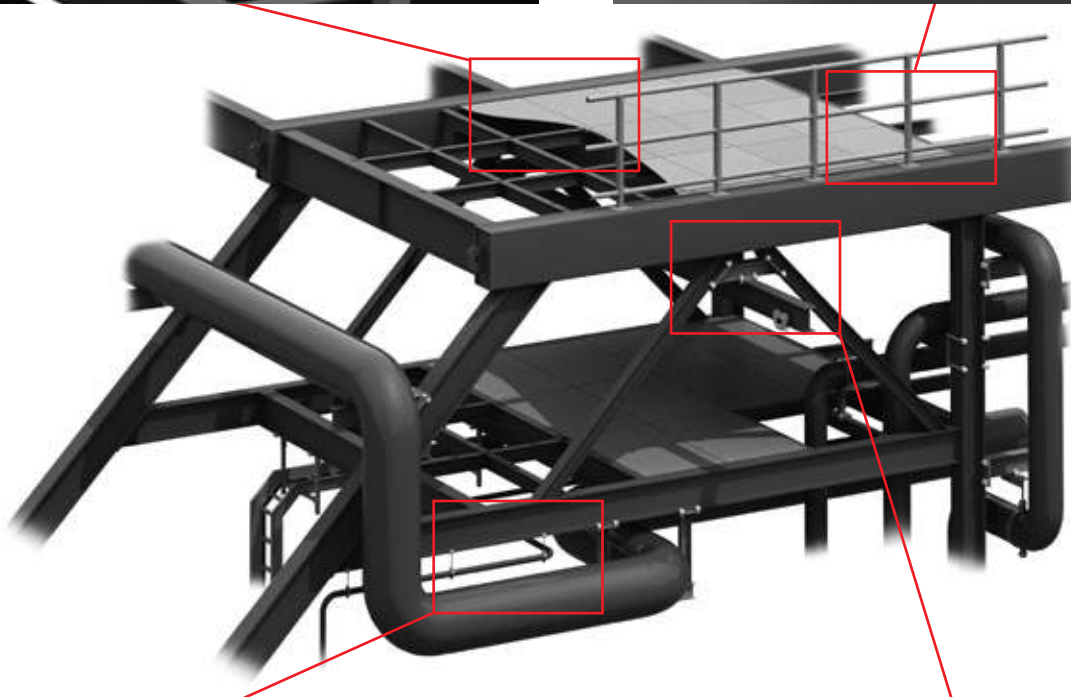
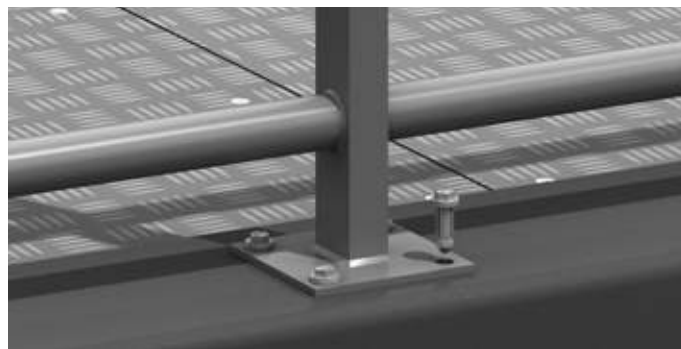
Floor Fixings

It is now possible to connect steel flooring to supporting steelwork without on-site drilling or welding for a fast, low cost operation. Lindapter fixings allow installation to be carried out safely from above, often by one person, without elevated floors thus significantly reducing costs.



Cavity Fixings

The legendary Hollo-Bolt® and Lindibolt® allow fast, cost-effective connections to SHS and other hollow sections, or conventional steelwork where access is available from one side only. The Hollo-Bolt can be used as a primary structural connection as detailed in the SCI/BCSA publication 'Joints in Steel Construction – Simple Connections'. Plug-like fixing element for hollow profiles, pipes and other constructions which are difficult to access from the rear.



Support Fixings

Lindapter provides easy-to-install solutions for supporting building services from structural or secondary beams, including: the suspension of HVAC equipment, pipe work, fire protection/sprinkler systems, suspended ceilings and electrical equipment.

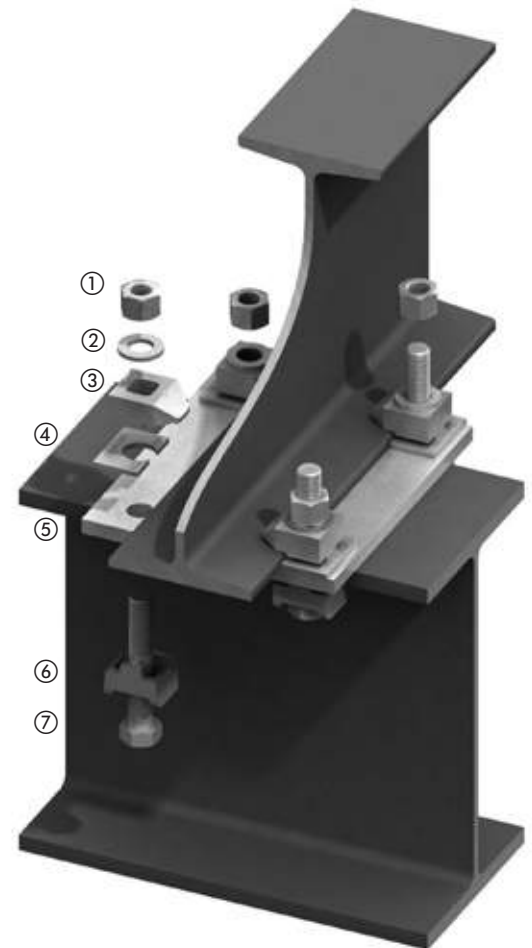


Steelwork Fixings

Lindapter has pioneered the development of steelwork clamping systems for over 75 years, and continues to innovate with their unique and proven concept: eliminate the need to drill or weld, to reduce installation time and labour costs. Lindapter steelwork fixings and girder clamps transform this concept into reality and are ideal for new construction and the refurbishment of existing structures.

Components of a girder clamp

1. Standard grade 8 hexagon nuts
2. Standard hardened washers
3. Lindapter clamp
Dependent on the application different clamps could be used i.e. Types A, B, BR, AF, LR, LS, D2 or D3.
4. Packing piece
In combination with the clamps mentioned above these parts increase the tail length to enable the product to sit correctly on the beam.
5. Location plate (can be supplied if required)
This is an essential part of the girder clamp assembly that enables all the components to be located in the correct position. The hole centres and plate thickness are calculated to suit the individual application.
6. Lindapter clamp
This can be of a similar type as 3 (above), although certain products are designed to specifically work together i.e. A + B.
7. Standard grade 8.8 hexagon head bolts



Loads

The table beneath shows tensile and frictional load capabilities for a standard four bolt girder clamp using 4 bolts and 8 clamps at a 90° crossover angle. Lindapter is only too pleased to carry out all design work for individual connections free of charge based on the following details:

- Load per connection
- Size and type of both beams
- Angle of crossover
- Distance between beams
- Inclination of beams

Clamps Screws Ø Property class		Typen A, B, LR				Typ AF	
		M 12	M 16	M 20	M 24	M 24	
		8.8	8.8	8.8	8.8	8.8	10.9
Permitted pulling force for four screws	kN	18.2	33.9	52.9	76.2	160.0	250.0 ^a
Permitted shearing force for four screws	kN	1.8	3.4	5.3	7.6	60.0 ^a	70.0 ^b
Tightening torque	Nm	69	147	285	491	800	1000

① safety factor 3,2:1/② safety factor 2:1

Note:
All loads are based on actual test data having a safety factor for friction against slip and for tensile against ultimate failure (typically 5:1). Use of lower safety factor is not recommended.

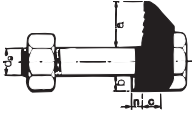
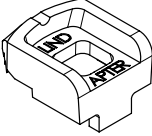
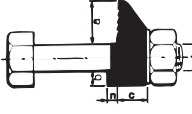
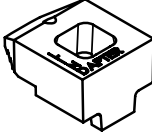
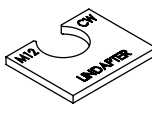
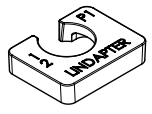
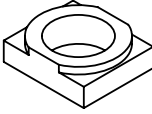
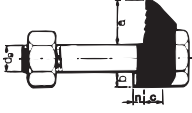
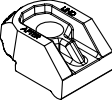
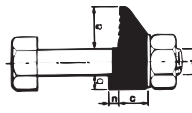
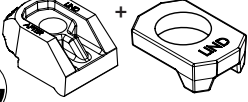
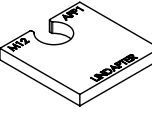
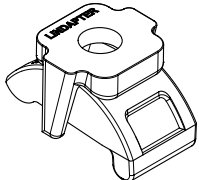
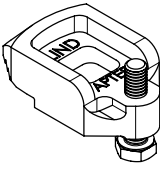
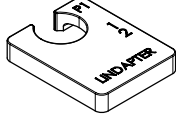
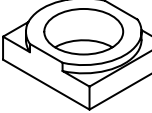
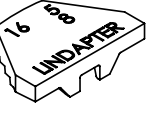
Approvals

All approvals apply to girder clamps using types A and B only, in sizes from M 12 to M 24, further information is available upon request.



You can find more detailed information in the Lindapter catalogue.
This can be requested directly from REYHER or downloaded from www.lindapter.de

Girder clamps

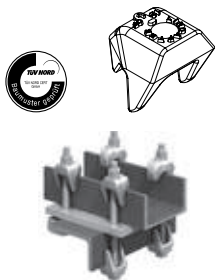
Typ A und B		Accessories for type A and B		Application examples
Typ A (R 82001)   	Typ B (R 82002)   	Typ CW (R 82011)   clipped washers for adjustment of different flange thicknesses	Typ P1k/P2k (R 82012/82013)  	  Clamps for static and dynamic loads with adjustment of flange inclinations of up to 8°
		Typ W (R 82021)  recess filling plates for type A	Typ T (R 82018)   to cancel the slope of the clamping nose of type A and B	
Girder clamp type AF		Accessories for type AF		Examples of use
Typ AF (R 82040)   	Typ AF + AFW (R 82040 + R 82041)   	Typ AFCW (R 82042)   clipped washers for adjustment of different flange thicknesses	Typ AFP1/AFP2 (R 82043/82044) 	 Clamps for high friction loads with adjustment of flange inclinations of up to 10°. Type AF can be used in combination with type CF.
Girder clamp of type LR and D2		Accessories for type LR and D2		Examples of use
Typ LR (R 82010)  	Typ D2 (R 82007)  	Typ P1L/P2L (R 82015/82016)   clipped washers for adjustment of different flange thicknesses	Typ W (R 82021)  recess filling plates for type D2	 Typ LR Adjustable two-part clamp with large clamping range. Adjustment of flange inclinations by up to 15°. Typ D2 Clamp with adjustable screw for large clamping range. Adjustment of flange inclinations by up to 5°.
		Typ T (R 82018)   to cancel the slope of clamping nose of type D2		

(R = REYHER-article number)

Information on the dimensioning and loads can be found in the Lindapter catalogue.
This can be requested directly from REYHER or downloaded www.lindapter.de

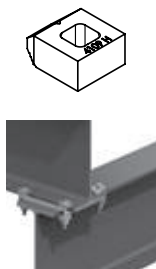
Girder clamps – special clamps

Typ CF
(R 82045)



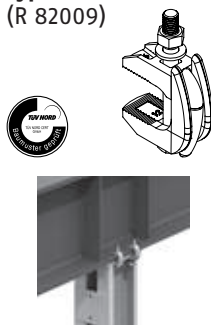
Clamps for frictional loads. Can be used in connection with type AF. This type hooks around the flange edge of the profiles.

Typ BSNT
(R 82003)



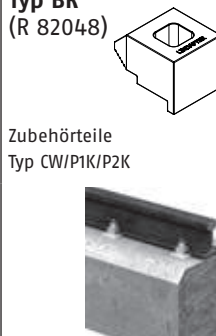
Special clamps for the assembly of girders – flange on flange. The inner plate is replaced by a flat steel frame which is welded onto the clamp.

Typ F9
(R 82009)



Flange clamp for parallel girders with identical widths. Not suitable for tapered flanges.

Typ BR
(R 82048)



Zubehörteile
Typ CW/P1K/P2K

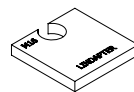
A versatile clamp for steel beams or rails. The skirt prevents the clamp from rotating during installation. The BR tail spans slotted holes. Suitable for flanges up to 8°.

Typ LS
(R 82046)



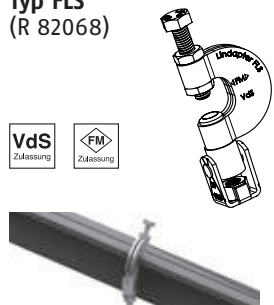
A self adjusting clamp for various flange thicknesses and slopes of up to 10°. The special serrations on the tail prevent the clamp rotating during installation. The LS tail spans over slotted holes.

Accessories
Typ LSP2
(R 82047)



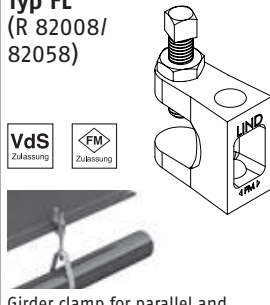
Support fixings

Typ FLS
(R 82068)



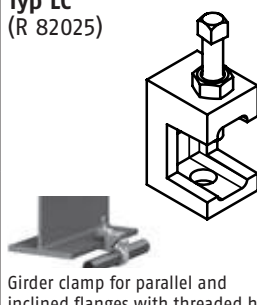
Girder clamp with swivel for use with parallel and inclined flanges

Typ FL
(R 82008/
82058)



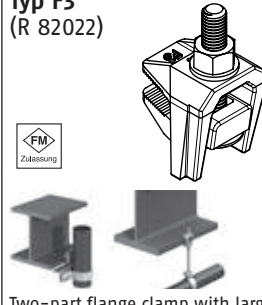
Girder clamp for parallel and inclined flanges with clearance hole or threaded hole

Typ LC
(R 82025)



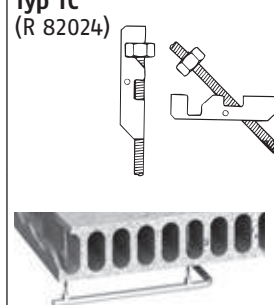
Girder clamp for parallel and inclined flanges with threaded hole parallel and perpendicular to the adjusting screw

Typ F3
(R 82022)



Two-part flange clamp with large clamping area for use on parallel flanges.

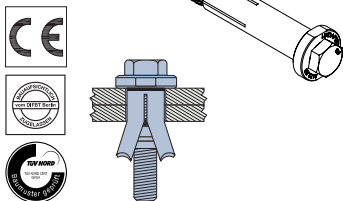
Typ TC
(R 82024)



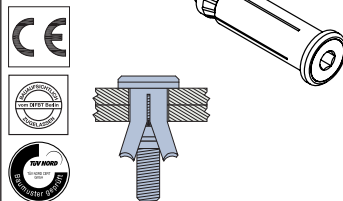
Toggle fixings for mounting to hollow ceilings or steel profiles

Cavity fixings

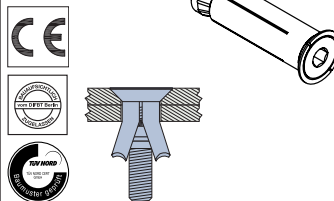
Typ HB – Hexagon head
(R 82031)



Typ HBCSK – Countersunk head
(R 82031)



Typ HBFF – Flush Fit
(R 82031)



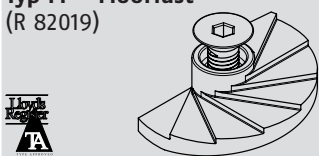
Examples of use



Suitable for hollow sections, tubes and where access is available from one side only.

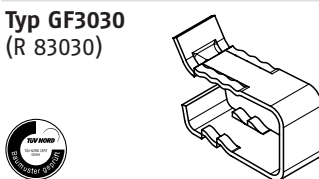
Floor fixings

Typ FF – Floorfast
(R 82019)



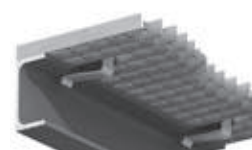
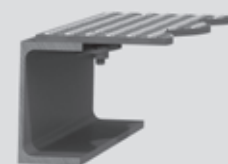
The eccentric stepped web of the casting allows it to lock under the steelwork, providing full face contact when torque is applied. Lloyds' Register Type Approval covers clamping force and vibration.

Typ GF3030
(R 83030)



Grating clamp for fast installation on parallel flanged girders.

Examples of use



(R = article numbers)



When selecting the right plug or anchor for all purposes of use the following important factors need to be taken into consideration – here is some advice to help you make your choice:

1. The building material (anchoring base):

Plugs and anchors can only ever support as much of a load as the anchoring base can handle.

REYHER fixing technology provides the proper technical and commercially economic solution from the catalogues of tried-and-tested proprietary brands FISCHER and UPAT for all intended uses.

The building material needs to be able to take the expansion force of the plug or anchor during frictional contact (→ Section. 2) without suffering damage. (Approved plugs/anchors for the corresponding building material → Table 6)

Table 1: Anchoring base acc. to building group

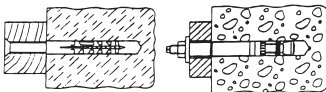
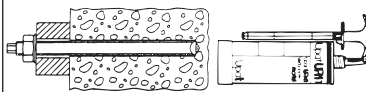
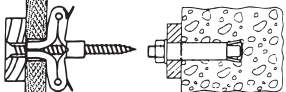
Concrete		Brickwork				Sheets/Panels
Normal concrete B 15 – B 55 C 15/20 – C 50/55	Light-weight concrete LB 10 – LB 55 e.g. Pumice/ expanded/porous (gas) concrete	Solid brick dense structure e.g. Solid brick (MZ)/ Sand lime solid bricks (KS)	Perforated brick dense structure e.g. Honeycomb brick Sand lime Perfo- rated bricks (KSL)	Solid brick porous structure e.g. Porous concrete (G) Light-weight concrete (V)	Perforated brick porous structure e.g. Honeycomb brick Light-weight concrete Hbl	Plasterboard/ Chipboard/ Fibreboard/ Fibre cement panels
BN	BL	VD	LD	VP	LP	HP

2. Mode of operation (load anchoring in the building material)

Plugs and anchors are classified into three groups according to their force transmission in the anchoring base.

This type of carrier mechanism is also a decisive factor for the anchoring base, resilience, edge distances and centre distances.

Table 2: Types of force transmission from plugs and anchors in the building ground

Force transmission:	Frictional contact (Traction from expansion)	Adhesive bond (expansion free)	Formschluss (expansion free)
Support mechanism:	Contact pressure of the expansion parts on the wall of the drilling hole = Friction > Tensile loads	Adhesive mortar joins with the anchor and anchoring base	Plug shape/Anchor part shape adapts to the drill hole shape
Plug/ Anchor types:	 Plastic expansion plug Metal expansion anchor	 Compound/Reaction anchor Injection anchor	 Cavity plug Zykon anchor

3. The area of use (pressure zone or tension zone?)

When using heavy-duty plugs/anchors in concrete it is decisive to know if the anchoring is to be carried out in the area of a proven pressure zone (consistently non-cracked concrete) or in a tension zone by itself (cracking concrete/concrete inclined to crack).

Tension zones with V-shaped bending cracks form in concrete due to its own weight, superficial loads, e.g. below ceilings. In this area of use, only plugs and anchors suited for crack/tension zones are permitted. Other plugs and anchors are only permitted for proved pressure zones.

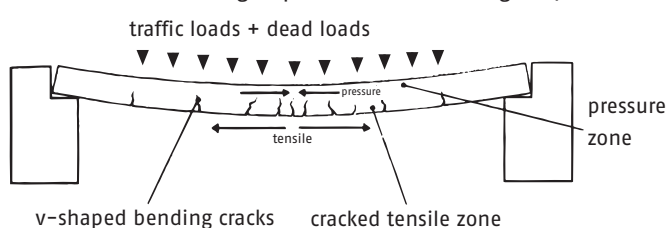
(Tension-zone approved plugs and anchors → Table 5)

4. The anchoring position

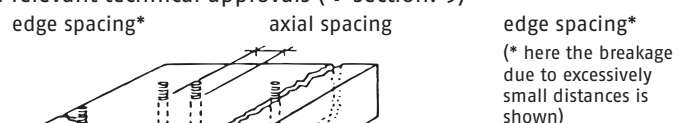
Plugs and anchors with high expansion pressure and heavy loads can lead to cracks or concrete edge failure of the component in any anchoring base, especially with narrow/flat components.

According to their mode of operation, dimensions and load magnitudes, the plugs and anchors have been assigned the following to prevent undesirable damage from happening:

- Minimum component thicknesses
- Edge spacing
- Axial spacing (with plug pairs/groups)
- Minimum anchoring depths/installation lengths (→ Section 7) in the relevant technical approvals (→ Section. 9)



If in doubt, it is recommended to use tension zone approved plugs and anchors.



Non-binding typical values:
 Edge spacing $\geq 2 \times$ minimum anchoring depth
 Axial spacing $\leq 4 \times$ minimum anchoring depth
 (the approval details are to be observed on a case-by-case basis)



5. Loading

Alongside the criteria treated in 1–4, the permitted load (F) per plug or anchor is influenced by:

- Plug/Anchor dimensioning, installation depth, distances
 - Material/Property class of the plug/anchor and the building component into which the loads were inserted
 - Building component thickness, load working point, load type (pull, diagonal pull, pressure, transverse force, bending)
 - Safety factors, details in the approvals
- For a) The basis used for the calculation is the size of the actually supporting threaded part (nominal size partially relate to the outer/sheath/drill diameters)
- For b) The basis used for the values in approvals/from manufacturers apply to the corresponding form of delivery – e.g. steel, 8.8 or stainless steel A2/A4

6. Corrosion protection

The following guideline applies when specifying the proper protection of fixings against various types of corrosion:

The "Plug/Anchor fixing corrosion system" needs to be at least as fixed, durable and corrosion-resistant in the conditions of use as the parts to be fitted

The task of constructive planning is to determine the necessary corrosion protection measures:

Here the wear-and-tear contingency of the corrosion protection in known operating conditions is to be taken into account until maintenance is due or until the limitation of damages has been reached. Surface or material specifications are to be set accordingly in the article order text.

Table 3: Overview of the surface and material corrosion protection options

Delivery condition/ Corrosion protection	Extent of load/ Protective effect	Area of use	Notes
Zinc plated steel Coating thickness ~ 5–8 mm	I – II = mild – moderate	closed, dry interior rooms	
Hot dip galvanized steel (tZn) Coating thickness ≥ 40 mm	≥ IV = very strong	outdoor area e.g. pole/ crash barrier fixing	only with thicker dimensions due to the necessary play of the thread not a component of the tech. approval
Plastic (Nylon)	> IV = very durable	all atmospheric conditions	only special models on offer
Stainless steel A 4 (Werkst.1.4401/ 1.4571)	> IV = very durable	general atmospheric conditions rear-ventilated facades/roofs seawater/sea air	not for atmospheres containing chlorine (danger of pitting/stress corrosion)
Stainless steel Material 1.4529	> IV = very durable	specifically, indoor swimming pools, tunnels, parking garages, seawater areas	specifically for areas with high chlorine/chloride exposure

7. The clamp length – the installation length

The entire length of ready-to-install complete plugs/anchors for push-through installations is subdivided into:

- Clamp length** ("use length", "grip strength", "grip thickness") $d_a/t_{fix}/d_o + t_{fix}$
These need to be chosen as at least as large as the entire thickness of the assembly components to be fastened + non-structural construction material layers (plaster)
– for stand-off fixing + distance
- Installation length/Anchoring length h_{ef}**
This needs to be integrated as a minimum anchoring depth in the fully load-bearing building material section. Load values only apply with the correct installation depth. See assembly instructions.

8. The assembly

Plugs and anchors can only achieve their intended task when they are properly installed.

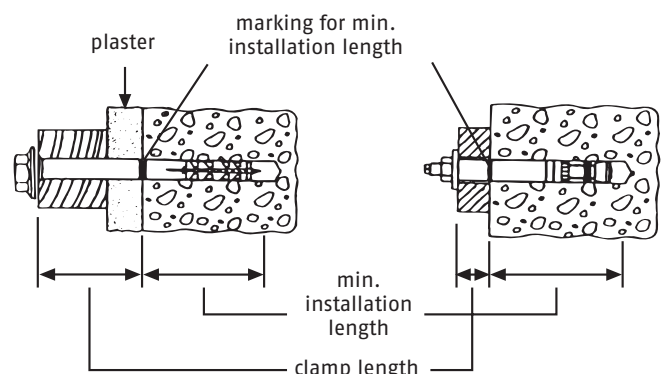
The planner is to instruct the following for installation:

- Type, execution and dimension of the plug/anchor
- Edge and axial spacing on the component
- Special specifications of the technical approval

The grip/use lengths and the installation lengths/depths for the corresponding plugs and anchors are listed in the REYHER catalogue.

The following needs to be taken into consideration for correct assembly:

- The specifications of the planner according to sections 1 – 7
- Drills and drill techniques (→ 8.1 Table 4)
- Drillhole Ø/depth (→ Assembly instructions of the manufacturer)
- Borehole cleaning (→ 8.2)
- Assembly type (→ 8.3)
- Minimum anchoring depth/clamp length (→ 7)





8.1 Drilling

Table 4:

Anchoring base	Drill	Drilling technique	Machine	Notes
Concrete $\geq$ B 25/C20/25	Hammer drills	Rotary/Hammer drilling low hammer count and high hammer power	Drilling hammer	for very large drillhole $\varnothing$ or very strong concrete reinforcement or diamond/ core drilling method.
	B 15/C12/15	Stone drills	Impact drilling machine	–
Solid building materials with dense/fixed structure	Stone drills	Impact drilling	Impact drilling machine	depending on the component thickness and component stability
	Hammer drills	Rotary/Hammer drilling	Drilling hammer	
Light-weight building mate- rial with low strength (Porous/Light-weight concrete)	Stone drills	Rotary drilling without impact	Drilling machine	make sure that the drill- hole does not get too large and that the bars of the hole/hollow brick stones don't break off
		Impact drilling	Impact drilling machine	
Perforated bricks	Stone drills	Rotary drilling without impact	Drilling machine	
Panels: Plasterboard/ Fibre cement	Stone drills			
Chipboard/ Wood/Wood- fibre boards	Spiral drill for wood			

8.2 Borehole cleaning

Since drill dust can not provide grip or can block the space of an undercut, all loose elements need to be removed from the drillhole before the plugs or anchors are inserted, e.g. by air-cleaning.

8.3 Assembly types (→ Bild 1)

- 8.3.1 The **push-through installation** is usually easiest for series assemblies and plug pairs as the insert holes of the building component can be used as drill gauges.
- 8.3.2 With **pre-positioned installation** the drillhole is to be accurately marked out. Internal thread anchors must end flush with the building material surface.
- 8.3.3 With **stand-off installation** pre-positioned inside thread/compound anchors with sufficiently long projecting lengths are to be used or fastening should be done with a suitably long screw.

8.4 Tightening torques/preloads

The values applicable for the various manufacturers and types are to be specified according to the technical approval by the construction engineer. Typical values can be found on the package or in the package insert.

8.5 Wrench sizes

For ready-to-install plugs and anchors, the wrench sizes are indicated on the package/in the package insert. The wrench sizes standardised for DIN/ISO screws apply to standard screws used for fastening, for example, inside thread anchors.

9. The approvals

For fasteners and anchors whose failure presents a danger to public safety, only plugs and anchors may be used which have been given approval for the use intended. General technical approvals are granted after type testing by the Deutsche Institut für Bautechnik (German Institute for Civil Engineering), Berlin (DIBT). Special approvals for particular uses are granted by the institutes declared responsible for them or the inspection centres of the relevant professional associations. Plugs and anchors with CE logos require "European Technical Approval" (ETA).

Picture 1

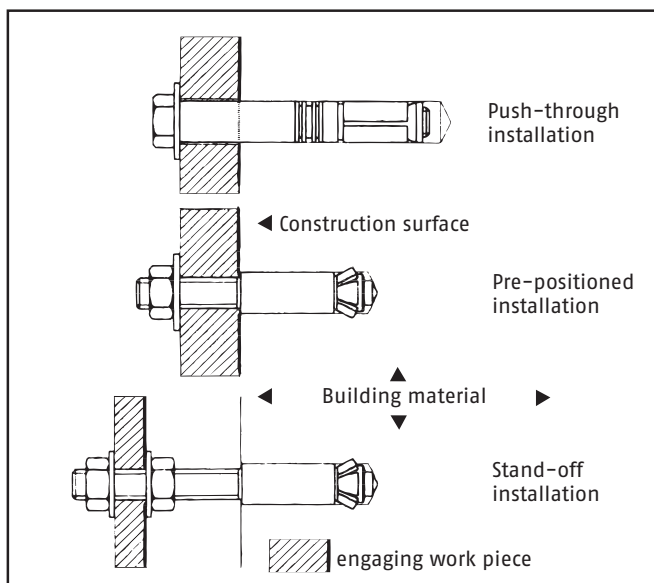


Table 5: Overview of the currently valid types of approval

German approvals 	– for metal plugs, compound anchors, plastic plugs for facade coverings and curtain wallings, plugs for light-weight suspended ceilings only, plugs for special building materials, injection anchoring for holes and hollow building materials, plugs for special requirements – for plugs with proof of suitability for use in cracks = thus usable in the tension and pressure zones of the concrete (It is fundamentally recommended that planners and operators use crack plugs/plugs suited for tension zones because attaining this means that pressure zone proof, which is difficult to attain, is not required.)
European approvals 	Building materials with the CE symbol may be traded freely in the EU economic zone. One of the requirements for the CE logo on plugs is the prior granting of "European Technical Approval" (ETA). ETA approvals are classified according to the use of the plug into Options 1–6 for cracked concrete and 7–12 for non-cracked concrete.



Overview of alternative plug/anchor systems of various manufacturers

General fixings

REYHER articles	Fischer	Upat	Sormat	TOX	Hilti	Würth	MKT	Mungo	Mea
88554	SX			AS-K/TRI/TRIKA	HUD-1	W-ZX		MQ	FX
88500	S			AS-K/TRI/TRIKA		master		MN	F
88520, 88381-383	UX		L4 KA/L4 A	AS-K/TRI/TRIKA	HUD-1	W-ZX	UD	MU	MZ/MZK
88507	GB			YTOX	HPD	W-GB/W-PA			GB
88545	FMD		4 M	MKD		W-MG		MEF	MSD
88510	M								
88506	M-S								
88521	PA 4								
88623	MS		Weco	MSD		Brass plugs		MMD	ME

High performance steel anchors

88583-589	FZA		BLS, SLS, SLKS, ILS		HDA /HSC				
88597	FZEA II				HSC-I				
88561/88741	FAZ II	MAX	BoA-X	S-FIX	HST	W-FAZ	BZ plus	m3	BAZ/BZ
88590-594	FH II		B/S/SK/AB/AS	SZ	HSL	W-HAZ	SZ	HL	SWA
88582/88764	FBN II	IMC	BoA	S-FN	HSA	W-FA	B	m2	BA/BAN
88715	EKA		BoA	S-KA	HSA	W-FA	B	m2	BA/BAN
88513	FHY				HKH/HTW	W-HD	Easy	MHDA	
88530	SLM-N/TAM						B-IG		
88567	EA II			E	HKD	W-ED	E	ESA	SA/SA-N
88546-549	FNA II		T-DN	TDN	DBZ/HA 8/HK	W-DSW-SD		MAN	MDA L
-	FDN								
88531	MR								
88688	FPX-I								
-	FBS								

Chemical fixings

88579	FHB II				HVZ/HIT-TZ/HIT-RE	W-VIZ	VMZ		
88686	FIS SB								
88579	FIS PF								
88533-534/88720-722	R	UKA 3, ASTA	KLS/KLP	TVA	HVA	W-VD	V	MVA	VA
88522/88733	FIS V360S	UPM 44		TVM-STV/STP	HIT-HY	W-VI/ WIT-VM	VMU	MIT-SE	MIS-V-V
88774, 88775	Assembly mortar	UPM 33, UPM 11							
88522/88772	FIS EM	UPM 55							
88579	FHB dynamic	UMV dyn			HDA/HVZ				

Cavity fixings

88512	HM			MHD	HHD	W-MH		MHD-S	HR/HRM
88509, 88518/519	K/KD/KDH/KM			Kippdübel	EFD/KD	W-FK /W-KD		MF/MK	FKS/FK-KS
88598	GK		LGK	GDK		W-GS Typ K		MFJ	GKD
88598	GKM			GD 37	HSP	W-GS Typ Z	GKD	MJP	GKDZ

Long-shaft anchors/frame fixings/adjustment fixings

88542	SXR				HRD-S/HRD-U	W-UR		MBR-X	R
88551	SXRL								
88504	SXS			SDF	HRD-S	WE/RW-UR		MBR	R
88563-564	FUR			SDF	HRD-U	W-RU/WD, HBR/W-UR			
88540	S-H-R				HRD-U	W-RU WD HBR/W-UR		MB	HBR
88503	N		LNS/LNZ	LSN /MSB-LSN	HPS-1	Zebra ND	ND	MNA	NP
88515	JUSS			JS-S	Set screw			MJB	JS
88516	F-S								FR
88680	F-M			MRD	HT	WUS		MMS	MR
-	Thermax								

Scaffold fixings

88536	S14ROE + GS 12			GRD + GRS	GD + GRS			MGD + MGv	GR + ÖS
-------	----------------	--	--	-----------	----------	--	--	-----------	---------

Insulation fixings

88514	DHK			DH	IDP	W-IN		MDS,MDP,MIS MIP	DSH
-------	-----	--	--	----	-----	------	--	-----------------	-----

Selection aids, dimensioning programmes and product information

fischer

Einfach. Sicher.

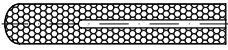
Upat

REYHER
www.fischer.de
www.reyher.de

Chemical fixings

Article 88579 FHB II-P

FISCHER resin capsules FHB II-P
building materials: BN



For use with anchors FHB-A.
Observe the period of hardening according to the package's specifications.

Dimensions in stock:

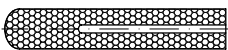
Fixing systems: 611

Dimensions	8x60	10x60	10x95	12x75	12x100	12x120	16x95
d_0	10	10	12	12	14	14	16
$h_0 = t$	75	75	110	90	115	135	110
h_{ef}	60	60	95	75	100	120	95
matching for	FHB II-A L	FHB II-A S	FHB II-A L	FHB II-A S	FHB II-A L	FHB II-A L	FHB II-A S

Dimensions	16x125	16x145	16x160	20x170	20x210	24x170	24x210
d_0	18	18	18	25	25	25	25
$h_0 = t$	145	165	175	190	235	190	235
h_{ef}	125	145	160	170	210	170	210
matching for	FHB II-A L	FHB II-A L	FHB II-A L	FHB II-A S	FHB II-A L	FHB II-A S	FHB-A L

Article 88533 RM

FISCHER resin capsules RM
building materials: BN, VD



For use with threaded rod RGM.
Observe the period of hardening according to the package's specifications.

Dimensions in stock:

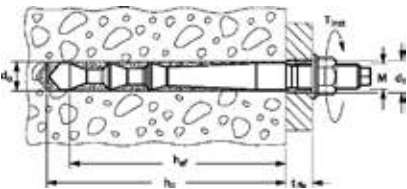
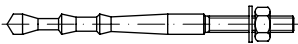
Fixing systems: 612

Dimensions	8	10	12	16
d_0	10	12	14	18
$t = h_{ef}$	80	90	110	125
matching for RG	M 8	M 10	M 12	M 16

Dimensions	20	24	27	30
d_0	25	28	32	35
$t = h_{ef}$	170	210	250	280
matching for RG	M 20	M 24	M 27	M 30

Article 88579 FHB II-A L

FISCHER highbond-anchors FHB II-A L
building materials: BN



For use with FHB II-P resin capsules

Dimensions in stock:

Fixing systems: 613-614

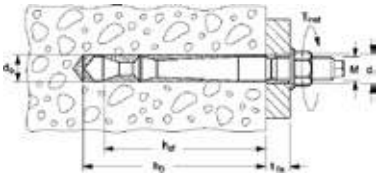
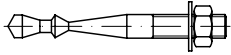
Dimensions	M 8x60/10	M 8x60/30	M 8x60/50	M 10x95/10
d_0	10	10	10	12
$h_0 = t$	75	75	75	110
h_{ef}	60	60	60	95
t_{fix}	10	30	50	10
thread	M 8	M 8	M 8	M 10
SW	13	13	13	17

Dimensions	M 10x95/20	M 10x95/40	M 10x95/60	M 10x95/100
d_0	12	12	12	12
$h_0 = t$	110	110	110	110
h_{ef}	95	95	95	95
t_{fix}	20	40	60	100
thread	M 10	M 10	M 10	M 10
SW	17	17	17	17

Chemical fixings

Article 88579 FHB II-A S

FISCHER highbond-anchors FHB II-A S
building materials: BN



For use with resin capsules FHB II-P
and FHB II-PF

Dimensions in stock:
Fixing systems: 613

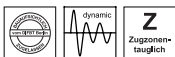
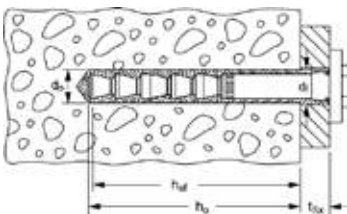
Dimensions	M 10x60/10	M 10x60/20	M 10x60/40	M 10x60/60	M 10x60/100	M 10x75/10	M 10x75/20
d_0	10	10	10	10	10	10	10
$h_0 = t$	75	75	75	75	75	90	90
h_{ef}	60	60	60	60	60	75	75
t_{fix}	10	20	40	60	100	10	20
M	M 10	M 10	M 10	M 10	M 10	M 10	M 10
SW	17	17	17	17	17	17	17

Dimensions	M 10x75/60	M 10x75/100	M 12x75/10	M 12x75/25	M 12x75/40	M 12x75/60	M 12x75/100
d_0	10	10	12	12	12	12	12
$h_0 = t$	90	90	90	90	90	90	90
h_{ef}	75	75	75	75	75	75	75
t_{fix}	60	100	10	25	40	60	100
M	M 10	M 10	M 12	M 12	M 12	M 12	M 12
SW	17	17	19	19	19	19	19

Dimensions	M 12x75/165	M 16x95/30	M 16x95/60	M 16x95/100	M 16x95/165	M 20x170/50	M 24x170/50
d_0	12	16	16	16	16	25	25
$h_0 = t$	90	110	110	110	110	190	190
h_{ef}	75	95	95	95	95	170	170
t_{fix}	165	30	60	110	165	50	50
M	M 12	M 16	M 16	M 16	M 16	M 20	M 24
SW	19	24	24	24	24	30	36

Article 88579 FHB-A dyn

FISCHER highbond-anchors FHB-A dyn
building materials: BN



For use with injection mortar FIS HB
(REYHER article 88522 and 88578)

Dimensions in stock:
Fixing systems: 614

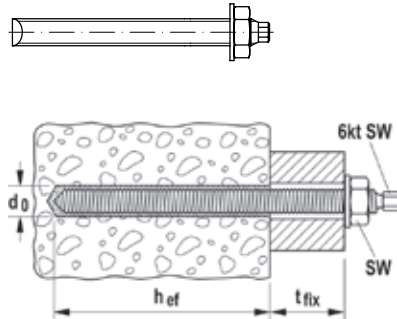
Dimensions	12x100/25	12x100/50	16x125/25
d_0	14	14	18
t_d	130	155	155
$t = h_{ef}$	100	100	125
t_{fix}	8 - 25	8 - 50	10 - 25
d_1	15	15	19
SW	19	19	24

Dimensions	16x125/50	20x170/50	24x220/50
d_0	18	24	28
t_d	180	225	275
$t = h_{ef}$	125	170	220
t_{fix}	10 - 50	12 - 50	14 - 50
d_1	19	25	29
SW	24	30	36

Chemical fixings

Article 88534 RG M

FISCHER anchor rods RG M
building materials: BN, VD



For use with cartridge RM and RSB
(REYHER article 88533 and 88687)

Dimensions in stock:

Fixing systems: 614

Dimensions	M 8x110	M 8x150	M 8x250	M 10x130	M 10x165	M 10x190	M 10x220	M 10x250
d ₀	10	10	10	12	12	12	12	12
t _{fix}	13	54	160	20	55	80	110	140
h _{ef}	80	80	80	90	90	90	90	90
wrench size hexagon	5	5	5	7	7	7	7	7

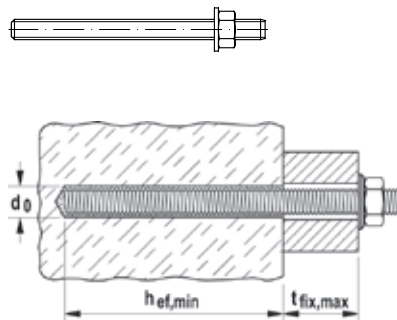
Dimensions	M 10x350	M 12x160	M 12x220	M 12x250	M 12x300	M 12x380	M 16x165	M 16x190
d ₀	12	14	14	14	14	14	18	18
t _{fix}	240	25	86	116	166	246	8	35
h _{ef}	90	110	110	110	110	110	125	125
wrench size hexagon	7	8	8	8	8	8	12	12

Dimensions	M 16x250	M 16x270	M 16x300	M 16x380	M 16x500	M 20x260	M 20x290	M 20x350
d ₀	18	18	18	18	18	25	25	25
t _{fix}	93	113	143	223	343	65	84	124
h _{ef}	125	125	125	125	125	170	170	170
wrench size hexagon	12	12	12	-	-	12	12	12

Dimensions	M 20x500	M 24x295	M 24x300	M 24x400	M 24x600	M 30x380	M 30x500	
d ₀	25	28	28	28	28	35	35	
t _{fix}	294	56	65	161	361	65	185	
h _{ef}	170	210	210	210	210	280	280	
wrench size hexagon	-	-	-	-	-	-	-	

Article 88523 FIS A

FISCHER threaded rods FIS A
building materials with
anchor sleeve: LD, VD
building materials without
anchor sleeve: BL, VD, VP



Dimensions in stock:

Fixing systems: 615

Dimensions	6x75	6x85	6x110	8x90	8x110	8x130	10x110
d ₀	8	8	8	10	10	10	12
t _{min.}	-	80	80	80	80	80	80
h _{ef min.}	-	75	75	75	75	75	75
t _{fix max.}	-	2	25	-	25	45	25
anchors per 360ml capsule*	56	56	56	56	56	56	42

Dimensions	10x130	10x150	10x200	12x140	12x160	12x180	12x210
d ₀	12	12	12	14	14	14	14
t _{min.}	80	80	80	80	80	80	80
h _{ef min.}	75	75	75	75	75	75	75
t _{fix max.}	45	65	115	50	70	90	120
anchors per 360ml capsule*	42	42	42	34	34	34	34

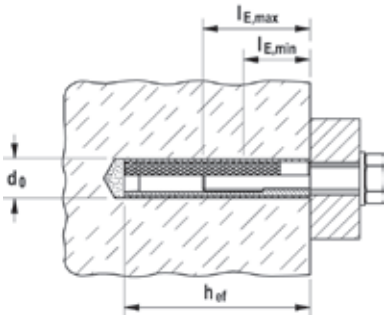
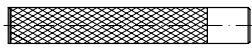
Dimensions	12x260	16x175	16x200	16x250	16x300	20x245	20x290
d ₀	14	18	18	18	18	24	24
t _{min.}	80	80	80	80	80	80	80
h _{ef min.}	75	75	75	75	75	75	75
t _{fix max.}	170	85	110	160	210	-	-
anchors per 360ml capsule*	34	24	24	24	24	-	-

Dimensions	24x290	24x380	30x340	30x430			
d ₀	28	28	35	35			
t _{min.}	80	80	80	80			
h _{ef min.}	75	75	75	75			
t _{fix max.}	-	-	-	-			
anchors per 360ml capsule*	-	-	-	-			

Chemical fixings

Article 88529 FIS-E

FISCHER internal threaded sockets FIS-E



For use with injection mortar
FIS-V, FIS-VS and FIS-VW (REYHER article 88522)
 l_E = length of thread engagement

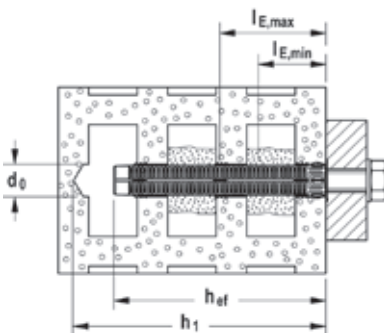
Dimensions in stock:

Fixing systems: 615

Dimensions	11x85	11x85	15x85	15x85
$t = h_{ef}$	85	85	85	85
$l_{E, min.}$	6	8	10	12
$l_{E, max.}$	60	60	60	60
d_s	M 6	M 8	M 10	M 12
matching for	FIS H 16x85 K FIS H 20x85 K	FIS H 16x85 K FIS H 20x85 K	FIS H 20x85 K	FIS H 20x85 K

Article 88562 FIS H K

FISCHER injection anchor sleeves FIS H K
building materials: LP, (VD)



For use with injection mortar
FIS-V, FIS-VS and FIS-VW
(REYHER article 88522)
* max. number when processing
with 1 static mixer

Dimensions in stock:

Fixing systems: 615

Dimensions	12x50	12x85	16x85
d_0	12	12	16
t_d	60	95	95
h_{ef}	50	85	85
matching for	FIS-A (M 6/M 8) FIS-EK Ø5	FIS-A (M 6/M 8) FIS-EK (Ø5/Ø6)	FIS-A (M 8/M 10) FIS-E (M 6/M 8) FIS-EK (Ø8/Ø10)
anchors per 360ml capsule*	34	17	14

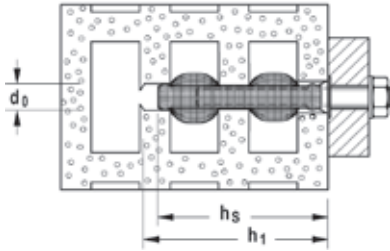
Dimensions	16x130	20x85	20x130
d_0	16	20	20
t_d	140	95	140
h_{ef}	130	85	130
matching for	FIS-A (M 8/M 10) FIS-E (M 6/M 8), FIS-EK (Ø8/Ø10)	FIS-A (M 12/M 16) FIS-E (M 6 - M 12)	FIS A (M 12 - M 16)
anchors per 360ml capsule*	11	11	

Dimensions	20x200		
d_0	20		
t_d	210		
h_{ef}	200		
matching for	FIS A (M 12 - M 16)		
anchors per 360ml capsule*			

Chemical fixings

Article 88526 FIS H N

FISCHER injection anchor sleeves FIS H N
building materials: LP, VD



For use with injection mortar
FIS-V, FIS-VS and FIS-VW (REYHER article 88522)
hs = anchor depth sleeve min.
hv = anchor depth anchor part min.
* max. number when processing with 1 static mixer

Dimensions	16x85	18x85
d_0	16	18
h_1	95	95
h_s	90	90
matching for FIS-A	M 8	M 10
anchors per 360ml capsule*	11	10
Dimensions	20x85	
d_0	20	
h_1	95	
h_s	90	
matching for FIS-A	M 12	
anchors per 360ml capsule*	9	

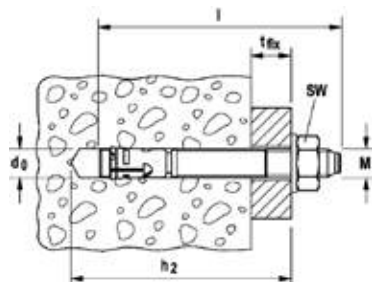
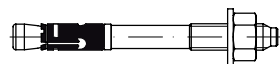
Dimensions in stock:

Fixing systems: 615

High performance steel anchors

Article 88561 FAZ II

FISCHER Anchor bolts FAZ II
building materials: BN, VD



Dimensions	8/10	8/30	8/50	10/10	10/20	10/30	10/50
d ₀	8	8	8	10	10	10	10
h ₂	65	85	105	85	95	105	125
l	75	95	115	95	105	115	135
t _{fix}	10	30	50	10	20	30	50
SW	13	13	13	17	17	17	17
Washer Ø für GS	22x2.5	22x2.5		25x3		25x3	

Dimensions	10/80	10/100	10/160	12/10	12/20	12/30	12/50
d ₀	10	10	10	12	12	12	12
h ₂	155	175	235	100	110	120	140
l	165	185	245	110	120	130	150
t _{fix}	80	100	160	10	20	30	50
SW	17	17	17	19	19	19	19
Washer Ø für GS				30x3	30x3	30x3	30x3

Dimensions	12/80	12/100	12/160	12/200	16/5	16/25	16/50
d ₀	12	12	12	12	16	16	16
h ₂	170	190	250	290		135	160
l	180	200	260	300	128	148	173
t _{fix}	80	100	160	200	5	25	50
SW	19	19	19	19	24	24	24
Washer Ø für GS		30x3	44x4				

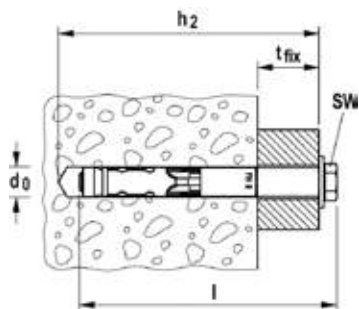
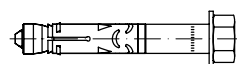
Dimensions	16/100	16/160	20/30	20/60	20/160	24/30	24/60
d ₀	16	16	20	20	20	24	24
h ₂	210	270	155	185	285	185	215
l	223	283	172	202	302	205	235
t _{fix}	100	160	30	60	160	30	60
SW	24	24	30	30	30	36	36
Washer Ø für GS		56x5					

Dimensions in stock:

Fixing systems: 616

Article 88593 FH II-S

FISCHER high performance anchors FH II-S
building materials: BN, VD



Dimensions	10/10	10/25	10/50	12/10	12/25	12/50	15/10	15/25	15/50
d ₀	10	10	10	12	12	12	15	15	15
t _d	65	80	105	90	105	130	100	115	140
h _{ef}	40	40	40	60	60	60	70	70	70
l	70	85	110	90	105	130	106	121	146
t _{fix}	10	25	50	10	25	50	10	25	50
thread	M 6	M 6	M 6	M 8	M 8	M 8	M 10	M 10	M 10
SW	10	10	10	13	13	13	17	17	17
washer	18x2	18x2	18x2	22x2.5	22x2.5	22x2.5	25x3	25x3	25x3

Dimensions	18/25	18/50	24/25	24/50	28/30	28/60	32/30	32/60	
d ₀	18	18	24	24	28	28	32	32	
t _d	130	155	150	175	185	215	210	210	
h _{ef}	80	80	100	100	125	125	150	150	
l	132	157	160	185	192	222	215	245	
t _{fix}	25	50	25	50	30	60	30	60	
thread	M 12	M 12	M 16	M 16	M 20	M 20	M 24	M 24	
SW	19	19	24	24	30	30	36	36	
washer	30x3	30x3	40x5	40x5	44x4.5	44x4.5	50x5	50x5	

l = total anchor length
VdS approval M 8 – M 20
FM approval starting from M 10

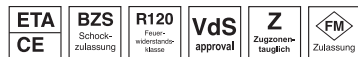
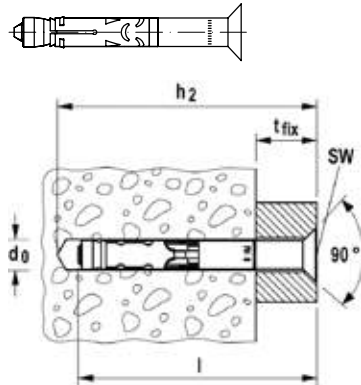
Dimensions in stock:

Fixing systems: 617

High performance steel anchors

Article 88594 FH II-SK

FISCHER high performance anchors FH II-SK
building materials: BN, VD



VdS approval M 8 – M 20
FM approval starting from M 10

Dimensions in stock:

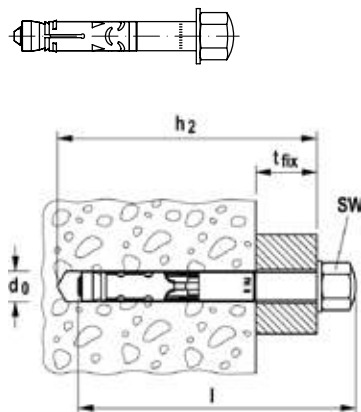
Fixing systems: 617

Dimensions	10/15	10/25	10/50	12/15	12/25	12/30	12/50
d ₀	10	10	10	12	12	12	12
t _d	70	80	105	95	105	110	130
h _{ef}	40	40	40	60	60		60
l	65	75	100	90	100	105	125
t _{fix}	10	25	50	15	25	30	50
thread	M 6	M 6	M 6	M 8	M 8		M 8
SW	4	4	4	5	5	6	5
x	5	5	5	5.8	5.8		5.8
D	18	18	18	22	22		22

Dimensions	15/15	15/25	15/50	18/15	18/25	18/30	18/50
d ₀	15	15	15	18	18	18	18
t _d	105	115	140	120	130	135	155
h _{ef}	70	70	70	80	80		80
l	100	110	135	115	125	130	150
t _{fix}	15	25	50	15	25	30	50
thread	M 10	M 10	M 10	M 12	M 12		M 12
SW	6	6	6	8	8	8	8
x	5.8	5.8	5.8	8	8		8
D	25	25	25	32	32		32

Article 88590 FH II-H

FISCHER high performance anchors FH II-H
building materials: BN, VD



l = total anchor length
VdS approval M 8 – M 20
FM approval starting from M 10

Dimensions in stock:

Fixing systems: 618

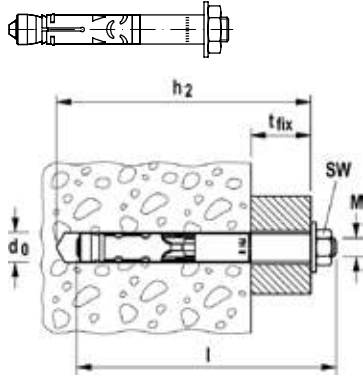
Dimensions	10/10	10/25	10/50	12/10	12/25	12/50
d ₀	10	10	10	12	12	12
t _d	65	80	105	90	105	130
h _{ef}	40	40	40	60	60	60
l	75	90	115	92	107	132
t _{fix}	10	25	50	10	25	50
thread	M 6	M 6	M 6	M 8	M 8	M 8
SW	13	13	13	17	17	17
washer	18x2	18x2	18x2	22x2.5	22x2.5	22x2.5

Dimensions	15/10	15/25	15/50	18/25	18/50	
d ₀	15	15	15	18	18	
t _d	100	115	140	130	155	
h _{ef}	70	70	70	80	80	
l	113	128	153	138	163	
t _{fix}	10	25	50	25	50	
thread	M 10	M 10	M 10	M 12	M 12	
SW	17	17	17	19	19	
washer	25x3	25x3	25x3	30x3	30x3	

High performance steel anchors

Article 88592 FH II-B

FISCHER high performance anchors FH II-B
building materials: BN, VD



l = total anchor length
VdS approval M 8 – M 20
FM approval starting from M 10

Dimensions in stock:

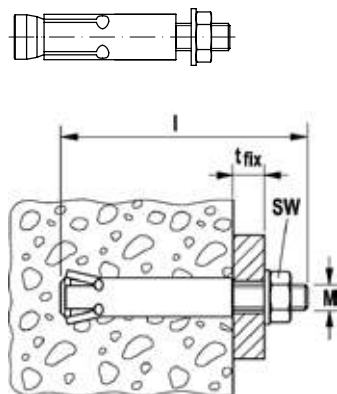
Fixing systems: 618

Dimensions	10/10	10/25	10/50	12/10	12/25	12/50	12/100	15/10	15/25
d ₀	10	10	10	12	12	12	12	15	15
t _d	65	80	105	90	105	130	190	100	115
h _{ef}	40	40	40	60	60	60	60	70	70
l	70	85	110	90	105	130	184	110	125
t _{fix}	10	25	50	10	25	50	100	10	25
thread	M 6	M 6	M 6	M 8	M 8	M 8	M 8	M 10	M 10
SW	10	10	10	13	13	13	13	17	17
washer	18x2	18x2	18x2	22x2.5	22x2.5	22x2.5	22x2.5	25x3	25x3

Dimensions	15/50	15/100	18/25	18/50	18/100	24/25	24/50	24/100	
d ₀	15	15	18	18	18	24	24	24	
t _d	140	190	130	155	205	150	175	225	
h _{ef}	70	70	80	80	80	100	100	100	
l	150	200	135	160	214	167	192	242	
t _{fix}	50	100	25	50	100	25	50	100	
thread	M 10	M 10	M 12	M 12	M 12	M 16	M 16	M 16	
SW	17	17	19	19	19	24	24	24	
washer	25x3	25x3	30x3	30x3	30x3	40x5	40x5	40x5	

Article 88583 FZA

FISCHER ZYKON bolt anchors FZA
building materials: BN, VD



VdS approval starting form M 8

Dimensions in stock:

Fixing systems: 617

Dimensions	10x40 M 6/10	10x40 M 6/35	12x40 M 8/15	12x50 M 8/15
d ₀	10	10	12	12
h _{ef}	40		40	50
t _{fix}	10	35	15	15
thread	M 6	M 6	M 8	M 8
SW	10	10	13	13
washer	12x1.6		16x1.6	16x1.6

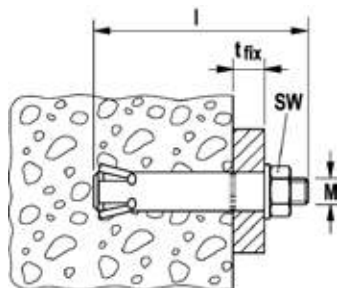
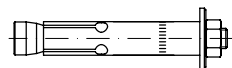
Dimensions	12x50 M 8/50	14x40 M 10/25	14x60 M 10/25	14x60 M 10/50
d ₀	12	14	14	14
h _{ef}	50	40	60	60
t _{fix}	50	25	25	50
thread	M 8	M 10	M 10	M 10
SW	13	17	17	17
washer	16x1.6	20x2	20x2	20x2

Dimensions	18x80 M 12/25	18x80 M 12/55	22x100 M 16/60	22x125 M 16/60
d ₀	18	18	22	22
h _{ef}	80	80	100	125
t _{fix}	25	55	60	60
thread	M 12	M 12	M 16	M 16
SW	19	19	24	24
washer	24x2.5	24x2.5	30x3	30x3

High performance steel anchors

Article 88584 FZA-D

FISCHER ZYKON through anchors FZA-D
building materials: BN, VD



VdS approval starting from M 8

Dimensions in stock:

Fixing systems: 618

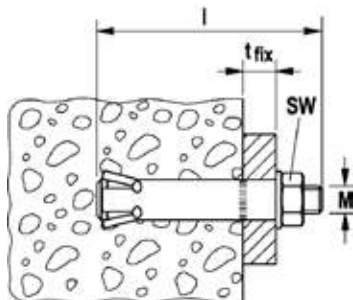
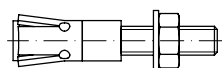
Dimensions	12x50 M 8/10	12x60 M 8/10	12x80 M 8/30
d_0	12	12	12
h_{ef}	40	50	50
t_{fix}	10	10	30
thread	M 8	M 8	M 8
SW	13	13	13
washer	22x2.5	22x2.5	22x2.5

Dimensions	14x80 M 10/20	14x100 M 10/40	18x100 M 12/20
d_0	14	14	18
h_{ef}	60	60	80
t_{fix}	20	40	20
thread	M 10	M 10	M 12
SW	17	17	19
washer	25x3	25x3	30x3

Dimensions	18x130 M 12/50	22x125 M 16/25	
d_0	18	22	
h_{ef}	80	100	
t_{fix}	50	25	
thread	M 12	M 16	
SW	19	24	
washer	30x3	40x4	

Article 88589 FZA ST

FISCHER ZYKON anchors for
fixing step irons FZA ST
building materials: BN, VD



Dimensions	14/40	14/60
d_0	14	14
h_{ef}	40	60
t_{fix}	30	30
thread	M 10	M 10
SW	16	16
washer	20x2	20x2

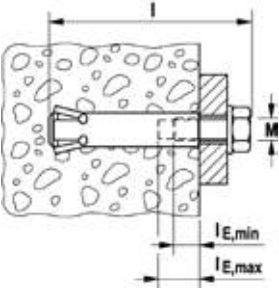
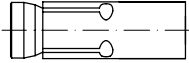
Dimensions in stock:

Fixing systems: 619

High performance steel anchors

Article 88585 FZA-I

FISCHER ZYKON internally threaded anchors FZA-I
building materials: BN, VD



VdS approval starting from M 8

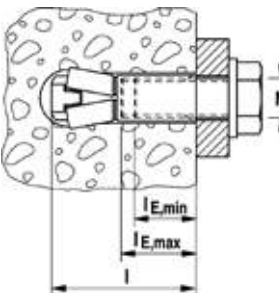
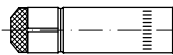
Dimensions in stock:

Fixing systems: 619

Dimensions	12x40 M 6	12x50 M 6	14x60 M 8
d_0	12	12	14
h_{ef}	40	50	60
d_s	M 6	M 6	M 8
e_2	8	8	11
e_1	13	13	17

Article 88597 FZEA II

FISCHER ZYKON hammerset anchors FZEA II
building materials: BN, VD



* internal thread

FM approval starting from M 10

VdS approval M 8 - M 20

Dimensions	10x40 M 8	12x40 M 10	14x40 M 12
d_0	10	12	14
h_{ef}	40	40	40
d_s^*	8	10	12
e_2	11	13	15
e_1	17	19	21

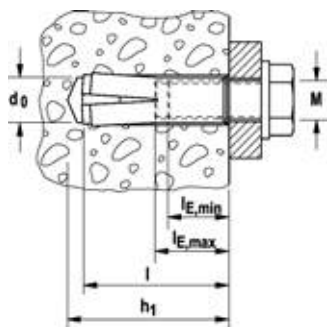
Dimensions in stock:

Fixing systems: 619

High performance steel anchors

Article 88567 EA II

FISCHER hammerset anchors EA II
building materials: BN, VD



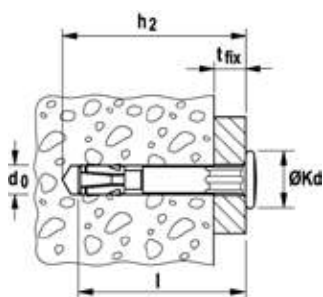
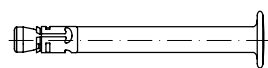
FM approval starting from M 10

Dimensions in stock:
Fixing systems: 620

Dimensions	M 6	M 8	M 8x40	M 10
d_0	8	10	10	12
$l = h_{ef}$	30	30	40	40
$l_{E, min.}$	6	8	8	10
$l_{E, max.}$	13	13	13	17
h_1	32	33	43	43
Dimensions	M 12	M 16	M 20	
d_0	15	20	25	
$l = h_{ef}$	50	65	80	
$l_{E, min.}$	12	16	20	
$l_{E, max.}$	22	28	34	
h_1	54	70	85	

Article 88546 FNA II

FISCHER nail anchors FNA II
building materials: BN, VD



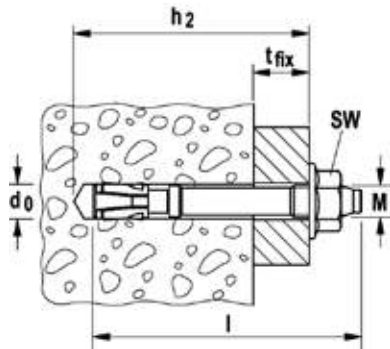
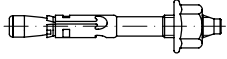
Dimensions in stock:
Fixing systems: 620

Dimensions	6x30/5	6x30/30	6x30/50
d_0	6	6	6
t_d	45	70	90
h_{ef}	30	30	30
l	40	65	85
t_{fix}	5	30	50
K_d	13	13	13
Dimensions	6x30/75	6x30/100	6x30/120
d_0	6	6	6
t_d	115	140	160
h_{ef}	30	30	30
l	110	135	155
t_{fix}	75	100	120
K_d	13	13	13

High performance steel anchors

Article 88547 FNA II M

FISCHER nail anchors FNA II M
building materials: BN, VD



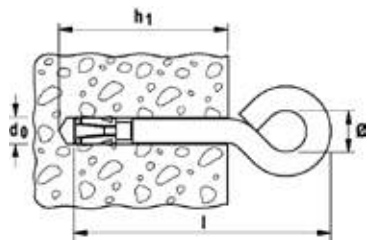
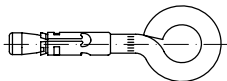
Dimensions	6x30 M 6/5
d_0	6
t_d	45
h_{ef}	30
l	50
t_{fix}	5
thread	M 6
SW	10

Dimensions in stock:

Fixing systems: 620

Article 88548 FNA II-OE

FISCHER nail anchors FNA II-OE
building materials: BN, VD



Dimensions	6x25 0e
d_0	6
t_d	35
h_{ef}	25
l	54
inner Ø eye	10

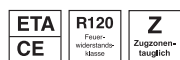
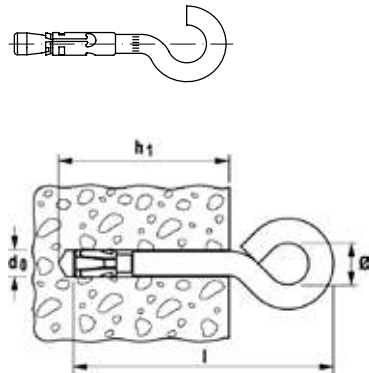
Dimensions in stock:

Fixing systems: 620

High performance steel anchors

Article 88549 FNA II-H

FISCHER nail anchors FNA II-H
building materials: BN, VD



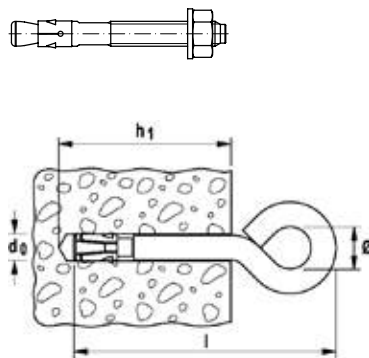
Dimensions	6x25 h
d_0	6
t_d	35
h_{ef}	25
l	54
inner $\varnothing$ hook	10
opening dimension of the fastening	6.5

Dimensions in stock:

Fixing systems: 620

Article 88582 FBN II/FBN II K

FISCHER bolt anchors FBN II/FBN II K
building materials: BN, VD



Dimensions	6/5	6/10	6/30	8/5	8/10	8/20	8/30	8/50
d_0	6	6	6	8	8	8	8	8
h_2								
l	50	55	75	66	71	81	91	111
t_{fix}	5/-	10/-	30/-	5/15	10/20	20/30	30/40	50/60
SW	10	10	10	13	13	13	13	13

Dimensions	8/70	8/100	10/10	10/20	10/30	10/50	10/70	10/100
d_0	8	8	10	10	10	10	10	10
h_2								
l	131	161	86	96	106	126	146	176
t_{fix}	70/80	100/110	10/20	20/30	30/40	50/60	70/80	100/110
SW	13	13	17	17	17	17	17	17

Dimensions	10/140	10/160	12/10	12/20	12/30	12/50	12/80	12/100
d_0	10	10	12	12	12	12	12	12
h_2								
l	216	236	106	116	126	146	176	196
t_{fix}	140/150	160/170	10/25	20/35	30/45	50/65	80/95	100/115
SW	17	17	19	19	19	19	19	19

Dimensions	12/120	12/140	12/160	16/25	16/50	16/80	16/100	16/140
d_0	12	12	12	16	16	16	16	16
h_2								
l	216	236	256	145	170	200	220	260
t_{fix}	120/135	140/155	160/175	25/40	50/65	80/95	100/115	140/155
SW	19	19	19	24	24	24	24	24

Dimensions	16/160	16/200	20/30	20/60	20/80	20/120		
d_0	16	16	20	20	20	20		
h_2								
l	280	320	187	217	237	277		
t_{fix}	160/175	200/215	30/55	60/85	80/105	120/145		
SW	24	24	30	30	30	30		

K = short version
with reduced anchor depth

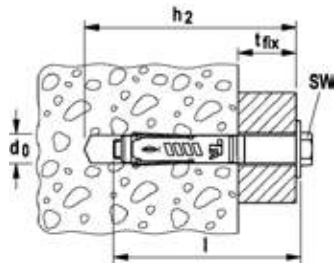
Dimensions in stock:

Fixing systems: 620

High performance steel anchors

Article 88683 TA M

FISCHER heavy duty anchors TA M
building materials: BN, VD



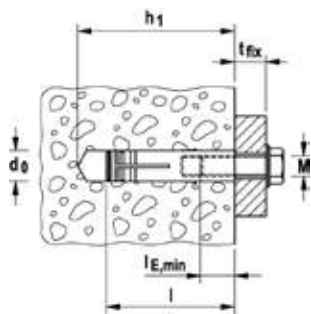
Dimensions	M 6	M 8	M 10	M 12
d_0	10	12	15	18
t	65	70	90	105
h_{ef}	40	45	55	70
l	49	56	69	86

Dimensions in stock:

Fixing systems: 622

Article 88530 SL M/SL M-N

FISCHER heavy duty anchors SL M/SL M-N
building materials: VD



Dimensions	8	10	16
d_0	12	16	24
t	60	70	110
h_{ef}	45	50	62
l	52	60	90
d_s^*	M 8	M 10	M 16

Dimensions	20	24
d_0	30	35
t	130	150
h_{ef}	77	90
l	110	125
d_s^*	M 20	M 24

$l_s = h_{ef} + d_s + t_{fix}$

* = internal thread

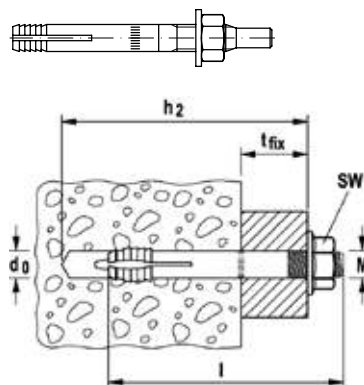
Dimensions in stock:

Fixing systems: 622

High performance steel anchors

Article 88531 MR

FISCHER wall screws MR
building materials: BN



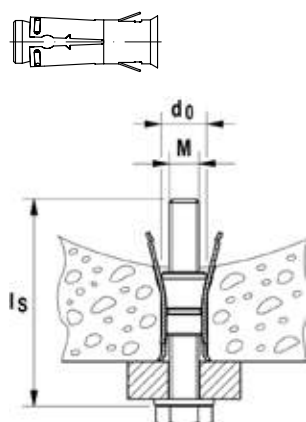
Dimensions	8	10	12
d_0	8	10	12
t_d	70	85	100
h_{ef}	40	50	60
l	70	85	100
t_{fix}	22	24	27
SW	13	15	18
thread	M 8	M 10	M 12

Dimensions in stock:

Fixing systems: 622

Article 88513 FHV

FISCHER hollow ceiling anchors FHV
building materials: BN



Approval only valid for zinc plated steel,
VdS approval starting from M 8

Dimensions	M 6	M 8	M 10
d_0	10	12	16
t_d	50	60	65
h_{ef}	30	35	40
l	37	43	52
e_1	37	43	52
e_1	45	55	60

Dimensions in stock:

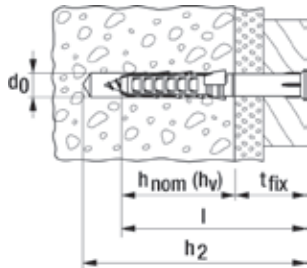
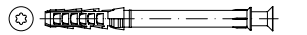
Fixing systems: 622

Long-shaft anchors/frame fixings/adjustment fixings

Article 88542 SXR-T

FISCHER frame fixings SXR-T

building materials: BN, VD, LD, LP, BL, VP



Dimensions	10x80	10x100	10x120	10x140	10x160
d_0	10	10	10	10	10
t_d	90	110	130	150	170
h_{ef}	50	50	50	50	50
l	80	100	120	140	160
t_{fix}	30	50	70	90	110
$d_s \times l_s$	7x87	7x107	7x127	7x147	7x167
drive	T40	T40	T40	T40	T40

Dimensions	10x180	10x200	10x230	10x260	
d_0	10	10	10	10	
t_d	190	210	240	270	
h_{ef}	50	50	50	50	
l	180	200	230	260	
t_{fix}	130	150	180	210	
$d_s \times l_s$	7x187	7x207	7x237	7x267	
drive	T40	T40	T40	T40	

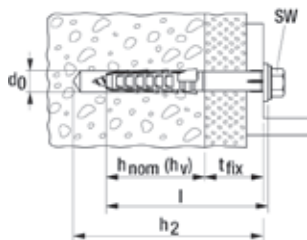
Dimensions in stock:

Fixing systems: 624–625

Article 88542 SXR-FUS

FISCHER frame fixings SXR-FUS

building materials: BN, VD, LD, LP, BL, VP



Dimensions	10x60	10x80	10x100	10x120	10x140
d_0	10	10	10	10	10
t_d	70	90	110	130	150
h_{ef}	50	50	50	50	50
l	60	80	100	120	140
t_{fix}	10	30	50	70	90
$d_s \times l_s$	7x69	7x89	7x109	7x129	7x149
drive	T40/SW13	T40/SW13	T40/SW13	T40/SW13	T40/SW13

Dimensions	10x160	10x180	10x200	10x230	10x260
d_0	10	10	10	10	10
t_d	170	190	210	240	270
h_{ef}	50	50	50	50	50
l	160	180	200	230	260
t_{fix}	110	130	150	180	210
$d_s \times l_s$	7x169	7x189	7x209	7x239	7x269
drive	T40/SW13	T40/SW13	T40/SW13	T40/SW13	T40/SW13

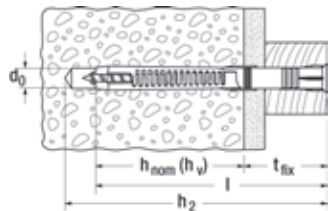
Dimensions in stock:

Fixing systems: 624

Long-shaft anchors/frame fixings/adjustment fixings

Article 88563 FUR-T

FISCHER frame fixings FUR-T
building materials: BN, VD, LD



Dimensions	8x80	8x100	8x120	10x80	10x100	10x115	10x135
d_0	8	8	8	10	10	10	10
t_d	90	110	130	90	110	125	145
h_{ef}	70	70	70	70	70	70	70
l	80	100	120	80	100	115	135
t_{fix}	10	30	50	10	30	45	65
$d_s \times l_s$	6x85	6x105	6x125	7x85	7x105	7x120	7x140
drive	T30	T30	T30	T40	T40	T40	T40

Dimensions	10x160	10x185	10x200	10x230	14x100	14x140	14x165
d_0	10	10	10	10	14	14	14
t_d	170	195	210	240	115	155	180
h_{ef}	70	70	70	70	70	70	70
l	160	185	200	230	100	140	165
t_{fix}	90	115	130	160	30	70	95
$d_s \times l_s$	7x165	7x190	7x205	7x235			
drive	T40	T40	T40	T40	T50	T50	T50

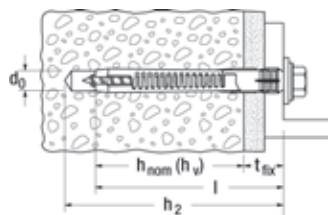
Dimensions	14x180	14x210	14x240	14x270	14x300	14x330	14x360
d_0	14	14	14	14	14	14	14
t_d	195	225	255	285	315	345	375
h_{ef}	70	70	70	70	70	70	70
l	180	210	240	270	300	330	360
t_{fix}	110	140	170	200	230	260	290
$d_s \times l_s$							
drive	T50	T50	T50	T50	T50	T50	T50

Dimensions in stock:

Fixing systems: 625

Article 88564 FUR-SS

FISCHER frame fixings FUR-SS
building materials: BN, VD, LD



Dimensions	8x80	8x100	8x120	10x80	10x100	10x115
d_0	8	8	8	10	10	10
t_d	90	110	130	90	110	125
h_{ef}	70	70	70	70	70	70
l	80	100	120	80	100	115
t_{fix}	10	30	50	10	30	45
$d_s \times l_s$	6x85	6x105	6x125	7x85	7x105	7x120
SW	10	10	10	13	13	13

Dimensions	10x135	10x160	10x185	10x200	10x230	
d_0	10	10	10	10	10	
t_d	145	170	195	210	240	
h_{ef}	70	70	70	70	70	
l	135	160	185	200	230	
t_{fix}	65	90	115	130	160	
$d_s \times l_s$	7x140	7x165	7x190	7x205	7x235	
SW	13	13	13	13	13	

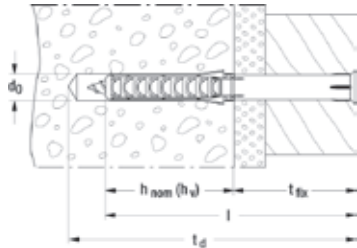
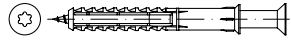
Dimensions in stock:

Fixing systems: 625

Long-shaft anchors/frame fixings/adjustment fixings

Article 88504 SXS-T

FISCHER long shaft anchors SXS-T
building materials: BN, VD, VP, HP



Dimensions	10x80	10x100	10x120
d_0	10	10	10
t_d	90	110	130
h_{ef}	50	50	50
l	80	100	120
t_{fix}	30	50	70
$d_s \times l_s$	7.6x89	7.6x109	7.6x129
drive	T40	T40	T40

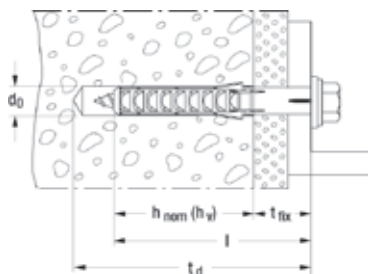
Dimensions	10x140	10x160	10x180
d_0	10	10	10
t_d	150	170	190
h_{ef}	50	50	50
l	140	160	180
t_{fix}	90	110	130
$d_s \times l_s$	7.6x147	7.6x167	7.6x187
drive	T40	T40	T40

Dimensions in stock:

Fixing systems: 626

Article 88504 SXS-F US

FISCHER long shaft anchors SXS-F US
building materials: BN, VD, VP, HP



Dimensions	10x60	10x80	10x100	10x120
d_0	10	10	10	10
t_d	70	90	110	130
h_{ef}	50	50	50	50
l	60	80	100	120
t_{fix}	10	30	50	70
$d_s \times l_s$	7.6x69	7.6x89	7.6x109	7.6x129
drive	T40	T40	T40	T40
SW	13	13	13	13

Dimensions	10x140	10x160	10x180	
d_0	10	10	10	
t_d	150	170	190	
h_{ef}	50	50	50	
l	140	160	180	
t_{fix}	90	110	130	
$d_s \times l_s$	7.6x147	7.6x167	7.6x187	
drive	T40	T40	T40	
SW	13	13	13	

Dimensions in stock:

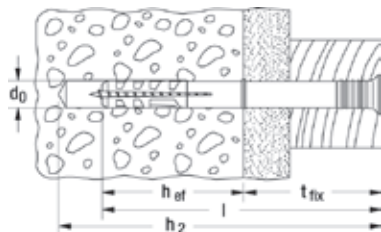
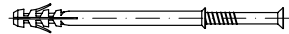
Fixing systems: 626

Long-shaft anchors/frame fixings/adjustment fixings

Article 88503 N-S

FISCHER nail plugs N-S

building materials: BN, VD, VP, HP, LD, LP



delivery Ø 5, 6, 8 mounted pre-finished

Dimensions in stock:

Fixing systems: 626

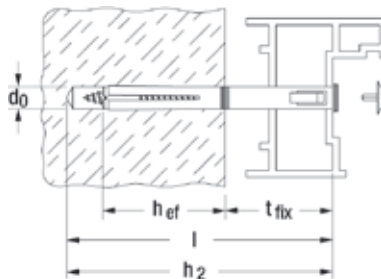
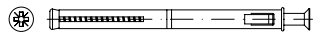
Dimensions	5x30	5x40	5x50	6x40	6x60	6x80	8x60
d ₀	5	5	5	6	6	6	8
t _d	45	55	65	55	75	95	75
h _{ef}	25	25	25	30	30	30	40
l	30	40	50	40	60	80	60
t _{fix}	5	15	25	10	30	50	20
d _s x l _s	3.5x38	3.5x48	3.5x58	4x48	4x64	4x88	5x65

Dimensions	8x80	8x100	8x120	10x100	10x135	10x160	10x230
d ₀	8	8	8	10	10	10	10
t _d	95	115	135	115	150	175	245
h _{ef}	40	40	40	50	50	50	50
l	80	100	120	100	135	160	230
t _{fix}	40	60	80	50	85	110	180
d _s x l _s	5x85	5x105	5x125	7x110	7x145	7x170	6x240

Article 88516 F-S

FISCHER frame fixings F-S

building materials: BN, VD, VP, BL, HP, LP



screw head Ø 10 mm/Ø 12 mm

Dimensions in stock:

Fixing systems: 627

Dimensions	F 8 S 100	F 8 S 120	F 8 S 140	F 10 S 75
d ₀	8	8	8	10
t _d	115	135	155	90
h _{ef}	40	40	40	50
l	100	120	140	75
t _{fix}	50	70	90	15
plug collar Ø	10	10	10	12

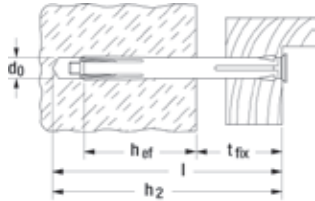
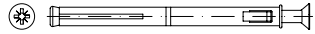
Dimensions	F 10 S 100	F 10 S 120	F 10 S 140	F 10 S 165
d ₀	10	10	10	10
t _d	115	135	155	180
h _{ef}	50	50	50	50
l	100	120	140	165
t _{fix}	40	60	80	105
plug collar Ø	12	12	12	12

Long-shaft anchors/frame fixings/adjustment fixings

Article 88680 F-M

FISCHER metal frame fixings F-M

building materials: BN, VD, VP, BL, HP



R120
Four-
sided anchor
Mass

The approval is only valid for $\varnothing 10$ mm
Screw head $\varnothing 9$ mm/ $\varnothing 13$ mm

Dimensions in stock:

Fixing systems: 627

Dimensions	F 8 M 72	F 8 M 92	F 8 M 112	F 8 M 132
d_0	8	8	8	8
t_d	90	110	130	150
h_{ef}	30	30	30	30
l	72	92	112	132
t_{fix}	42	62	82	102

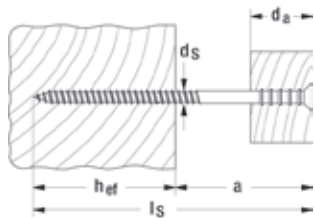
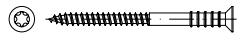
Dimensions	F 10 M 72	F 10 M 92	F 10 M 112	F 10 M 132
d_0	10	10	10	10
t_d	90	110	130	150
h_{ef}	30	30	30	30
l	72	92	112	132
t_{fix}	42	62	82	102

Dimensions	F 10 M 152	F 10 M 182	F 10 M 202	
d_0	10	10	10	
t_d	170	200	220	
h_{ef}	30	30	30	
l	152	182	202	
t_{fix}	122	152	172	

Article 88515 JUSS

FISCHER adjustment screws JUSS

building materials: Wood and wood materials



Dimensions	6x60	6x70	6x80	6x90
h_{ef}	30	30	30	30
a	30	40	50	60
$d_s \times l_s$	6x60	6x70	6x80	6x90
d_a	20	25	25	25
drive	T25	T25	T25	T25

Dimensions	6x100	6x110	6x120	6x145
h_{ef}	30	30	30	30
a	70	80	90	115
$d_s \times l_s$	6x100	6x110	6x120	6x145
d_a	25	25	25	25
drive	T25	T25	T25	T25

Dimensions in stock:

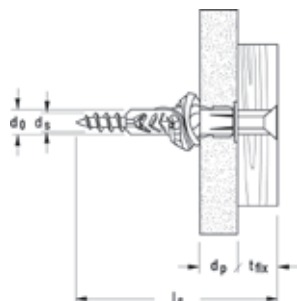
Fixing systems: 627

General fixings

Article 88520 UX

FISCHER universal plugs UX

building materials: BN, BL, VD, LD, VP, LP, HP



$$l_s = l + d_p + t_{fix} + d_s$$

* also with border

Dimensions in stock:

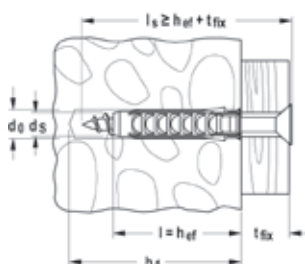
Fixing systems: 627

Dimensions	6x35*	8x50*	10x60*
d_0	6	8	10
t	45	60	75
d_p	9.5	9.5	12.5
l	35	50	60
d_s	4 - 5	4.5 - 6	6 - 8
Dimensions	12x70	14x75	
d_0	12	14	
t	85	95	
d_p	-	-	
l	70	75	
d_s	8 - 10	10 - 12	

Article 88554 SX

FISCHER expansion plugs SX

building materials: BN, VD, VP, BL, HP, LP, LD



* with screw

Dimensions in stock:

Fixing systems: 628

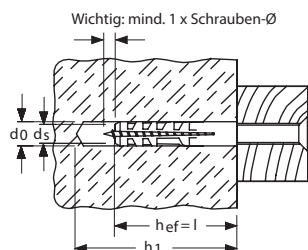
Dimensions	4x20	5x25	6x30	6x30 S/10*	8x40
d_0	4	5	6	6	8
t	25	35	40	40	50
$l = h_{ef}$	20	25	30	30	40
d_s	2 - 3	3 - 4	4 - 5	4.5x40	4.5 - 6
Dimensions	8x40 S/20*	10x50	12x60	14x70	16x80
d_0	8	10	12	14	16
t	50	70	80	90	100
$l = h_{ef}$	40	50	60	70	80
d_s	5x60	6 - 8	8 - 10	10 - 12	12 (1/2")

General fixings

Article 88500 S

FISCHER expansion plugs S

building materials: BN, VD, VP



Dimensions	4	5	6	7	8
d_0	4	5	6	7	8
t	25	35	40	40	55
$l = h_{ef}$	20	25	30	30	40
d_s	2 - 3	3 - 4	4 - 5	4 - 5.5	4.5 - 6

Dimensions	10	12	14	16	20
d_0	10	12	14	16	20
t	70	80	90	100	120
$l = h_{ef}$	50	60	75	80	90
d_s	6 - 8	8 - 10	10 - 12	12 (1/2")	16

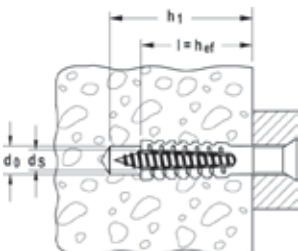
Dimensions in stock:

Fixing systems: 628

Article 88545 FMD

FISCHER steel expansion plugs FMD

building materials: BN, VD, VP, BL, HP, LP, LD



Dimensions	6x32	8x38	8x60	10x60
d_0^*	6 - 7	10	10 - 12	12 - 14
$l = h_{ef}$	38	46	60	60
t	32	38	68	68
d_s	5 - 6	6 - 8	6 - 8	8 - 10

* the higher the building material pressure resistance the larger the drill diameter

Dimensions in stock:

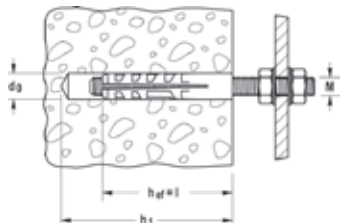
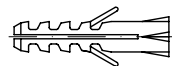
Fixing systems: 628

General fixings

Article 88506 M-S

FISCHER expansion plugs M-S

building materials: BN, VD, VP, HP, LP, LD, BL



Dimensions	6	8	10	12
d_0	8	10	14	16
t	55	70	90	100
$l = h_{ef}$	40	50	70	80
thread	M 6	M 8	M 10	M 12

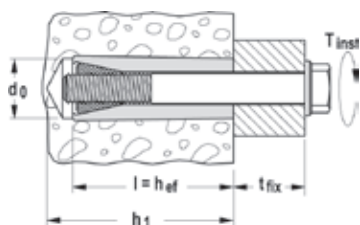
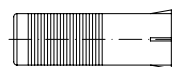
Dimensions in stock:

Fixing systems: 628

Article 88510 M

FISCHER anchors M

building materials: BN, VD, VP, BL, HP



Dimensions	M 5	M 6	M 8	M 10	M 12
d_0	10	12	16	20	24
t	45	50	65	80	90
$l = h_{ef}$	35	40	50	60	65

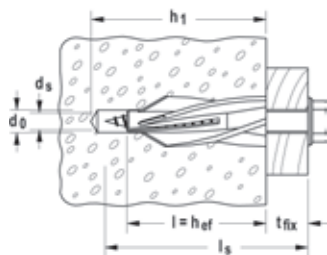
Dimensions in stock:

Fixing systems: 628

General fixings

Article 88507 GB

FISCHER aircrete anchors GB
building materials: VP



$$l_s = h_{ef} + d_s + t_{fix}$$

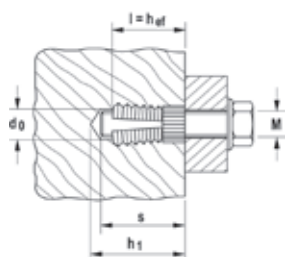
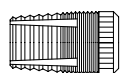
Dimensions in stock:

Fixing systems: 628

Dimensions	8	10	14
d_0	8	10	14
t	60	65	90
$l = h_{ef}$	50	55	75
d_s	5	7	10

Article 88521 PA 4

FISCHER brass fixings PA 4
building materials: BN, VD, HP



* with soft building material drill $\varnothing$
reduce by 0.5 mm

Dimensions in stock:

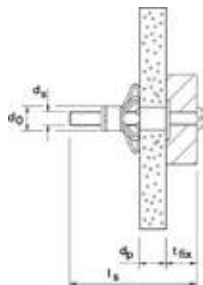
Fixing systems: 628

Dimensions	M 6/7.5	M 6/10.5	M 6/13.5	M 8/25	M 10/25
d_0^*	8	8	8	10	12
t	7.5	10.5	13.5	25	25
$l = h_{ef}$	7.5	10.5	13.5	25	25
thread	M 6	M 6	M 6	M 8	M 10
s	7.5	10.5	13.5	25	25

Cavity fixings

Article 88512 HM-S

FISCHER cavity metal fixings HM-S
building materials: HP



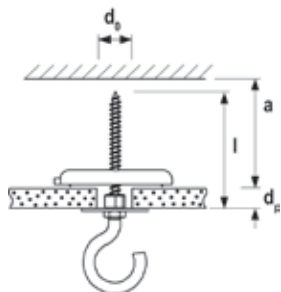
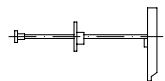
Dimensions	4x32	4x46	4x59	5x37	5x52
d ₀	8	8	8	10	10
t	42	56	69	47	62
l	32	46	59	37	52
d _s x l _s	M 4x40	M 4x52	M 4x66	M 5x45	M 5x60
d _p	3 – 13	5 – 18	35 – 42	6 – 15	7 – 21
t _{fix}	16	23	16	19	24

Dimensions	5x65	6x37	6x52	6x80	
d ₀	10	12	12	12	
t	75	47	62	90	
l	65	37	52	80	
d _s x l _s	M 5x73	M 6x45	M 6x60	M 6x88	
d _p	20 – 34	6 – 15	10 – 21	38 – 50	
t _{fix}	24	14	24	24	

Dimensions in stock:
Fixing systems: 628

Article 88509 K 54

FISCHER toggle fixings K 54
building materials: HP, LP



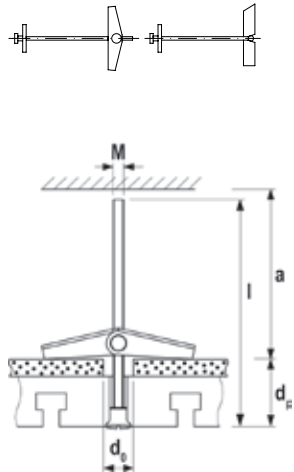
Dimensions	54
d ₀	10
d _p	65
a	58
l	125
thread	Holzschraube 4 mm

Dimensions in stock:
Fixing systems: 629

Cavity fixings

Article 88518 KD 3+4

FISCHER spring toggles KD 3+4
building materials: HP, LP



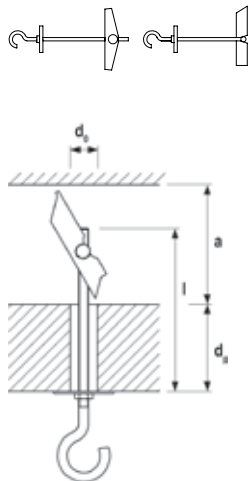
Dimensions	3	4	5	6	8
d_0	12	14	16	16	20
d_p	65	69	63	63	55
a	27	34	70	70	75
l	95	105	100	100	100
thread	M 3x90	M 4x100	M 5x100	M 6x100	M 8x100

Dimensions in stock:

Fixing systems: 629

Article 88519 KDH 3+4

FISCHER spring toggles KDH 3+4
building materials: HP, LP



Dimensions	3	4	5	6	8
d_0	12	14	16	16	20
d_p	51	35	60	60	55
a	27	34	70	70	75
l	105	95	130	130	130
thread	M 3x80	M 4x70	M 5x90	M 6x100	M 8x100

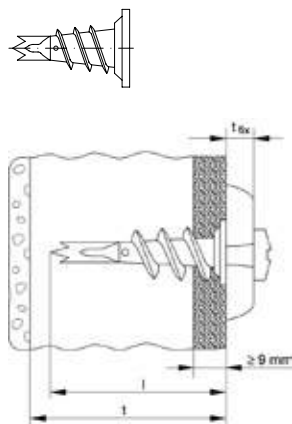
Dimensions in stock:

Fixing systems: 629

Cavity fixings

Article 88598 GKM

FISCHER plasterboard fixings GKM
self-tapping thread, Pozidriv cross recess Z2



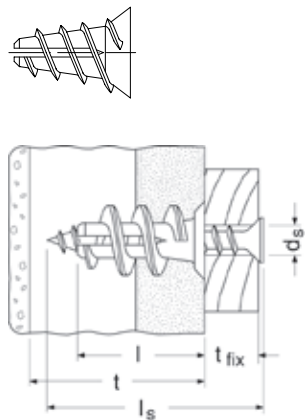
Dimensions	5
l	31
t	35
d _s	4 - 5
t _{fix}	-
building materials	HP

Dimensions in stock:

Fixing systems: 629

Article 88598 GK

FISCHER plasterboard fixings GK
with setting tool



Dimensions	5
l	22
t	25
d _s	4 - 5
t _{fix}	-
building materials	HP

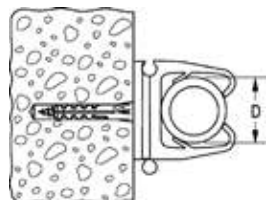
Dimensions in stock:

Fixing systems: 629

Electrical fixings

Article 88558 FC

FISCHER pipe clips FC
for conduits and pipes



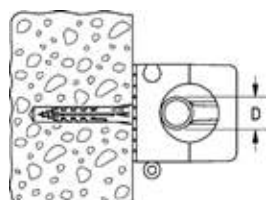
Dimensions	6 – 9	9 – 12	12 – 16	16 – 20
$d_{\min.} - d_{\max.}$	6 – 9	9 – 12	12 – 16	16 – 20

Dimensions in stock:

Fixing systems: 629

Article 88559 SCH

FISCHER saddle clips SCH
for conduits and pipes



Dimensions	812*	1216**	1619**
h	23.1	28.7	37.6
b	21.5	27.5	32.5
s	16.5	16.5	16.5
a	6.1	6.7	8
l	12	16	18
t	4.5	4.5	4.5
c	5.1	5.1	5.1
$d_{\min.} - d_{\max.}$	8 – 12	12 – 16	16 – 19
for WICU pipes	22x1 – 22x1.5	10x1 – 12x1	–

Dimensions	1623**	2332*	3242**
h	37.6	50	–
b	36	46.5	–
s	16.5	16.5	–
a	7.6	10	–
l	18	28	–
t	4.5	4.5	–
c	5.1	5.1	–
$d_{\min.} - d_{\max.}$	16 – 23	23 – 32	32 – 42
for WICU pipes	15x1 – 18x1	22x1 – 22x1.5	22x1 – 22x1.5

* only available in white

** available in grey or white

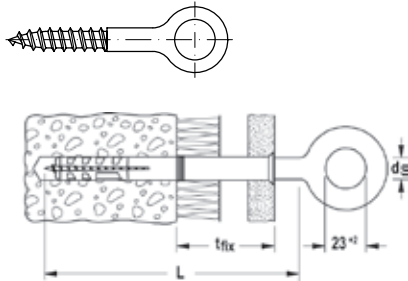
Dimensions in stock:

Fixing systems: 629

Scaffold fixings

Article 88536

FISCHER scaffold eyebolts
for use with plugs S 14 ROE
building materials: BN, VD

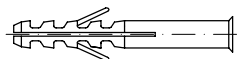


Dimensions	12x90	12x120	12x160	12x190	12x230	12x300	12x350
d_s	12	12	12	12	12	12	12
L	90	120	160	190	230	300	350
t_{fix}	15	45	85	115	155	225	275
eye $\varnothing$	23	23	23	23	23	23	23

Dimensions in stock:
Fixing systems: 630

Article 88536

FISCHER plugs S 14 ROE
building materials: BN, VD



Dimensions	70	100	135	185
d_0	14	14	14	14
t_d	80	110	145	195
h_{ef}	70	70	70	70
l	70	100	135	185
t_{fix}	–	30	65	110
l + 5 mm	75	105	140	190

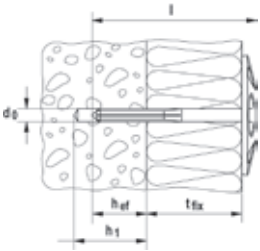
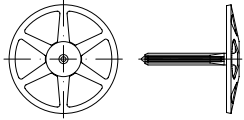
Dimensions in stock:
Fixing systems: 629

Insulation supports

Article 88514 DHK

FISCHER insulation supports DHK

building materials: BN, VD, VP, BL, LP, LD



disc $\varnothing$ 90 for soft insulation

Dimensions in stock:

Fixing systems: 630

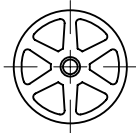
Dimensions	40	60	80	100	120
d_0	8	8	8	8	8
t_d	30	30	30	30	30
h_{ef}	20	20	20	20	20
l	65	85	105	125	145
t_{fix}	40	60	80	100	120

Dimensions	140	160	180	200	220
d_0	8	8	8	8	8
t_d	30	30	30	30	30
h_{ef}	20	20	20	20	20
l	165	185	205	225	245
t_{fix}	140	160	180	200	220

Article 88580 DT

FISCHER insulation discs DT

for use with nail plug N



Dimensions	90/4	90/8
disc $\varnothing$	90	90
disc height	7	7
d_f	4	8

Dimensions in stock:

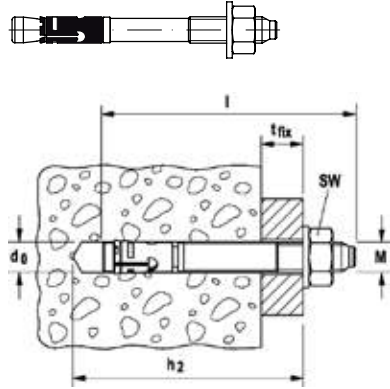
Fixing systems: 630

High performance steel anchors

Article 88741

UPAT express anchors MAX

with 1 expanding cone, nut and washer



Dimensions	8/10/75	8/30/95	8/50/115	10/10/95	10/20/105	10/30/115	10/50/135
d ₀	8	8	8	10	10	10	10
h ₂	65	85	105	85	95	105	125
l	75	95	115	95	105	115	135
t _{fix}	10	30	50	10	20	30	50
SW	13	13	13	17	17	17	17

Dimensions	10/80/165	10/100/185	12/10/110	12/20/120	12/30/130	12/50/150	12/80/180
d ₀	10	10	12	12	12	12	12
h ₂	165	175	100	110	120	140	180
l	80	185	110	120	130	150	80
t _{fix}	100	100	10	20	30	50	100
SW	17	17	19	19	19	19	19

Dimensions	12/100/200	12/120/220	12/160/260	12/200/300	16/25/148	16/50/173	16/100/223
d ₀	12	12	12	12	16	16	16
h ₂	190	210	250	290	135	160	210
l	200	220	260	300	148	173	223
t _{fix}	100	120	160	200	25	50	100
SW	19	19	19	19	24	24	24

Dimensions	16/160/283	16/200/323	16/250/373	16/300/423	20/30/172	20/60/202	
d ₀	16	16	16	16	20	20	
h ₂	270	310	360	410	155	185	
l	283	323	373	423	172	202	
t _{fix}	160	200	250	300	30	60	
SW	24	24	24	24	30	30	

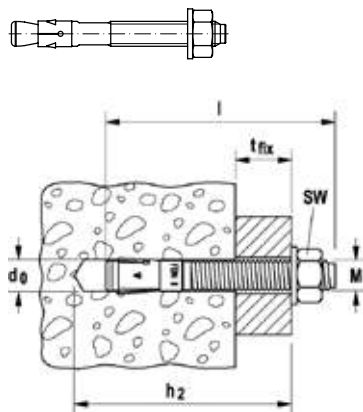
Dimensions in stock:

Fixing systems: 630–632

Article 88764

UPAT express anchors IMC

with 1 expanding cone, nut and washer



Dimensions	6/10/55	8/5/56 K	8/5/66	8/10/71	8/20/81	8/30/91	8/50/111
d ₀	6	8	8	8	8	8	8
h ₂	50	51	61	66	76	86	106
l	55	56	66	71	81	91	111
t _{fix}	10/-	-/5	5/15	10/20	20/30	30/40	50/60
SW	13	13	13	13	13	13	13

Dimensions	8/100/161	10/5/71 K	10/10/86	10/20/96	10/30/106	10/50/126	10/100/176
d ₀	8	10	10	10	10	10	10
h ₂	156	63	78	88	98	118	168
l	161	71	86	96	106	126	176
t _{fix}	100/110	-/5	10/20	20/30	30/40	50/60	100/110
SW	13	17	17	17	17	17	17

Dimensions	12/5/86 K	12/10/106	12/20/116	12/30/126	12/50/146	12/100/196	16/15/120 K
d ₀	12	12	12	12	12	12	16
h ₂	75	95	105	115	135	185	105
l	86	106	116	126	146	196	120
t _{fix}	-/5	10/25	20/35	30/45	50/65	100/115	-/15
SW	19	19	19	19	19	19	24

Dimensions	16/25/145	16/50/170	16/100/220	20/30/184	20/60/214		
d ₀	16	16	16	20	20		
h ₂	129	154	204	165	195		
l	145	170	220	184	214		
t _{fix}	25/40	50/65	100/115	30/55	60/85		
SW	24	24	24	30	30		

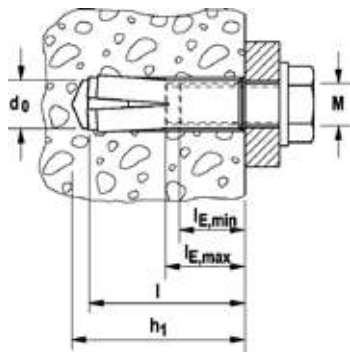
Dimensions in stock:

Fixing systems: 630

High performance steel anchors

Article 88716

UPAT impact anchors USA
with internal thread M



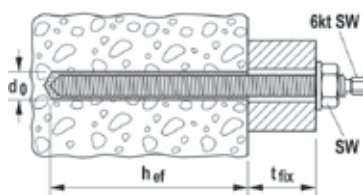
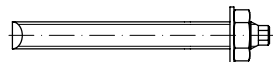
Dimensions	M 6	M 8	M 8x40	M 10	M 12	M 16	M 20
d_0	8	10	10	12	15	20	25
$l = h_{ef}$	30	30	40	40	50	65	80
$l_{E, \min}, l_{E, \min.}$	6	8	8	10	12	16	20
$l_{E, \min}, l_{E, \max.}$	13	13	13	17	22	28	34
h_1	32	33	43	43	54	70	85

Dimensions in stock:

Fixing systems: 631

Article 88722

UPAT threaded rods UKA 3-ASTA
with nut and washer



Dimensions	M 8x110	M 8x150	M 8x190	M 10x130	M 10x165	M 10x190
d_0	10	10	10	12	12	12
t_{fix}	13	60	96	20	57	82
h_{ef}	80	80	80	90	90	90
wrench size hexagon	5	5	5	5	7	7

Dimensions	M 12x160	M 12x180	M 12x220	M 12x250	M 12x300	M 14x170
d_0	14	14	14	14	14	16
t_{fix}	25	50	90	120	170	38
h_{ef}	110	110	110	110	110	120
wrench size hexagon	8	8	8	8	8	10

Dimensions	M 16x165	M 16x190	M 16x250	M 16x300	M 20x220	M 20x260
d_0	18	18	18	18	25	25
t_{fix}	13	35	98	148	30	65
h_{ef}	125	125	125	125	170	170
wrench size hexagon	12	12	12	12	12	12

Dimensions	M 20x300	M 20x350	M 22x280	M 24x300	M 27x340	M 30x380
d_0	25	25	30	28	32	35
t_{fix}	105	155	65	65	60	65
h_{ef}	170	170	210	210	250	280
wrench size hexagon	12	12	12	-	-	-

for use with UKA 3-cartridges and
injection mortar UPM 55, UPM 44, UPM 33

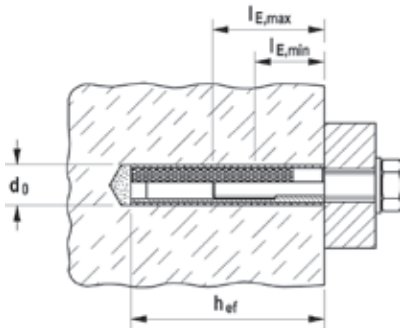
Dimensions in stock:

Fixing systems: 631

High performance steel anchors

Article 88714

UPAT internal thread bushes UKA 3-IST



* steel zinc plated/A 4

Dimensions in stock:

Fixing systems: 632

Dimensions	M 5	M 6	M 8	M 10	M 12	M 16	M 20
d_0	10	12	14	18	20	24	32
$h_{ef \min.}^*$	75/-	75/-	90/80	90/80	125/115	160/160	200/-

Chemical fixings

Article 88770

UPAT internal thread anchors UPM-I



d_0 = drill hole $\varnothing$

Dimensions in stock:

Fixing systems: 633

Dimensions	M 6	M 8	M 10	M 12
d_0	14	14	18	18

Article 88735

UPAT mesh bushes UPM-SH-K



d_0 = drill hole $\varnothing$

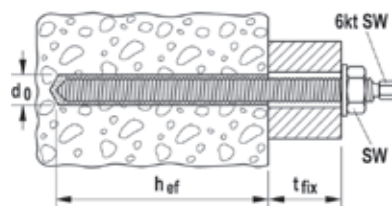
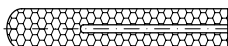
Dimensions in stock:

Fixing systems: 633

Dimensions	12	16	20
d_0	12	16	20
matching for UPM-A	M 6 – M 8	M 8 – M 10	M 12 – M 16
matching for UPM-I	–	M 6 – M 8	M 6 – M 12

Article 88720

UPAT resin capsules UKA 3-P



ETA approval not for M 14/M 22

Dimensions in stock:

Fixing systems: 633

Dimensions	M 8	M 10	M 12	M 14	M 16
$t = h_{ef}$	80	90	110	120	125
matching for ASTA	M 8	M 10	M 12	M 14	M 16
matching for IST	M 5	M 6	M 8	M 10	–
Dimensions	M 20	M 22	M 24	M 27	M 30
$t = h_{ef}$	170	210	210	250	280
matching for ASTA	M 20	M 22	M 24	M 27	M 30
matching for IST	M 20	–	–	–	–



The "MULTI-MONTI fastener system" is a fast, secure, time-saving and cost-cutting screw fastening method.

Without plugs and without expansion pressure, "MULTI-MONTI screw anchors" can be mounted into building materials like

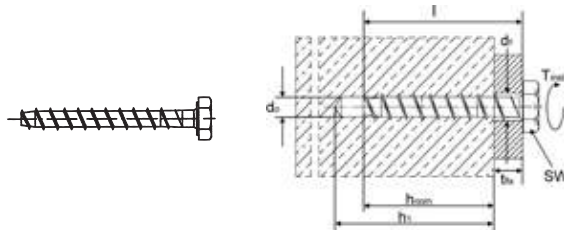
- Concrete, natural stone • Lime sand brick
- Solid brick, clinker brick • Hollow-block concrete

"MULTI-MONTI screw anchors HMS and MMS" are well-suited to all regular standard fastenings.

REYHER ARTICLE/MULTI-MONTI TYPE

88902

Type S
Hexagon head
steel, ZP



ETA 05/0010



Z-211-1503



Zugzulassung



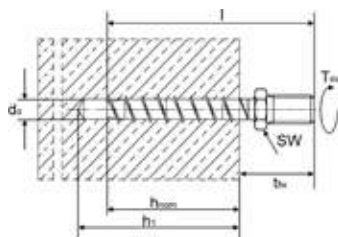
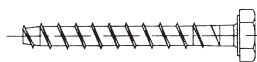
$\varnothing \times l$ [mm]	Wrench size hexagon	Drill $\varnothing$ [mm]	Drill depth h_1 [mm]	Anchor depth h_{nom} [mm]	Clamping length t_{fix} [mm]	Admissible tension load in cracked concrete C20/25 [kN]	Admissible tension load in non-cracked concrete C20/25 [kN]	Recommended tension load in non-cracked concrete C20/25 ⁴⁾ [kN]
6x40 ¹⁾	SW 10	5	45	35	5	-	-	2.4
6x50	SW 10	5	55	45	5	0.3 ²⁾	1.5 ²⁾	3.8
6x60	SW 10	5	55	45	15	0.3 ²⁾	1.5 ²⁾	3.8
6x80	SW 10	5	55	45	35	0.3 ²⁾	1.5 ²⁾	3.8
6x100	SW 10	5	55	45	55	0.3 ²⁾	1.5 ²⁾	3.8
7.5x35 ¹⁾	SW 13	6	40	35	1	-	-	2.2
7.5x40 ¹⁾	SW 13	6	45	35	5	-	-	2.2
7.5x45	SW 13	6	55	45	1	0.5 ²⁾	2.0 ²⁾	3.7
7.5x50	SW 13	6	55	45	5	0.5 ²⁾	2.0 ²⁾	3.7
7.5x60	SW 13	6	65	55	5	2.0 ³⁾	3.1 ³⁾	5.3
7.5x80	SW 13	6	65	55	25	2.0 ³⁾	3.1 ³⁾	5.3
7.5x100	SW 13	6	65	55	45	2.0 ³⁾	3.1 ³⁾	5.3
7.5x120	SW 13	6	65	55	65	2.0 ³⁾	3.1 ³⁾	5.3
7.5x140	SW 13	6	65	55	85	2.0 ³⁾	3.1 ³⁾	5.3
10x60	SW 16	8	65	55	5	0.8 ²⁾	-	5.0
10x70	SW 16	8	75	65	5	3.7 ³⁾	4.9 ³⁾	6.8
10x80	SW 16	8	75	65	15	3.7 ³⁾	4.9 ³⁾	6.8
10x100	SW 16	8	75	65	35	3.7 ³⁾	4.9 ³⁾	6.8
10x120	SW 16	8	75	65	55	3.7 ³⁾	4.9 ³⁾	6.8
10x140	SW 16	8	75	65	75	3.7 ³⁾	4.9 ³⁾	6.8
10x160	SW 16	8	75	65	95	3.7 ³⁾	4.9 ³⁾	6.8
12x60 ¹⁾	SW 18	10	65	55	5	-	-	4.7
12x80	SW 18	10	85	75	5	4.9 ³⁾	6.5 ³⁾	8.3
12x90	SW 18	10	85	75	15	4.9 ³⁾	6.5 ³⁾	8.3
12x100	SW 18	10	85	75	25	4.9 ³⁾	6.5 ³⁾	8.3
12x120	SW 18	10	85	57	45	4.9 ³⁾	6.5 ³⁾	8.3
12x140	SW 18	10	85	75	65	4.9 ³⁾	6.5 ³⁾	8.3
12x160	SW 18	10	85	75	75	4.9 ³⁾	6.5 ³⁾	8.3
14x80	SW 21	12	80	70	10	-	-	7.3
14x110	SW 21	12	105	95	15	8.2 ³⁾	12.3 ³⁾	12.5
14x130	SW 21	12	105	95	35	8.2 ³⁾	12.3 ³⁾	12.5
14x150	SW 21	12	105	95	55	8.2 ³⁾	12.3 ³⁾	12.5
16x80 ¹⁾	SW 24	14	80	70	10	-	-	7.3
16x120 ¹⁾	SW 24	14	130	110	10	-	-	15.9
16x130	SW 24	14	130	115	15	12.1 ³⁾	16.4 ³⁾	17.0
16x150	SW 24	14	130	115	35	12.1 ³⁾	16.4 ³⁾	17.0
20x100 ¹⁾	SW 30	18	110	90	10	-	-	10.5
20x130 ¹⁾	SW 30	18	140	115	15	-	-	18.3

1) = not a component of the approvals 2) = in acc. with DIBt approval no. Z-211-1503 3) = in acc. with ETA 05/0010 4) = manufacturer specification for use without approval

REYHER ARTICLE/MULTI-MONTI TYPE

88903

Type St
Metric stud
steel, ZP



ETA 05/0010



Z-211-1503



Zugzone-tauglich



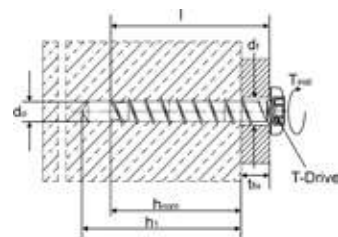
$\varnothing \times l$ [mm]	Wrench size hexagon	Connection Thread	Drill- $\varnothing$ d_0 [mm]	Drill depth h_1 [mm]	Anchor depth h_{nom} [mm]	Clamping length t_{fix} [mm]	Admissible tension load in cracked concrete C20/25 [kN]	Admissible tension load in non-cracked concrete C20/25 [kN]	Recommended tension load in non-cracked concrete C20/25 ⁴⁾ [kN]
6x60	SW10	M 6x5	5	55	45	15	0.3 ²⁾	1.5 ²⁾	3.8
7.5x70	SW10	M 8x14	6	55	45	25	0.5 ²⁾	2.0 ²⁾	3.7
7.5x80	SW10	M 8x14	6	65	55	25	2.0 ³⁾	3.1 ³⁾	5.3
7.5x100	SW10	M 8x14	6	65	55	45	2.0 ³⁾	3.1 ³⁾	5.3
7.5x120	SW10	M 8x14	6	65	55	65	2.0 ³⁾	3.1 ³⁾	5.3
7.5x140	SW10	M 8x14	6	65	55	85	2.0 ³⁾	3.1 ³⁾	5.3
7.5x160	SW10	M 8x14	6	65	55	105	2.0 ³⁾	3.1 ³⁾	5.3
10x80	SW13	M 10x11	8	65	55	25	0.8 ²⁾	–	5.0
10x100	SW13	M 10x11	8	75	65	35	3.7 ³⁾	4.9 ³⁾	6.8
10x120	SW13	M 10x11	8	75	65	55	3.7 ³⁾	4.9 ³⁾	6.8
10x140	SW13	M 10x11	8	75	65	75	3.7 ³⁾	4.9 ³⁾	6.8
10x160	SW13	M 10x11	8	75	65	95	3.7 ³⁾	4.9 ³⁾	6.8

1) = not a component of the approvals 2) = in acc. with DIBt approval no. Z-21.1-1503 3) = in acc. with ETA 05/0010 4) = manufacturer specification for use without approval

REYHER ARTICLE/MULTI-MONTI TYPE

88908

Type P
Pan head
steel, ZP



ETA 05/0010



Z-211-1503



Zugzone-tauglich

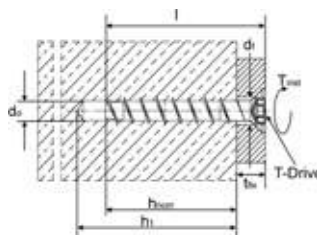


$\varnothing \times l$	Hexalobu- lar socket size	Head- $\varnothing$ [mm]	Drill- $\varnothing$ d_0 [mm]	Drill depth h_1 [mm]	Anchor depth h_{nom} [mm]	Clamping length t_{fix} [mm]	Admissible tension load in cracked concrete C20/25 [kN]	Admissible tension load in non-cracked con- crete C20/25 [kN]	Recommended tension load in non-cracked concrete C20/25 ⁴⁾ [kN]
5x30 ¹⁾	T-20	7.9	4	35	30	1	–	–	1.9
5x50 ¹⁾	T-20	7.9	4	40	35	15	–	–	2.6
6x30 ¹⁾	T-30	11.6	5	35	30	1	–	–	1.9
6x40 ¹⁾	T-30	11.6	5	40	35	5	–	–	2.4
6x50	T-30	11.6	5	55	45	5	0.3 ²⁾	1.5 ²⁾	3.8
6x60	T-30	11.6	5	55	45	15	0.3 ²⁾	1.5 ²⁾	3.8
6x80	T-30	11.6	5	55	45	35	0.3 ²⁾	1.5 ²⁾	3.8
7.5x25 ¹⁾	T-40	13.6	6	30	25	1	–	–	1.2
7.5x45	T-40	13.6	6	55	45	1	0.5 ²⁾	2.0 ²⁾	3.7
7.5x50	T-40	13.6	6	55	45	5	0.5 ²⁾	2.0 ²⁾	3.7
7.5x70	T-40	13.6	6	65	55	15	2.0 ³⁾	3.1 ³⁾	5.3
10x70	T-40	17	8	75	65	5	3.7 ³⁾	4.9 ³⁾	6.8

1) = not a component of the approvals 2) = in acc. with DIBt approval no. Z-21.1-1503 3) = in acc. with ETA 05/0010 4) = manufacturer specification for use without approval



REYHER Article/MULTI-MONTI TYPE

88905Type F
Countersunk head

ETA 05/0010



Z-211-1503



$\varnothing \times l$	Hexalobular socket size	Head- $\varnothing$ [mm]	Drill- $\varnothing$ d_0 [mm]	Drill depth h_1 [mm]	Anchor depth h_{nom} [mm]	Clamping length t_{fix} [mm]	Admissible tension load in cracked concrete C20/25 [kN]	Admissible tension load in non-cracked concrete C20/25 [kN]	Recommended tension load in non-cracked concrete C20/25 ⁴⁾ [kN]
5x30 ¹⁾	T-25	8.7	4	35	30	1	–	–	1.9
5x40 ¹⁾	T-25	8.7	4	40	35	5	–	–	2.6
5x50 ¹⁾	T-25	8.7	4	40	35	15	–	–	2.6
5x60 ¹⁾	T-30	8.7	4	40	35	25	–	–	2.6
6x40 ¹⁾	T-30	11	5	35	30	10	–	–	1.9
6x50	T-30	11	5	55	45	5	0.3 ²⁾	1.5 ²⁾	3.8
6x60	T-30	11	5	55	45	15	0.3 ²⁾	1.5 ²⁾	3.8
6x80	T-30	11	5	55	45	35	0.3 ²⁾	1.5 ²⁾	3.8
6x100	T-30	11	5	55	45	55	0.3 ²⁾	1.5 ²⁾	3.8
6x120	T-30	11	5	55	45	75	0.3 ²⁾	1.5 ²⁾	3.8
6x140	T-30	11	5	55	45	95	0.3 ²⁾	1.5 ²⁾	3.8
7.5x50	T-40	13.6	6	55	45	5	0.5 ²⁾	2.0 ²⁾	3.7
7.5x60	T-40	13.6	6	65	55	5	2.0 ³⁾	3.1 ³⁾	5.3
7.5x80	T-40	13.6	6	65	55	25	2.0 ³⁾	3.1 ³⁾	5.3
7.5x100	T-40	13.6	6	65	55	45	2.0 ³⁾	3.1 ³⁾	5.3
7.5x120	T-40	13.6	6	65	55	65	2.0 ³⁾	3.1 ³⁾	5.3
7.5x140	T-40	13.6	6	65	55	85	2.0 ³⁾	3.1 ³⁾	5.3
7.5x160	T-40	13.6	6	65	55	105	2.0 ³⁾	3.1 ³⁾	5.3

1) = not a component of the approvals 2) = in acc. with DIBt approval no. Z-211-1503 3) = in acc. with ETA 05/0010 4) = manufacturer specification for use without approval

MULTI-MONTI anchors A4/A5



- on request
- acc. to ETA 05/0011

MULTI-MONTI
assembly system

= Innovative fixing elements from





Standards and standard conversion for blind rivets:

For the use of blind rivets as calculable construction elements, it was necessary to normatively and uniformly regulate dimensions, mechanical properties, such as tension and shearing loads, as well as general quality-related requirements.

This was done in the national standard DIN 7337 "Blind rivets with break pull mandrel" – first publication May 1985 – amended version July 1985 – follow-up version August 1991.

DIN 7337 – August 1991 included the version: Type A protruding head and type B countersunk head. In May 1997, the version "Open rivets with break pull mandrel" included published as the intended follow-up version for DIN 7337 – August 1991 with additional type C large protruding head.

In 1997, the international and European standards, ISO and EN, adopted the standardisation of the blind rivets.

Then, the basic standards, ISO 14588 and 14589, were published in August 2001.

In April 2003, the product standards, ISO 15973–16585 followed – a separate standard for each material combination/version/type. Here, DIN 7337 incl. design were withdrawn. ①

For the standardised versions and higher, special types are offered for particular uses.

Standards, versions, head types	DIN 7337 Material Rivet/Mandrel	in DIN 7337	ISO – standards Material 2 Rivet/Mandrel	ISO	Reyher- article- Nr.
Basic standards:					
– "Blind rivets: Terms and definition"	–	included	–	14588	–
– "Blind rivets: Mechanical test"	–		–	14589	–
Product standards:					
– Open-end blind rivets with protruding head	Al alloy/steel zinc plated steel zinc plated/steel zinc plated Al alloy/Al alloy A 2/A 2 copper/steel zinc plated copper/bronze – NiCu/steel zinc plated NiCu/A 4 – A 2/steel zinc plated A 4/A 4 Al alloy/A 2 plastic/plastic	included as type A–	AIA/St. St./St. AIA/AIA A 2/A 2 Cu/St. Cu/Br Cu/SSt NiCu/St. NiCu/SSt A 2/SSt – – – –	15977 15979 15981 15983 16582 16582 16582 16584 16584 16585 – – – –	88402, 88417 88401 88410 88404 88406 88407 – – 88493 – 88405 88415 88403 88408
– Open-end blind rivets with countersunk head	Al alloy/steel zinc plated steel zinc plated/steel zinc plated– – – – –	included as type B	AIA/St. St./St. AIA/AIA A 2/A 2 Cu/St. Cu/Br Cu/SSt	15978 15980 15982 15984 16583 16583 16583	88412 88411 – – – – –
– Open-end blind rivets with large protruding head	Al alloy/steel zinc plated steel zinc plated/steel zinc plated Al alloy/Al alloy Al alloy/A 2	included as type C	– – – –	– – – –	88409 88413 88414 88416
– Closed-end blind rivets with protruding head	Al alloy/steel phosphated – – Al alloy/A 2 copper/steel copper/A 2	–	AIA/St. AIA/AIA St./St. A 2/SSt – – –	15973 15975 15976 16585 – – –	88420(CAP) – – – 88420(CAP) 88420(CAP) 88420(CAP)
– Closed-end blind rivets with countersunk head	–	–	AIA/St.	15974	–

① For the conversion to ISO standards, production needs a certain amount of customisation/transition time. Until otherwise regulated, the article descriptions and REYHER article numbers in the article heads of this catalogue apply to the blind rivets offered. The Technical Information in the TI section of this catalogue also applies here.

For versions and/or material combinations for which standards currently do not exist, subsequent ISO standardisation or a remaining standard, DIN 7337, may have to be reckoned with.

② AIA = aluminium alloy (Al alloy) – SSt = stainless steel
St. = steel (should be protected for storage – e.g. zinc plated version)



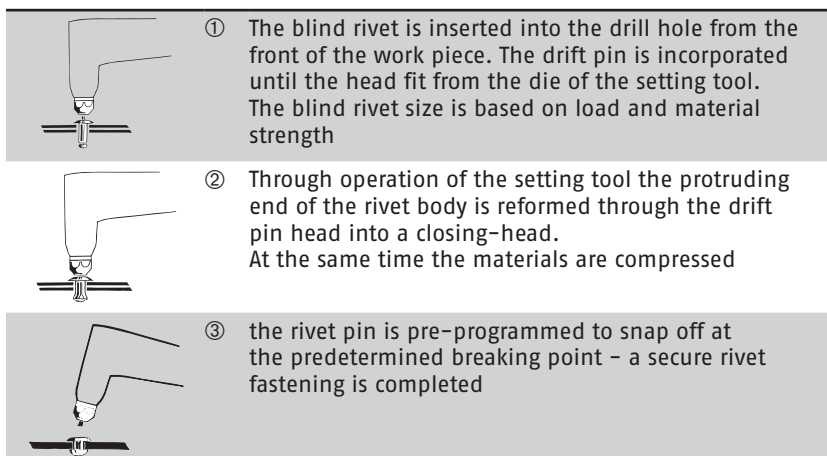
Blind rivets: Function and assembly process

Blind rivet technology was developed as a fastening procedure for hollow profiles and similar single-side access use fields.

The simple, fast, and thus very economical, blind rivet principle has since replaced conventional fastening tasks in many assembly fields and is continually finding new fields of application.

REYHER has a comprehensive range of blind rivets so that a suitable design is available for every purpose.

The placement devices provided are ergonomically formed and designed for long-term professional use.



Dimensions blind rivets

Open-end blind rivet with protruding head

R 88401
steel zinc plated/steel zinc plated

R 88402
Al alloy/steel zinc plated

R 88403
Al alloy/A2

R 88404
A2/A2

R 88405
A 2/steel zinc plated

R 88406
copper/steel zinc plated

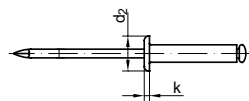
R 88407
copper/bronze

R 88410
Al alloy/Al alloy

R 88415
A4/A4

R 88417
Al alloy/steel zinc plated

R 88493
NiCu/A4



1) A 4 ~ ISO 15983

Nominal Ø	2.4	3	3.2	4	4.8	5	6	6.4
d ₂	5	6.5	6.5	8	9.5	9.5	12	13
k	0.65	1.0	1.0	1.2	1.3	1.3	1.5	1.8
drill Ø	2.5	3.1	3.3	4.1	4.9	5.1	6.1	6.5

Material rivet	Shear strength (Tensile strength)							
Al alloy (ISO 15977)	350 (550)	550 (850)	750 (1100)	1250 (1800)	1850 (2600)	2150 (3100)	3200 (4600)	3400 (4850)
Steel (ISO 15979)	650 (700)	950 (1100)	1100 (1200)	1700 (2200)	2900 (3100)	3100 (4000)	4300 (4800)	4900 (5700)
A 2, A 4 ¹⁾ (ISO 15983)	–	1800 (2200)	1900 (2500)	2700 (3500)	4000 (5000)	4700 (5800)	–	–
Cu (ISO 16582)	–	760 (950)	800 (1000)	1500 (1800)	2000 (2500)	–	–	–
NiCu–Monel (ISO 16584)	–	–	1400 (1900)	2200 (3000)	3300 (3700)	–	–	5500 (6800)

Length	Clamping length range (min. – max.)							
4	0.5–1.5	0.5–1.5	0.5–1.5	–	–	–	–	–
5	–	1.5–2.5	–	0.5–1.5	–	–	–	–
6	1.5–3.5	2.5–3.5	1.5–3.5	1.5–3.0	2.0–2.5	2.0–2.5	–	–
8	3.5–5.0	4.5–5.0	3.5–5.0	4.0–5.0	2.5–4.5	2.5–4.5	2.0–3.0	–
10	–	5.0–7.0	5.0–7.0	5.0–6.5	4.5–6.0	4.5–6.0	3.0–5.0	–
12	–	7.0–9.0	7.0–9.0	6.5–8.5	6.0–8.0	6.0–8.0	5.0–7.0	2.0–6.0
14	–	9.0–11.0	9.0–11.0	8.5–10.5	8.0–10.0	8.0–10.0	–	–
16	–	11.0–13.0	11.0–13.0	10.5–12.5	10.0–12.0	10.0–12.0	7.0–11.0	6.0–10.0
18	–	13.0–15.0	13.0–15.0	10.5–12.5	12.0–14.0	12.0–14.0	11.0–13.0	10.0–12.0
20	–	15.0–17.0	15.0–17.0	14.5–16.5	14.0–15.0	14.0–15.0	13.0–15.0	12.0–14.0
25	–	17.0–22.0	17.0–22.0	16.5–21.5	15.0–20.0	15.0–20.0	15.0–20.0	14.0–18.0
30	–	22.0–26.0	–	21.5–26.0	20.0–25.0	20.0–25.0	20.0–24.0	18.0–23.0
35	–	–	–	26.0–30.0	–	25.0–30.0	24.0–29.0	–
40	–	–	–	30.0–35.0	–	30.0–35.0	29.0–34.0	–
45	–	–	–	–	–	35.0–40.0	–	–
50	–	–	–	–	–	40.0–45.0	34.0–44.0	–
60	–	–	–	–	–	48.0–52.0	–	–
65	–	–	–	–	–	52.0–57.0	–	–
70	–	–	–	–	–	57.0–62.0	–	–
80	–	–	–	–	–	62.0–72.0	–	–



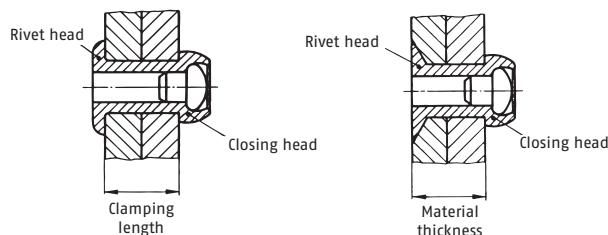
Rivet length specification:

For blind rivets with smooth rivet shafts and head types A, B, C or similar, the suitable nominal length can be set according to the rule of thumb:

**Clamping length (material thickness) + 1 x rivet nom. Ø
= rivet nominal length min.***

(* For interim results, the next-largest rivet length is to be chosen)

The allocation of the rivet nominal length according to clamping length/ material thickness differs minimally for standard blind rivets – between standard specifications (DIN 7337, attachment A and B) and factory specifications – according to various material combinations.



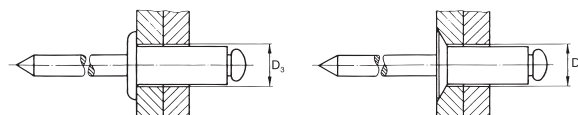
Rivet hole/Drill diameter:

For blind rivets of the types A, B or C corresponding or similar to DIN 7337 as well as for "CAP" and "PolyGrip" multi-section blind rivets, the rivet/drill hole diameter is specified according to the following rule of thumb:

Rivet nom. Ø: d1 + 0.1 mm (tol. +0.1mm) = Rivet hole/Drill hole Ø D3

The following applies for blind-rivet nuts:

Shaft Ø: d1/wrench size + 0.1 mm = Drill/Punch/Hole Ø D3



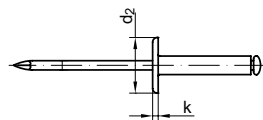
Dimensions blind rivets

Open-end blind rivets with protruding head

similar to DIN 7337-A

R 88408

plastic



Nominal Ø	4	5	6
d ₂	9	11	13
k	1,2	1,5	1,5
drill Ø	4,1	5,1	6,1
Material rivet	Shear strength min. in N (Tensile strength min. in N)		
plastic	180 (-)	290 (-)	440 (-)
Length	Clamping length range (min. – max.)		
8	0.5 – 5.0	0.5 – 5.0	0.5 – 5.0
12	5.0 – 9.0	5.0 – 9.0	5.0 – 9.0

Open-end blind rivets with large protruding head

acc. to DIN 7337-C

R 88409

Al alloy/steel zinc plated

R 88413

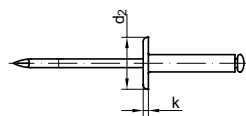
steel zinc plated

R 88414

Al alloy/Al alloy

R 88416

Al alloy/A2



Nominal Ø	3.2	4	4.8	5
d ₂	9.5	12	16	11/14
k	1.3	1.6	1.8	1.8
drill Ø	3.3	4.1	4.9	5.1
Material rivet	Shear strength min. in N ① (Tensile strength min. in N) ①			
Al alloy/steel	720 (950)	1400 (2000)	1800 (2700)	2000 (2800)
Length	Clamping length range (min. – max.)			
6	1.5 – 3.5	1.5 – 3.0	–	–
8	3.5 – 5.0	3.0 – 5.0	2.5 – 4.5	2.5 – 4.5
10	5.0 – 7.0	5.0 – 6.5	4.5 – 6.0	4.5 – 6.0
12	7.0 – 9.0	6.5 – 8.5	6.0 – 8.0	6.0 – 8.0
14	–	–	–	8.0 – 10.0
16	9.0 – 13.0	8.5 – 12.5	8.0 – 12.0	10.0 – 12.0
18	–	12.5 – 16.5	–	12.0 – 14.0
20	–	–	12.0 – 15.0	14.0 – 15.0
25	–	–	15.0 – 20.0	15.0 – 20.0
30	–	–	–	20.0 – 25.0

① acc. to DIN 7337



Dimensions blind rivets

Open-end blind rivets with countersunk head

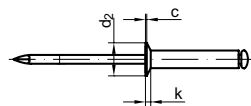
acc. to DIN 7337-B

R 88411

steel zinc plated

R 88412

Al alloy/steel zinc plated



Nominal Ø	3	4	5
d ₂	6.0	7.5	9.0
k	0.9	1.0	1.2
c	0.3	0.3	0.4
drill Ø	3.1	4.1	5.1

Shear strength (Tensile strenght)

Force specifications are identical to the specifications for Article 88401 (see [TI-200](#))

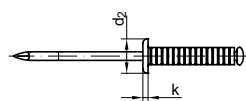
Length	Clamping length range (min. – max.)		
4 St./Al.	-1.0 – 1.5	-	-
6 St./Al.	1.0 – 3.0/1.5 – 3.5	1.0 – 2.5/1.0 – 3.0	1.0 – 2.0/-
8 St./Al.	3.0 – 5.0/3.5 – 5.0	2.5 – 4.5/3.0 – 5.0	2.0 – 4.0/2.0 – 4.5
10 St./Al.	5.0 – 6.5/5.0 – 7.0	4.5 – 6.5/5.0 – 6.5	4.0 – 6.0/4.5 – 6.0
12 St./Al.	6.5 – 8.5/7.0 – 9.0	6.5 – 8.5/6.5 – 8.5	6.0 – 8.0/6.0 – 8.0
14 St./Al.	-	-	8.0 – 9.5/-
16 St./Al.	-9.0 – 13.0	8.5 – 12.0/8.5 – 12.5	-
18 St./Al.	-	-12.5 – 14.5	-
20 St./Al.	-	12.0 – 16.0/14.5 – 16.5	-
25 St./Al.	-	-	-

Open-end blind rivets with grooved rivet body

for blind holes

R 88419 G

Al alloy/steel zinc plated



Nominal Ø	3.2	4	4.8
d ₂	6.5	8	9.5
k	1	1.2	1.3
drill Ø	3.3	4.1	4.9

Material rivet	Shear strength min. in N (Tensile strenght min. in N)		
Al alloy	720 (950)	1400 (2000)	1800 (2700)

Length	plate thickness (– max.)		
8	-	4	-
10	6	-	6
12	-	8	-
14	-	-	10
16	12	12	-
18	-	-	13
20	-	-	15
25	-	-	20

Closed-end blind rivets with protruding head

for air- and water-tight riveting drill

R 88420 F

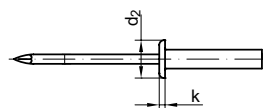
Al alloy/steel phos.

Al alloy/A2

Cu/steel oiled

Cu/steel oiled

Cu/A2



Dimensions	3.2	4	4.8
d ₂	6	8	9.5
k	1.1	1.3	1.8
Drill Ø	3.3	4.1	4.9

Material rivet	Shear strength min. in N (Tensile strenght min. in N) ①		
Al alloy (~ISO 15973)	1050 (1250)	1550 (2100)	2400 (3500)
Cu	1000 (1400)	1500 (2200)	2100 (3100)

Length	Clamping length range (min. – max.)		
6.5	0.5 – 2.0	-	-
7.5	1.0 – 3.0	-	-
8	1.5 – 3.0	0.5 – 3.0	1.0 – 3.0
9.5	3.0 – 5.0	3.0 – 5.0	3.0 – 5.0
10.5	5.0 – 6.5	-	-
11	4.5 – 6.5	4.5 – 6.5	4.5 – 6.5
12.5	6.0 – 8.0	6.0 – 8.0	6.0 – 8.0
14	-	-	7.5 – 9.5
16	-	-	9.0 – 11.0
18	-	-	10.5 – 13.0
21	-	-	13.0 – 16.0

① Manufacturer specification

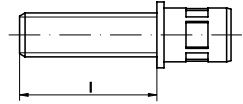


Dimensions blind rivets

Open-end blind rivets with connection thread

R 88421

steel zinc plated/steel zinc plated

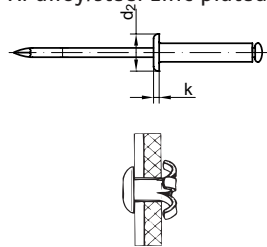


Nominal Ø	M 4	M 5	M 6	M 8
hole diam. Ø	6.1	7.1	9.1	11.1
l	10	11.5	13	15.5
Material rivet	Shear strength min. in N (Thread breaking strength min. in N)			
St.	5160 (6030)	7200 (10800)	10800 (17800)	18400 (27800)
Clamping length range (min. – max.)				
	0.25 – 3.0	0.25 – 3.0	0.25 – 3.0	0.25 – 3.0

Open-end blind rivets with protruding head and peel rivet body

R 88422

Al alloy/steel zinc plated

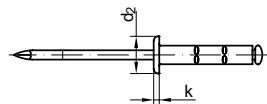


Nominal Ø	3.2	4	4.8
d ₂	6.5	8	9.5
k	1	1.2	1.3
drill Ø	3.3	4.1	4.9
Material rivet	Shear strength min. in N (Tensile strength min. in N)		
Al alloy	800 (950)	1.400 (2.000)	2.000 (2.700)
Length	Clamping length range (min. – max.)		
8	1.0 – 3.5	1.0 – 3.0	–
10	2.5 – 5.0	2.5 – 5.0	2.5 – 5.0
12	4.5 – 7.0	4.5 – 6.5	4.5 – 7.0
14	–	6.0 – 8.0	6.5 – 9.0
16	6.5 – 11.0	7.5 – 10.0	8.5 – 10.0
18	–	9.0 – 12.0	9.5 – 12.0
20	–	11.5 – 14.0	11.5 – 14.0
25	–	–	13.5 – 19.0

Open-end blind rivets with protruding head and multigrip rivet body

R 88474

Al alloy/steel zinc plated
steel zinc plated/steel zinc plated
Al alloy/A2



DIBt approval no. Z14.1-4 for
Ø 4.8 Al-Leg./St. and Al-Leg./A2

Nominal Ø	3.2	4	4.8
d ₂	6.5	8	9.5
k	0.8	1	1.3
drill Ø	3.3	4.1	4.9
Material rivet	Shear strength min. in N (Tensile strength min. in N)		
Al alloy	720 (1.050)	1.060 (1.680)	1.600 (2.270)
Steel	1.200 (1.600)	1.650 (2.400)	2.400 (3.200)
A2/A4	1.450 (2.300)	2.650 (3.600)	4.000 (5.000)
Length	Clamping length range (min. – max.)		
8	0.5 – 5.0	–	–
9.5	1.5 – 6.5	–	–
10	–	0.5 – 6.5	0.5 – 6.5
11	3.0 – 8.0	–	–
13	–	3.5 – 9.5	–
15	–	–	4.5 – 11.0
17	–	7.0 – 13.0	6.5 – 13.0
25	–	–	11.0 – 19.5
30	–	–	16.0 – 24.0

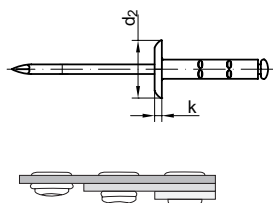


Dimensions blind rivets

Open-end blind rivets with large protruding head and multigrip rivet body

R 88475

Al alloy/steel zinc plated
steel zinc plated/steel zinc plated
Al alloy/A2

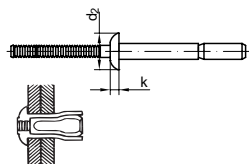


Nominal Ø	3.2	4	4.8
d ₂	9.5	12	16
k	1.3	1.5	1.8
drill Ø	3.3	4.1	4.9
Material rivet	Shear strength min. in N (Tensile strength min. in N)		
Al-Leg.	720 (1.050)	1.060 (1.680)	1.600 (2.270)
Stahl	1.200 (1.600)	1.650 (2.400)	2.400 (3.200)
Length	Clamping length range (min. – max.)		
8	0.5 – 5.0	–	–
9.5	1.5 – 6.5	–	–
10	–	0.5 – 6.5	0.5 – 6.5
11	3.0 – 8.0	–	–
13	–	3.5 – 9.5	–
15	–	–	4.5 – 11.0
17	–	7.0 – 13.0	6.5 – 13.0
25	–	–	11.0 – 19.5
30	–	–	16.0 – 24.0

Open-end blind rivets with protruding head for high strength assembly

R 88476

steel zinc plated/steel zinc plated

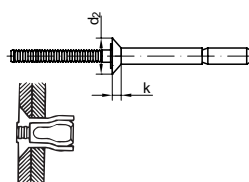


Nominal Ø	4.8	6.4
d ₂	9.2	12.4
k	2.2	2.6
drill Ø	4.9	6.5
Material rivet	Shear strength min. in N (Tensile strength min. in N)	
St.	6.850 (4.500)	12.500 (8.200)
Length	Clamping length range (min. – max.)	
10.5	1.6 – 6.4	–
14.1	–	2.0 – 9.5
14.5	5.5 – 11.1	–
20.5	–	2.0 – 15.9

Open-end blind rivets with countersunk head for high strength assembly

R 88477

steel zinc plated/steel zinc plated



Nominal Ø	4.8	6.4
d ₂	8.9	11
k	2.2	2.6
drill Ø	4.9	6.5
Material rivet	Shear strength min. in N (Tensile strength min. in N)	
St.	6.850 (4.500)	12.500 (8.200)
Length	Clamping length range (min. – max.)	
10.5	1.6 – 6.4	–
14.1	–	2.0 – 9.5
14.5	5.5 – 11.1	–

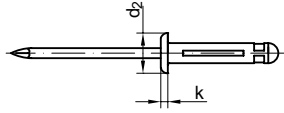


Dimensions blind rivets

Dimensions blind rivets

R 88488

Al alloy/Al alloy

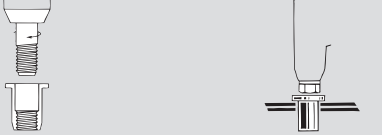
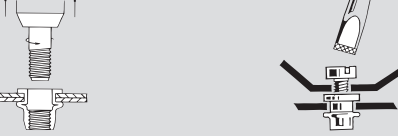


Nominal $\varnothing$	4.1	5.2
d_2	8	10
k	1.4	1.9
Bohrer $\varnothing$	4.2	5.3
Material rivet	Shear strength min. in N (Tensile strength min. in N)	
Al alloy	890 (1.000)	1.550 (2.000)
Length	Clamping length range (min. – max.)	
14.5	1.0 – 3.0	–
19	–	1.6 – 6.3
19.5	1.0 – 6.3	–
21.1	1.0 – 9.5	–
22.2	–	4.7 – 9.5
24.3	3.2 – 12.7	–
25.4	–	7.9 – 12.7
28.5	–	11.1 – 15.9
31.7	–	14.2 – 19.0



Blind rivet nuts: Function and assembly process

By combining two fastening options, blind rivet nuts provide cost and quality benefits. On the one hand, a rivet fastening is made by rivetting the nuts with sheet metal and, on the other hand, a screw fastening is created. This combination makes it possible to use thin-walled component parts for which the inclusion of a thread is sometimes problematic due to the low material strength. A further advantage is that a detachable screw fastening is created without any heat impact and thus, an unchecked thermal lag in the components can be prevented. Additionally, various materials can be connected with each other.

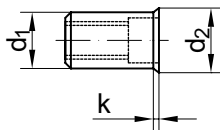
	① The blind rivet nut is screwed onto the thread mandrel and inserted into the drill hole from the front side of the workpiece. The length of the blind rivet nut is based on the material strength.
	② By using the setting tool the blind rivet nut is reshaped, which creates a firmly-sitting, immovable thread in seconds. At the same time, materials can be pressed together in this process.
	③ After unscrewing the thread mandrel, a metric screw can be used to fasten an additional part.

Blind rivet nuts dimensions

Open blind rivet nuts with small countersunk head

R 88418

Al alloy
Steel ZP
A2
A4

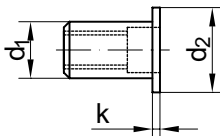


Dimensions	M 4	M 5	M 6	M 8
d ₁	6	7	9	11
d ₂	6.9	7.9	9.9	12
k	0.6	0.6	0.6	0.6
drill Ø	6.1	7.1	9.1	11.1
Available clamping lengths → price pages				

Open blind rivet nuts with protruding head

R 88423

Al alloy
Steel ZP
A2
A4

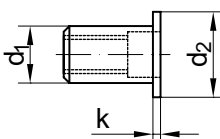


Dimensions	M 4	M 5	M 6	M 8	M 10
d ₁	6	7	9	11	12
d ₂	9	10	12	14	15
k	0.8	1	1.5	1.5	1.5
drill Ø	6.1	7.1	9.1	11.1	12.1
Available clamping lengths → price pages					

Open blind rivet nuts with protruding head, with multigrip rivet body for variable clamping length

R 88490

Al alloy
Steel ZP
A2



Dimensions	M 4	M 5	M 6	M 8
d ₂	10	11	13	16
k	0.8	1.0	1.5	1.5
drill Ø	6 ^{+0.1}	7 ^{+0.1}	9 ^{+0.1}	11 ^{+0.1}
clamping length	0.5 – 6.0	0.5 – 6.0	0.5 – 6.0	0.5 – 7.5



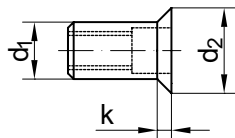
Blind rivet nuts dimensions

Open blind rivet nuts with countersunk head, with multigrip rivet body

for variable clamping length

R 88491

Al alloy
Steel ZP

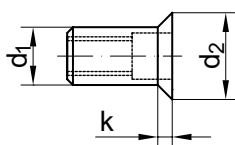


Dimensions	M 4	M 5	M 6	M 8
d ₂	10	11	13	16
k	1.5	1.5	1.5	1.5
drill Ø	6 ^{+0.1}	7 ^{+0.1}	9 ^{+0.1}	11 ^{+0.1}
Clamping length	1.5 – 6.0	1.5 – 6.0	1.5 – 6.0	1.5 – 7.5

Open blind rivet nuts with countersunk head

R 88424

Al alloy
Steel ZP
A2
A4



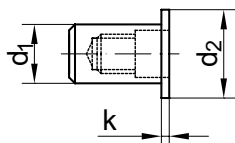
Dimensions	M 4	M 5	M 6	M 8	M 10
d ₁	6	7	9	11	12
d ₂	9	10	12	14	15
k	1.5	1.5	1.5	1.5	1.5
drill Ø	6.1	7.1	9.1	11.1	12.1

Available clamping lengths → price pages

Closed blind rivet nuts with flat head

R 88480

Al alloy
Steel ZP



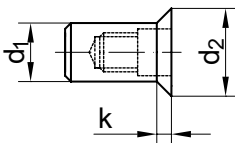
Dimensions	M 4	M 5	M 6	M 8	M 10
d ₁	6	7	9	11	13
d ₂ (St./Al.)	9/10	11	12/13	14/16	19
k	0.8	1.0	1.2	1.3	2.0
drill Ø	6.1	7.1	9.1	11.1	13.1

Available clamping lengths → price pages

Closed blind rivet nuts with countersunk head

R 88481

Al alloy
Steel ZP



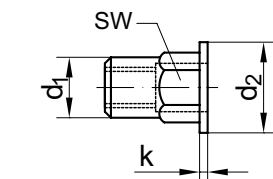
Dimensions	M 4	M 5	M 6	M 8
d ₁ (St./Al.)	6/-	7	9	11
d ₂ (St./Al.)	8.3/-	9.3	11.3	13.3
k (St./Al.)	0.8/-	1.5	1.5	1.5
drill Ø	6.1	7.1	9.1	11.1

Available clamping lengths → price pages

Open blind rivet nuts with hexagonal protruding head

R 88483

Steel ZP
A2



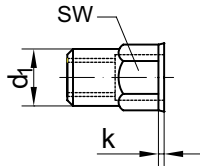
Dimensions	M 4	M 5	M 6	M 8	M 10
d ₁	6	7	9	11	13
d ₂	9	10	13	16	16.5
k	0.8	1	1.5	1.5	2.0
Hexagon size	6	7	9	11	13
Mounting hole	6 ^{+0.1}	7 ^{+0.1}	9 ^{+0.1}	11 ^{+0.1}	13 ^{+0.1}

Available clamping lengths → price pages

**Blind rivet nuts dimensions****Open blind rivet nuts
with hexagonal
small countersunk head****R 88484**

Steel ZP

A2



Dimensions	M 4	M 5	M 6	M 8	M 10
d ₁	6	7	9	11	13
k	0.6	0.6	0.6	0.6	0.7
Hexagon size	6	7	9	11	13
Mounting hole	6 ^{+0.1}	7 ^{+0.1}	9 ^{+0.1}	11 ^{+0.1}	13 ^{+0.1}
Available clamping lengths → price pages					



REM – REYHER Engineering Management

TECHNICAL COMPETENCE & HIGH QUALITY COMMITMENT

The REM – REYHER Engineering Management team deals with all technical matters and details involving fasteners and fixing technology. Our engineers and technicians are always at the cutting-edge of technology – for the benefit of you, our customer.

Products received are tested in-house using the latest methods and technologies. We are well-known in the industry for very high product quality requirements and our stringent choice of suppliers.

For more information, see www.reyher.de



Technically a thread is "a bevelled level equally wound around a cylinder".

This principle enables both a screw on/in as well as screw off function and thus forms the basic characteristic for "detachable" fastenings = screws and nuts.

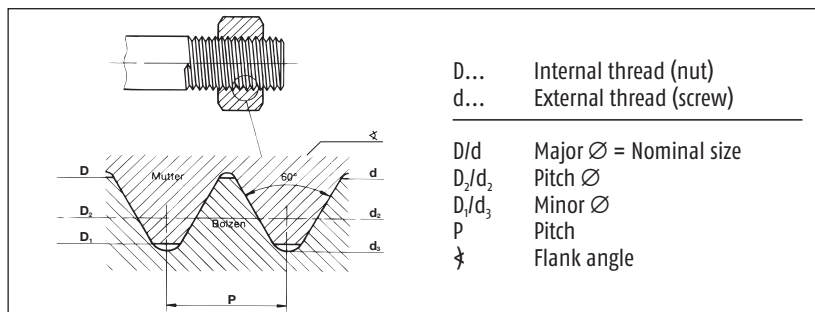
The geometric shape and the standardised dimension and tolerance system are the requirements for the coupling and exchangeability of the same kinds of thread profiles.

Thread profile, thread measuring points

The basic profile and the five measuring points of the thread are illustrated in figure A.

For external threads (screw) the dimension inspection is executed using ring gauges, flank micrometers and optical measuring devices, for internal threads (nuts), this is done using plug gauges.

Figure A:
Thread profile with 5 measuring points



Thread types

Table 1 shows an overview of the most common thread types for screws and nuts. The metric ISO thread has been valid since 1963 as a basis for global, uniform standardisation (ISO) for "Mechanical Fasteners".

Table 1: Overview of the most conventional thread types for mechanical fasteners (excerpt from DIN 202)

Code letter	Description	Version Usage		Designation Example	Flank ↙	acc. to Standard
M	Metric ISO thread	Coarse thread	right-hand	M 20x80	60°	ISO 724
M-LH		Coarse thread	left-hand	M 20x80 LH		(DIN 13-1)
M		Fine thread	right-hand	M 20x2x80		ISO 724
M-LH		Fine thread	left-hand	M 20x2x80 LH		(DIN 13-2...11)
M-SN 4	Metric ISO thread for transition fit	Interference fit thread	sealing	M 20 Sn 4x80		DIN 13-51
M-Sk 6		Interference fit thread	non-sealing	M 20 Sk 6x80		
MFS				MFS 20x80		DIN 8141-1
M	Metric thread with large clearance	Screw threads with larger thread limit deviation nut tolerance 6H		DIN 2510 M 20x80		DIN 2510-2
EG-M	Metric ISO thread: helical coil threads for inserts	External thread dimensions for thread inserts with coarse and fine threading		EG M 20 / EG M 20x2		DIN 8140-2
M-az/M-AZ	Metric ISO thread for HDG items	undersized and oversized thread for HDG external and internal threads		M 12-6az	60°	ISO 965-4 ISO 965-5
M-keg.	Metric external taper screw thread	for screw plugs and lubricating nipples		M 20x1.5 taper		DIN 158-1
G	Cylindrical Ww pipe threads where pressure-tight joints are not made on the threads	for pipes/pipe fastenings		G 3/4"	55°	ISO 228-1
R	Taper Ww piping thread where pressure-tight joints are not made on the threads	for external threads pipes/ fittings/pipe screwed fastenings		R 3/4"		DIN 2999-1 DIN 3858
Rp	Cylindrical Ww Pipe threads where pressure-tight joints are made on the thread	for internal thread pipes/ fittings/pipe screwed fastenings		Rp 3/4"		
Tr	Metric ISO trapezoidal thread (single-start and multi-start thread)	for general use		Tr 20x4	30°	ISO 2901-04
		Precision movement thread		nach Angabe		DIN 3975
Rd	Cylindrical round thread (single-start and multi-start thread)	for, e.g. flush pipe screwed fastenings		Rd 20x1/8		DIN 405-1,2
ST	Tapping screw thread			ST 4,2	60°	ISO 1478
-	Wooden screw thread			-		DIN 7998
UNC	USA: inch thread	Coarse thread		3/4-10 UNC	60°	ANSI B 1.1
UNF		Fine thread		3/4-16 UNF		B.S. 1580-1.2
BSW	UK: inch thread	Coarse thread		3/4-10 BSW	55°	B.S. 84
BSF		Fine thread		3/4-12 BSF		

Thread manufacture

- Non-cutting production (= normal for large series production of screws)
 - thread rolling using profile barrels (M 2-M 30)
 - thread rolling using profile rolls ≥ M 20
- Metal-cutting production
 - cutting using profile threading die
 - thread-chasing using profile clip
 - reeling using profile threading die
 - milling, grinding (for special movement threads)



Fit of thread/Threadability

For the screw-in function of internal and external threads (e.g. screw with nut), the standards are generally based on the functional quality upon assembly with the corresponding tool.

With additional thicker layers/coatings and/or required light-running clearance in the thread (manual assembly) additional measures and order information are necessary!

The basic parameters for threadability:

- **placement of tolerance**
= Distance of the upper dimension of the external thread to the lower limit deviation of the internal thread
→ Figure B
- **tolerance interval**
(„Tolerance quality“)
= Distance of lower to upper limit deviation (interval size $es-ei/EI-ES$)
- **length of thread engagement:**
Minor form and position differences which can occur depending on the length as a kind of lead deviation are unavoidable in mass production.

For this reason, length of thread engagement of the external thread into the internal thread for normal screw fastenings (= screw-in group N) according to ISO 965/DIN 13-14 is restricted due to pitch dependency.

→ Table 3

For higher lengths of thread engagements (L) correspondingly larger tolerance intervals are to be selected.

- **Surface discontinuities/damages to the thread**
During thread production, small laps and/or profile deviations may occur – in the later manufacturing process (quenching and tempering, transport, drum-coating) minor damage like dents, nicks and gouges are unavoidable and make the threadability with thread gauges and mating threads more difficult.
These manufacturing-related surface discontinuities/damages are permitted up to specific limits according to ISO 6157-1/-3 (DIN 267-19) for screws or according to ISO 6157-2 (DIN 267-20) for nuts.
Should especially smooth-running threads be necessary for specific operating situations, either higher tolerance qualities or supplementary "smoothing rolls" with thread protection are needed.

Note: The standardised permitted stress loads for screw fastenings are valid for the tolerances assigned in the respective product standards. Understandably, increases in the tolerance placements/intervals lead to a reduction in the stress capacity in the thread.

Figure B: Placement of tolerance tolerance interval

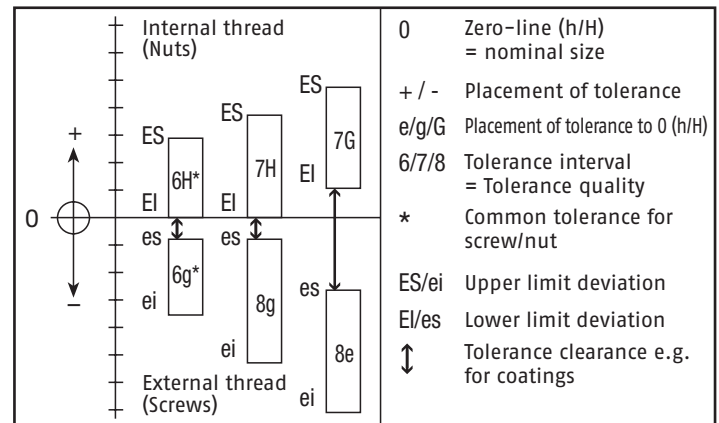


Table 2: Recommended tolerance intervals for length of thread engagement N (before applying a corrosion protection coating*)

Tolerance class:		medium		coarse	
Thread		Ext. thread. (screw)	Int. thread. (nut)	Ext. thread. (screw)	Int. thread. (nut)
for surface condition	– without coating (plain)* – thin coatings** (electro plated)	6g*	6H*	8g*	7H*
	– with large clearance (plain) – thick coatings** (electro plated)	6e	6G	8e	7G
Article product class:		A, B (m, mg)		C (g)	
= e. g. DIN		931, 933	934	558, 601	555
ISO		4 014, 4 017	4 032	4 018, 4 016	4 034

* general tolerance without/before application of coatings

** → TI-217, Table 8/TI-219, Table 9

Table 3: Length of thread engagement $N_{max.}$ for coarse and fine pitch thread

Nominal $\varnothing$ d/D	d/D	M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24	M 27	M 30	M 33	M 36	M 39	M 42	M 45
Pitch P	RG	0.8	1	1.25	1.5	1.75	2	2.5	3	3.5	4	4.5							
	FG	0.5	0.75	1	1.25	1.5	1.5	2	2	2	3	3							
Length of thread engagement $N_{max.}$	RG	7.5	9	12	15	18	24	30	36	45	53	63							
	FG	4.5	7.1	9	12	13	16	16	25	25	36	36							



Table 4: Limit deviations AO – AU (min. – max.) for external and internal threads (bolts/nuts) with coarse and fine pitch thread (RG/FG)
(Extracts from ISO 965-2 / DIN 13 – 20, 21, 22, 27)

				External thread (Bolts/Screws)							Internal thread (Nuts)					
Thread Nom. Ø	Pitch P		Pitch Ø Zero-line	Toler- ance	Major Ø _d		Pitch Ø _{d₂}		Minor Ø _{d₃}		Toler- ance	Major Ø _D	Pitch Ø _{D₂}		Minor Ø _{D₃}	
d/D	RG	FG	h/H		max.	min.	max.	min.	max.	min.		min.	max.	min.	max.	min.
M 3	0.5		2,675	6g	2,980	2,874	2,655	2,580	2,367	2,273	6H	3,000	2,775	2,675	2,599	2,459
				6e	2,950	2,844	2,625	2,550	2,337	2,243	6G	3,020	2,795	2,695	2,619	2,479
M 4	0.7		3,545	6g	3,978	3,838	3,523	3,433	3,119	3,002	6H	4,000	3,663	3,545	3,422	3,242
				6e	3,944	3,804	3,489	3,399	3,085	2,968	6G	4,022	3,685	3,567	3,444	3,264
M 5	0.8		4,480	6g	4,976	4,826	4,456	4,361	3,995	3,869	6H	5,000	4,605	4,480	4,334	4,134
				6e	4,940	4,790	4,420	4,325	3,959	3,833	6G	5,024	4,629	4,504	4,358	4,158
M 6	1		5,350	6g	5,974	5,794	5,324	5,212	4,747	4,596	6H	6,000	5,500	5,350	5,153	4,917
				6e	5,940	5,760	5,290	5,178	4,713	4,562	6G	6,026	5,526	5,376	5,179	4,943
M 8	1.25		7,188	6g	7,972	7,760	7,160	7,042	6,438	6,272	6H	8,000	7,348	7,188	6,912	6,647
				8e	7,937	7,602	7,125	6,935	6,403	6,165	6G	8,028	7,376	7,216	6,940	6,675
		1	7,350	6g	7,974	7,794	7,324	7,212	6,747	6,596	6H	8,000	7,500	7,350	7,153	6,917
M 10	1.5		9,026	6g	9,968	9,732	8,994	8,862	8,128	7,938	6H	10,000	9,206	9,026	8,676	8,376
				8e	9,933	9,558	8,959	8,747	8,093	7,823	6G	10,032	9,238	9,058	8,708	8,408
		1.25	9,188	6g	9,972	9,760	9,160	9,042	8,438	8,272	6H	10,000	9,348	9,188	8,912	8,647
M 12	1.75		10,863	6g	11,966	11,701	10,829	10,679	9,819	9,602	6H	12,000	11,063	10,863	10,441	10,106
				8e	11,929	11,504	10,792	10,556	9,782	9,479	6G	12,034	11,097	10,897	10,475	10,140
		1.5	11,026	6g	11,968	11,732	10,994	10,854	10,128	9,930	6H	12,000	11,216	11,026	10,676	10,376
M 14	2		12,701	6g	13,962	13,682	12,663	12,503	11,508	11,271	6H	14,000	12,913	12,701	12,210	11,835
				8e	13,929	13,479	12,630	12,380	11,475	11,148	6G	14,038	12,951	12,739	12,248	11,873
		1.5	13,026	6g	13,968	13,732	12,994	12,854	12,128	11,930	6H	14,000	13,216	13,026	12,676	12,376
M 16	2		14,701	6g	15,962	15,682	14,663	14,503	13,508	13,271	6H	16,000	14,913	14,701	14,210	13,835
				8e	15,929	15,479	14,630	14,380	13,475	13,148	6G	16,038	14,951	14,739	14,248	13,873
		1.5	15,026	6g	15,968	15,732	14,994	14,854	14,128	13,930	6H	16,000	15,216	15,026	14,676	14,376
M 18	2.5		16,376	6g	17,958	17,623	16,334	16,164	14,891	14,625	6H	18,000	16,600	16,376	15,744	15,294
				8e	17,920	17,390	16,296	16,031	14,853	14,492	6G	18,042	16,642	16,418	15,786	15,336
		2	16,701	6g	17,962	17,682	16,663	16,503	15,508	15,271	6H	18,000	16,913	16,701	16,210	15,835
M 20	2.5		18,376	6g	19,958	19,623	18,334	18,164	16,891	16,625	6H	20,000	18,600	18,376	17,744	17,294
				8e	19,920	19,390	18,296	18,031	16,853	16,492	6G	20,042	18,642	18,418	17,786	17,336
		2	18,701	6g	19,962	19,682	18,663	18,503	17,508	17,271	6H	20,000	18,913	18,701	18,210	17,835
M 22	2.5		20,376	6g	21,958	21,623	20,334	20,164	18,891	18,625	6H	22,000	20,600	20,376	19,744	19,294
				8e	21,920	21,390	20,296	20,031	18,853	18,492	6G	22,042	20,642	20,418	19,786	19,336
		2	20,701	6g	21,962	21,682	20,663	20,503	19,508	19,271	6H	22,000	20,913	20,701	20,210	19,835
M 24	3		22,051	6g	23,952	23,577	22,003	21,803	20,271	19,955	6H	24,000	22,316	22,051	21,252	20,752
				8e	23,915	23,315	21,966	21,651	20,234	19,803	6G	24,048	22,364	22,099	21,300	20,800
		2	22,701	6g	23,962	23,682	22,663	22,493	21,508	21,261	6H	24,000	22,925	22,701	22,210	21,835
M 27	3		25,051	6g	26,952	26,577	25,003	24,803	23,271	22,955	6H	27,000	25,316	25,051	24,252	23,752
				8e	26,915	26,315	24,966	24,651	23,234	22,803	6G	27,048	25,364	25,099	24,300	23,800
		2	25,701	6g	26,962	26,682	25,663	25,493	24,508	24,261	6H	27,000	25,925	25,701	25,210	24,835
M 30	3.5		27,727	6g	29,947	29,522	27,674	27,462	25,653	25,306	6H	30,000	28,007	27,727	26,771	26,211
				8e	29,910	29,240	27,637	27,302	25,616	25,146	6G	30,053	28,060	27,780	26,824	26,264
		2	28,701	6g	29,952	29,577	28,003	27,803	26,271	25,955	6H	30,000	28,316	28,051	27,252	26,752
M 33	3.5		30,727	6g	32,947	32,522	30,674	30,462	28,653	28,306	6H	33,000	31,007	30,727	29,771	29,211
				8e	32,910	32,240	30,637	30,302	28,616	28,146	6G	33,053	31,060	30,780	29,824	29,264
		2	31,701	6g	32,962	32,682	31,663	31,493	30,508	30,261	6H	33,000	31,925	31,701	31,210	30,835
M 36	4		33,402	6g	35,940	35,465	33,342	33,118	31,033	30,655	6H	36,000	33,702	33,402	32,270	31,670
				8e	35,905	35,155	33,307	32,952	30,998	30,489	6G	36,060	33,762	33,462	32,330	31,730
		3	34,051	6g	35,952	35,577	34,003	33,803	32,271	31,955	6H	36,000	34,316	34,051	33,252	32,752

Table 5: Dimensions in millimeters for Ww pipe threads

Thread Nom. Ø in mm	Zoll	1/16	1/8	1/4	3/8	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3
Major Ø in mm	d/D	7.72	9.73	13.16	16.66	20.96	26.44	33.25	41.91	47.80	59.61	75.18	87.88
Distance measuring level a		4.0	4.0	6.0	6.4	8.2	9.5	10.4	12.7	12.7	15.9	17.5	20.6

G = cylindrical external/internal thread
R = taper external thread
R_p = cylindrical internal thread
a = distance of the reference level/measuring level from the start of thread in mm


Table 6: Limit deviation for UNC and UNF threads acc. to ASME B 1.1

Thread Nom. Ø UNC/UNF Nr.	UNC/ UNF	Pitches	Tolerances for external thread in inch Tolerance class 2A					Tolerances for internal thread in inch Tolerance class 2B				
			Major Ø min.	Pitch Ø		Minor Ø		Major Ø min.	Pitch Ø		Minor Ø	
				max.	min.	max.	min.		min.	max.	min.	max.
2	UNC	56	0,0813	0,0854	0,0717	0,0738	0,0641	0,0860	0,0744	0,0772	0,0667	0,0737
	UNF	64	0,0816	0,0854	0,0733	0,0753	0,0668	0,0860	0,0759	0,0786	0,0691	0,0752
3	UNC	48	0,0938	0,0983	0,0825	0,0848	0,0735	0,0990	0,0855	0,0885	0,0764	0,0845
	UNF	56	0,0942	0,0983	0,0845	0,0867	0,0770	0,0990	0,0874	0,0902	0,0797	0,0865
4	UNC	40	0,1061	0,1112	0,0925	0,0950	0,0814	0,1120	0,0958	0,0991	0,0849	0,0939
	UNF	48	0,1068	0,1113	0,0954	0,0978	0,0865	0,1120	0,0985	0,1016	0,0894	0,0968
5	UNC	40	0,1191	0,1242	0,1054	0,1080	0,0944	0,1250	0,1088	0,1121	0,0979	0,1062
	UNF	44	0,1195	0,1243	0,1070	0,1095	0,0972	0,1250	0,1102	0,1134	0,1004	0,1079
6	UNC	32	0,1312	0,1372	0,1141	0,1169	0,1000	0,1380	0,1177	0,1214	0,1040	0,1140
	UNF	40	0,1321	0,1372	0,1184	0,1210	0,1074	0,1380	0,1218	0,1252	0,1110	0,1190
8	UNC	32	0,1571	0,1631	0,1399	0,1428	0,1259	0,1640	0,1437	0,1475	0,1300	0,1390
	UNF	36	0,1577	0,1632	0,1424	0,1452	0,1301	0,1640	0,1460	0,1496	0,1340	0,1420
10	UNC	24	0,1818	0,1890	0,1586	0,1619	0,1394	0,1900	0,1629	0,1672	0,1450	0,1550
	UNF	32	0,1831	0,1891	0,1658	0,1688	0,1519	0,1900	0,1697	0,1736	0,1560	0,1640
12	UNC	24	0,2078	0,2150	0,1845	0,1879	0,1654	0,2160	0,1889	0,1933	0,1710	0,1810
	UNF	28	0,2085	0,2150	0,1886	0,1918	0,1725	0,2160	0,1928	0,1970	0,1770	0,1860
1/4	UNC	20	0,2408	0,2489	0,2127	0,2164	0,1894	0,2500	0,2175	0,2224	0,1960	0,2070
	UNF	28	0,2425	0,2490	0,2225	0,2258	0,2065	0,2500	0,2268	0,2311	0,2110	0,2200
5/16	UNC	18	0,3026	0,3113	0,2712	0,2752	0,2451	0,3125	0,2764	0,2817	0,2520	0,2650
	UNF	24	0,3042	0,3114	0,2806	0,2843	0,2618	0,3125	0,2854	0,2902	0,2670	0,2770
3/8	UNC	16	0,3643	0,3737	0,3287	0,3331	0,2993	0,3750	0,3344	0,3401	0,3070	0,3210
	UNF	24	0,3667	0,3739	0,3430	0,3468	0,3243	0,3750	0,3479	0,3528	0,3300	0,3400
7/16	UNC	14	0,4206	0,4361	0,3826	0,3897	0,3510	0,4375	0,3911	0,4003	0,3600	0,3760
	UNF	20	0,4281	0,4362	0,3995	0,4037	0,3767	0,4375	0,4050	0,4104	0,3830	0,3950
1/2	UNC	13	0,4876	0,4985	0,4435	0,4485	0,4069	0,5000	0,4500	0,4565	0,4170	0,4340
	UNF	20	0,4906	0,4987	0,4619	0,4662	0,4392	0,5000	0,4675	0,4731	0,4460	0,4570
9/16	UNC	12	0,5495	0,5609	0,5016	0,5068	0,4617	0,5625	0,5084	0,5152	0,4720	0,4900
	UNF	18	0,5524	0,5611	0,5205	0,5250	0,4949	0,5625	0,5264	0,5323	0,4050	0,5150
5/8	UNC	11	0,6112	0,6233	0,5588	0,5643	0,5150	0,6250	0,5660	0,5732	0,5270	0,5460
	UNF	18	0,6149	0,6236	0,5828	0,5875	0,5574	0,6250	0,5889	0,5949	0,5650	0,5780
3/4	UNC	10	0,7353	0,7482	0,6773	0,6832	0,6291	0,7500	0,6850	0,6927	0,6420	0,6630
	UNF	16	0,7391	0,7485	0,7029	0,7079	0,6741	0,7500	0,7094	0,7159	0,6820	0,6960
7/8	UNC	9	0,8592	0,8731	0,7946	0,8009	0,7408	0,8750	0,8028	0,8110	0,7550	0,7780
	UNF	14	0,8631	0,8734	0,8216	0,8270	0,7883	0,8750	0,8286	0,8356	0,7980	0,8130
1	UNC	8	0,9830	0,9980	0,9101	0,9168	0,8492	1,0000	0,9188	0,9276	0,8650	0,8900
	UNF	12	0,9868	0,9982	0,9382	0,9441	0,8990	1,0000	0,9459	0,9535	0,9100	0,9280
1 1/8	UNC	7	1,1064	1,1228	1,0228	1,0300	0,9527	1,1250	1,0322	1,0416	0,9700	0,9980
	UNF	12	1,1118	1,1232	1,0631	1,0691	1,0240	1,1250	1,0709	1,0787	1,0350	1,0530
1 1/4	UNC	7	1,2314	1,2478	1,1476	0,1550	1,0777	1,2500	1,1572	1,6680	1,0950	1,1230
	UNF	12	1,2368	1,2482	1,1879	1,1941	1,1490	1,2500	1,1959	1,2039	1,1600	1,1780
1 3/8	UNC	6	1,3544	1,3726	1,2563	1,2643	1,1741	1,3750	1,2667	1,2771	1,1950	1,2250
	UNF	12	1,3617	1,3731	1,3127	1,3190	1,2739	1,3750	1,3209	1,3291	1,2850	1,3030
1 1/2	UNC	6	1,4794	1,4976	1,3812	1,3893	1,2991	1,5000	1,3917	1,4022	1,3200	1,3500
	UNF	12	1,4867	1,4981	1,4376	1,4440	1,3989	1,5000	1,4459	1,4542	1,4100	1,4280
1 3/4	UNC	5	1,7268	1,7473	1,6085	1,6175	1,5091	1,7500	1,6201	1,6317	1,5330	1,5670
	UNF	12	1,7368	1,7482	1,6881	1,6941	1,6490	1,7500	1,6959	1,7037	1,6600	1,6780
2	UNC	4 1/2	1,9751	1,9971	1,8433	1,8528	1,7325	2,0000	1,8557	1,8681	1,7590	1,7950
	UNF	12	1,9868	1,9982	1,9380	1,9441	1,8990	2,0000	1,9459	1,9538	1,9100	1,9280
3	UNC	4	2,9730	2,9968	2,8237	2,8344	2,6991	3,0000	2,8376	2,8515	2,7290	2,7670
4	UNC	4	3,9728	3,9966	3,8229	3,8342	3,6989	4,0000	3,8376	3,8523	3,7290	3,7670



Thread pitches P in mm for

ISO-metric coarse pitch thread M
ISO-metric fine pitch thread M-F
Trapezoidal thread Tr

Threadturn count per inch for

UNC coarse pitch thread
UNF fine pitch thread
BSW coarse pitch thread (Ww)
BSF fine pitch thread
Whitworth pipe thread

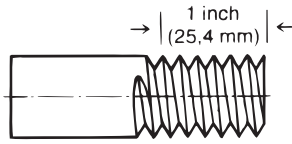
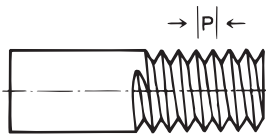


Table 6:

Thread Ø		Pitch P				
M	Tr	M	M-F	M-F2	M-F3	Tr
1		0.25	(0.2)			
1.2		0.25	(0.2)			
1.4		0.3	(0.2)			
1.6		0.35	(0.2)			
1.8		0.35	(0.2)			
2		0.4	(0.25)			
2.2		0.45	(0.25)			
2.5		0.45	(0.35)			
3		0.5	(0.35)			
3.5		0.6	(0.35)			
4		0.7	0.5			
5		0.8	0.5			
6		1	0.75	0.5		
8	8	1.25	1	0.75	0.5	1,5
10	10	1.5	1.25	1	0.75	2 1,5
12	12	1.75	1.5	1.25	1	3 2
14	14	2	1.5	1.25	1	4 3 2
16	16	2	1.5		1	4 2
18	18	2.5	2	1.5	1	4 2
20	20	2.5	2	1.5	1	4 2
22	22	2.5	2	1.5	1	8 5 3
24	24	3	2	1.5	1	8 5 3
27	26/28	3	2	1.5	(1)	8 5 3
30	30	3.5	2	1.5	(1)	10 6 3
33	32/34	3.5	2	1.5		10 6 3
36	36	4	3	2	1.5	10 6 3
39	38/40	4	3	2	1.5	10 7 3
42	42	4.5	(4) 3	2	1.5	10 7 3
45	44/46	4.5	(4) 3		1.5	12 7/8 3
48	48	5	(4) 3	2	1.5	12 8 3
52	50/52	5	(4) 3	2	1.5	12 8 3
56	55	5.5	4	3/2	1.5	14 9 3
60	60	5.5	4	3/2	1.5	14 9 3
64	65	6	4	3	2 (1.5)	16 10 4
68	70	6	4	3	2 (1.5)	16 10 4
Flank ↘		60°				30°

With fine pitch thread, M-F insertion is preferred

Thread Ø			Number G (per 1 inch)				
UNC/UNF No.	Inch	= mm	UNC (NC)	UNF (NF)	BSW (Ww C)	BSF (Ww F)	R, G Rp
0		1,524	–	80	–	–	–
1		1,854	64	72	–	–	–
2		2,184	56	64	–	–	–
3		2,515	48	56	–	–	–
4		2,845	40	48	–	–	–
5		3,175	40	44	–	–	–
6		3,505	32	40	–	–	–
8		4,166	32	36	–	–	–
10		4,826	24	32	–	–	–
12		5,486	24	28	–	–	–
	1/8	3,175	–	–	40	–	28
	5/32	3,969	–	–	32	–	–
	3/16	4,763	–	–	24	32	–
	7/32	5,556	–	–	24	28	–
	1/4	6,350	20	28	20	26	19
	5/16	7,938	18	24	18	22	–
	3/8	9,525	16	24	16	20	19
	7/16	11,113	14	20	14	18	–
	1/2	12,700	13	20	12	16	14
	9/16	14,288	12	18	12	16	–
	5/8	15,875	11	18	11	14	14
	3/4	19,050	10	16	10	12	14
	7/8	22,225	9	14	9	11	14
	1	25,401	8	12	8	10	11
	1 1/8	28,575	7*	12	7	9	11
	1 1/4	31,750	7*	12	7	9	11
	1 3/8	34,925	6*	12	6	8	11
	1 1/2	38,100	6*	12	6	8	11
	1 3/4	44,450	5*	12	5	7	11
	2	50,802	4 1/2*	12	4 1/2	7	11
	2 1/4	57,150	4 1/2*	–	4	–	11
	2 1/2	63,500	4*	–	4	–	11
	2 3/4	69,850	4*	–	3 1/2	–	11
	3	76,200	4*	–	3 1/2	–	11
	4	101,60	4*	–	3	–	11
–			60°		55°		

* Studbolts Ø ≥ 1" = constant 8 threads/inch

** Pipe threads have a larger major diameter (→ Table 5)



General information

Corrosion is the reaction of a metallic material with its environment which causes a measurable change in the material and can negatively influence the function of a metallic component or an entire system. In most cases, this reaction is of an electrochemical nature, but, in some cases, it can be of a chemical or a metal-physical nature. (Definition: Basic principle of "Corrosion" according to ISO 8044)

Table 1 shows the most important corrosion types from a selection of different corrosions which need to be considered with "mechanical fasteners".

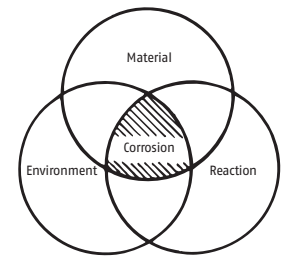


Table 1: Corrosion types

Surface corrosion, e.g. rust Pitting corrosion	Crevice corrosion	Electrochemical corrosion (Contact corrosion) (see Table 2)	intergranular/ transgranular corrosion	Stress corrosion cracking

Corrosion is unavoidable, but damage due to corrosion is avoidable, provided the proper planning of suitable corrosion protection measures is in place. The corrosion protection of screw fastenings needs to be at least as corrosion-resistant as the components to be connected.

The task of constructive planning is to determine the necessary corrosion protection measures. Here the resilience of the corrosion protection in known operating conditions is to be taken into account until maintenance is due or until the limitation of damages has been reached. Surface or material specifications are to be listed in the article order text according to standards.

The next page provides a rough overview of the corrosion protection options for fasteners.

Inspection standards for corrosion protection procedures, compiled in DIN pocketbook 175, stipulate uniform conditions for the type and setup of equipment and methods for checking adherence to the specified coating type, layer thickness and optical appearance. The inspections according to these standards do not provide any information on the effect or fatigue strength of the corrosion protection under practical operating conditions.

An overview of the friction coefficients for various surface combinations → TI assembly. The friction ratios in the screw fastenings are vital when determining the correct tightening torque (→ VDI 2230)

Electrochemical corrosion

The combination of electrochemical noble and ignoble metals in humid conditions (= electrolyte) generates corrosion currents which spread from ignoble (anodic) metal to more noble metal (cathode). This means that less noble metal will be more eroded or corroded. The corrosion current thicknesses are also vital. If the ignoble, anodic part is small in comparison with the surrounding cathodic area (screw head on sheet surface), a very high anodic current thickness will generate which will carry off a lot of material.

Example 1:

Zinc plated screws for fastening a copper sheet:

Zinc is considerably less noble compared to copper. In humid conditions, a very high corrosion current thickness occurs on the small, ignoble, anodic screw head (left column zinc – small) in the direction of the noble, cathodic copper sheet (upper row – copper). The galvanized surface of the screw erodes in a short space of time and red rust appears on the steel.

Remedy:

In relation to the metallic building component, the fasteners should be as similar as possible if not more noble.

Screw	Component
zinc plated	zinc plated
nickel plated	steel, copper, brass
stainless	steel, zinc plated, aluminium, copper, brass

Example 2:

Copper or stainless steel screws which work in a similar way for fastening a zinc plated metal sheet:

This time, the ignoble, anodal, galvanized section is very large in relation to the small, noble, cathodic screw head. The corrosion current which stretches over the entire surface has very low tightness in the anode. The material degradation occurs across the entire surface and shows hardly any corrosion. This process actually additionally protects the nobler screw head against corrosion.

If unfavourable metal pairings cannot be avoided, they should be isolated from each other, e.g. using intermediate layers or coatings. Here, it must be made sure that the full strength of the connection remains intact.

Table 2: Electrochemical corrosion with metal pairings

In regard to contact corrosion of observed material ▼	Area ratio*	Magnesium alloy	Zinc	Hot-dip galvanized steel	Aluminium alloy	Cadmium coating	Construction steel	Low-alloy steel	Cast steel	Chrome steel	Lead	Tin	Copper	Stainless steel
Magnesium alloy	small large		S M	S M	S M	S M	S S	S S	S S	S S	S S	S S	S S	S S
Zinc	small large	M G		G G	M G	M G	S G	S G	S G	S G	S G	S G	S G	S G
Hot dip galvanized steel	small large	M G	G G		M G	M G	S G	S G	S G	S G	S G	S G	S G	S G
Aluminium alloy	small large	M G	G M	G M		G G	M G	G G	S M	M S	S S	S S	S S	S M
Cadmium coating	small large	G M	G G	G M	G G		S G	S G	S G	S G	S G	S G	S G	S G
Construction steel	small large	G G	G G	G G	G G	G G		M G	S G	S G	S G	S G	S G	S G
Low-alloy steel	small large	G G	G G	G G	G G	G G	G G		G G	S G	S G	S G	S G	S G
Cast steel	small large	G G	G G	G G	G G	G G	G G	M G		S G	S G	S G	S S	S S
Chrome steel	small large	G G	G G	G G	G G	G G	G G	G G		M G	M G	S G	S G	S G
Lead	small large	G G	G G	G G	G G	G G	G G	G G	G M	G G		G G	G G	G G
Tin	small large	G G	G G	G G	G G	G G	G G	G G	G G	G M	G G			
Copper	small large	G G	G G	G G	G G	G G	G G	G G	G G	M G	M G	S M		G G
Stainless steel	small large	G G	G G	G M	G G	G G	G G	G G	G G	M G	M G	M G	G G	

S = strong corrosion of the observed material

M = moderate corrosion of the observed material (in very humid environments)

G = negligible or zero corrosion of the observed material

* ratio of the surface of the "observed" material to the surface of the "pairing material" (Source: "FEUERVERZINKEN" (HOT DIP GALVANIZATION) information centre)



Corrosion protection measures

Constructive measures e.g. isolation, avoidance of crevices...

Electrochemical measures e.g. cathodic protection, ventilation

Table 3: Surface measures

Measures	Procedures	Coatings	Coat-thicknesses μm	Standards Brand names
• Non-metallic coatings (inorganic/ *organic coatings)	Lubrication	Oil	–	
	Browning, oxidising	Iron oxide coat	0,5 – 2	DIN 50938
	Phosphate-coating	Phosphate coat	–	EN 12476 (DIN 50942)
	Thin-layer coats of lacquer*	Lacquer/Plastic / Resin (Fluoropolymer/TEFLON)	3 – 20	IRCO-SEAL, KLEVER-COL, XYLAN, PTFE, STAND-COTE
	Dip coating*	Epoxide resin/Polyester/ Phenolic resin	10 – 20	KTL-KATAPHORESE, ECO 2000
	Powder coatings*	Polyester powder	60 – 90	PULVER-COLOR, WEMA-KOR-EX
• Metallic coatings (inorganic coatings)	Electroplated coatings: (electrolytic/chemical/acidic/ alkaline/cyanidic)	Zinc Cadmium Copper	3 – 25	ISO 4042
	+ Conversion layers (e.g. passivation/ chromating – ISO 4520)	Copper-zinc Nickel Nickel-chrome Copper-nickel Copper-nickel-chrome Tin Copper-tin Silver Copper-silver Zinc-nickel Zinc-cobalt Zinc-iron		
	Hot dip galvanization tZn	Zinc		
	Mechanical plating (plated coatings)	Zinc powder on sub-layer copper-plating (chromating possible)		
	Diffusion coatings	Zinc power burned in/on		
• Zinc flake coating	Basecoat (dispersions coatings = inorganic)	Zn-/Al lamellas (silver)	5 – 20	ISO 10683, DACROMET/GEOMET, DELTA-TONE, ZINCTECH
	Topcoat (thin-layer lacquering = organic)	Thin layer argentine or coloured, lubrication integration possible	8 – 15	DELTA-SEAL, DELTA-PROTEKT KL + VH, GEOMET PLUS VL

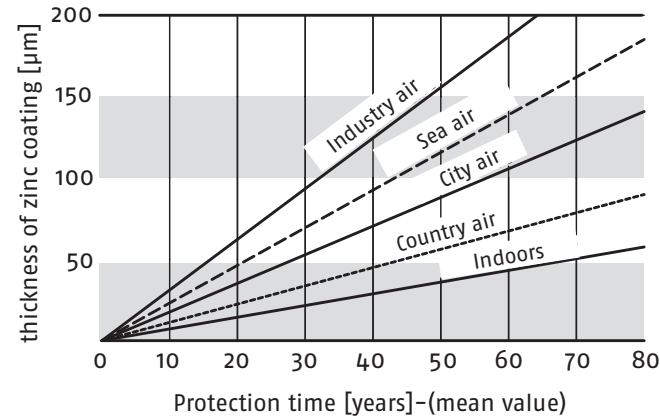
Table 4: Material measures

Measures	Procedure	Coatings	Standards	Brand names
• Non-ferrous metals (NE)	Copper (Cu) Brass (CuZn) Bronze (CuNiSi, CuSn)	– Ni plated, Cr plated, browned –	ISO 8839 (DIN 267-18) (galv. coatings ISO 4042 [DIN 267-9])	KURBUS Special brass 59 KUPRODUR
	Aluminium (Al)	anodised	–	–
	Titanium/Titanium alloys	–	ISO 8839 (DIN 267-18)	–
	Plastics PA, POM, PP, PVDF, Nylon	–	VDI 2544 DIN 34810 – 34816	ULTRAMID, DELRIN, HOSTALEN...
• Stainless steels	Ferritic steels (F) 1.4016, 1.4568	clean and metallic, bright-polished	ISO 3506 (DIN 267-11) EN 10088 (DIN 17224)	–
	Martensite steels (C) 1.4016, 1.4057, 1.4122...		ISO 3506 (DIN 267-11) EN 10088 (DIN 17442)	–
	Austenitic steels (A) A 1 = 1.4305 A 2 = 1.4301, 1.4303 A 4 = 1.4401 A 3 = 1.4541 A 5 = 1.4571 FSt = 1.4310		ISO 3506 (DIN 267-11) EN 10088 (DIN 17440, 17244)	NIRO, NIROSTA, INOX, CRONIFER, REMANIT, UNOX, SINOX ...
			EN 10088 (DIN 17224)	Austenitic/austenitic-ferritic steels with particular resistance against chlorine-induced stress corrosion, e.g. indoor swimming pools → TI-226
• Special materials	Nickel, nickel alloys	metallic, bright-polished	DIN 17740, 17742-44	INCONEL, HASTELLOY, MONEL...
	Special copper alloys Multi-component bronzes		DIN 17662-17665	Sn-/Al-Bronze, NEUSILBER, RESISTIN, CUNIFER...
	Special steels		EN 10269 (DIN 17240), SEW 390	URANUS, SICROMAL, MANOX...

* mechanical properties → TI-227



Table 5: Yearly erosion values for zinc
(for flat surface corrosion)



Service condition	µm/year
Indoors	1,0 – 2,0
Country air*	1,3 – 2,5
City air*	1,9 – 5,6
Industry air*	6,4 – 19
Sea air*	2,2 – 7,2

* In practice, a mixed climate is to be reckoned with.

Table 6: Service conditions/Layer thicknesses for zinc plated steel

Service condition (areas of application)	Allocation of zinc layer thickness in µm	Description examples
0 "very mild" (Decorative use without strain)	3 – 5 ①	„zinc plated“ A 1 A/B/F A 2 A/B/F Fe/Zn 3/5
1 "mild" (Indoor conditions in warm, dry atmosphere)	5 – 8 ①	„zinc plated“ A 2 C/D A 3 A/B/F Fe/Zn 5/8
2 "moderate" (Indoor conditions in rooms in which condensation may occur)	8 – 12 ②	A 3 C/D Fe/Zn 12 A/F Fe/Zn 8/12
3 "strong" (Outdoor weathering under moderate conditions)	12 – 25 ②	A 4 C/D A 5-6/B-G A 7 A/F Fe/Zn 12-25
4 "very strong" (Outdoor weathering under difficult corrosive conditions – e.g. sea/industry environment)	25 ③	A 7 C/D Fe/Zn 25 c 2 C/D

① Corresponds to general standard stock type

② ③ Observe maximum layer thicknesses according to Table 8.

Thread size/oversize required, choose hot dip galvanization if necessary

– Extract from EN 1403, ISO 2081 (protective effects differ in practice)

Table 7: Reference values for corrosion and temperature resistance of galvanizing on steel

Coating	Cr(VI)- free	Coat thickness [µm]	Saltspray test according to ISO 9227		Temperature resistance Coating up to approx. ... °C
			White rust [h] ⑤	Red rust [h] ⑤	
zinc plated colourless/blue passivated ①	yes	3 5 8	2 12 24	12 36 72	60
zinc plated yellow chromated ①	no	5 8	48 72	72 120	60
zinc plated olive chromated ①	no	5 8	72 96	96 144	60
zinc plated black chromated ①	no	5 8	12 24	– 72	60
zinc plated colourless/blue passivated with sealing ②	yes	5 8	72 72	96 120	60
zinc plated thicklayer passivated (TLP) without sealing ②	yes	5 8	48 72	72 120	120
zinc plated thicklayer passivated with sealing ②	yes	5 8	96 96	168 240	120
zinc plated black passivated with sealing ②	yes	5 8	24 24	72 96	60
ZnFe black without sealing ②③	yes	5 8	24 24	48 72	100
ZnFe black with sealing ②	yes	5 8	120 120	196 240	
ZnNi black without sealing ②③	yes	5 8	24 24	360 480	180
ZnNi black with sealing ②	yes	5 8	120 120	600 720	
ZnNi transparent without sealing ②	yes	5 8	120 120	360 600	180
ZnNi transparent with sealing ②	yes	5 8	144 144	480 720	
Zinc flake coating with chromate (Cr-(VI))	no	5 8	– –	480 720	150/180 ④
Zinc flake coating without chromate	yes	6 8	– –	240 480	150/180 ④

① Resistance according to ISO 4042 attachment B (informative)

② Typical values for drum goods, before first assembly and without thermal processing. All surfaces with sealant are only electrically conductive to a limited extent. The friction coefficients vary and need to be inspected when undertaking actual installation work.

③ Limited abrasion resistance of the black surface

④ Temperature dependent on the product used

⑤ Reference values apply for homogeneous surfaces without mistakes



The technical conditions of delivery ISO 4042 apply to electroplated coatings on standard and non-standard fasteners.

Example for a short description of the desired electroplated coatings:

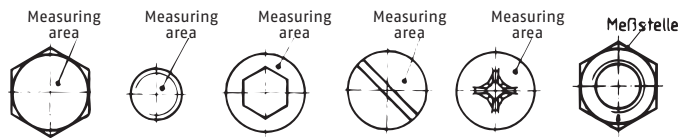
Description according to ISO 4042 – attachment B
(e.g. ISO 4014 – M 16 x 60 – 8.8 Fe/Zn5c Bk)

Fe/Zn	5	c	Bk
			Type of chromation Bk = Black
			Chromation
			Minimum coat thickness of the coating metal 5 = 5 µm (eff. detail!)
			Type of application of the coating material, whereby Fe = iron/steel describes the basic material and Zn = Zinc, the coating material

Description according to ISO 4042 – attachment E
(e.g. ISO 4014 – M 16 x 60 – 8.8 A2S)

A	2	S
		Degree of gloss and post-processing of the chromation S = black
		Code number for the minimum layer thickness and layer composition 2 = 5 µm (encrypted detail)
		Code letter for coating metal A = zinc

When testing, the layer thickness at the measuring point applies.



Normal storage:

„galZn“

„galZnC“ gelb chromat.

„galZn 8 DiSP“

Layer thickness = Type (≥ M 5)

approx. 5 µm = A2A/A2B/A2E/A2F

approx. 5 µm = A2C/A2G/A2L

approx. 8 µm with thick layer passivation

a) Coating metal

A	=	Zn	=	Zinc
B	=	Cd	=	Cadmium
C	=	Cu	=	Copper
D	=	CuZn	=	Brass
E	=	Ni	=	Nickel
F	=	NiCr	=	Nickel-Chrome
G	=	CuNi	=	Copper-Nickel
H	=	CuNiCr	=	Copper-Nickel-Chrome
J	=	Sn	=	Tin
P	=	ZnNi	=	Zinc-Nickel Alloy
R	=	ZnFe	=	Zinc-Iron Alloy

b) Layer thickness/µm (2 coating metals)

1	=	3	–
2	=	5	(2 + 3)
3	=	8	(3 + 5)
9	=	10	(4 + 6)
4	=	12	(4 + 8)
5	=	15	(5 + 10)
6	=	20	(8 + 12)
7	=	25	(10 + 15)
8	=	30	(12 + 18)

c) Postprocessing (passivation/chromation)

Degree of gloss	Types of process	Colour
A =	A	colourless
B = mt	B	bluish
C = (matt)	C	yellowish*
D =	D	olive*
E =	A	colourless
F = bk	B	bluish
G = (blank)	C	yellowish*
H =	D	olive*
J =	A	colourless
K = gl	B	bluish
L = (glossy)	C	yellowish*
M =	D	olive*
P/U = any	wie B, C oder D	
R = mt (matt)	F/Bk	} black*
S = bk (blank)	F/Bk	
T = gl (glossy)	F/Bk	

* Attention: Contains mostly chrome (VI)

The thread tolerances apply before the coatings are plated (when coating, the zero line may not be exceeded with screw threads or come up short with nut threads). Thus the screw thread with coating can be positioned between the upper size of the tolerance field and the zero line.

In the interest of threadability, the layer thickness for thread parts with a normal degree of tolerance of 6g/6H is logically limited. The empirically recommended limit values possible according to ISO 4042 can be found in Table 8. Thicker coatings require different tolerance zones with larger sizes according to DIN 13-14 (custom-made).

When inspecting the threadability, ISO 6157-1/-3 (DIN 267-19, Section 2.7) needs to be observed.

Table 8: Maximum layer thicknesses for outer threads with thread tolerance group g

Thread Ø M	Pitch	Max. coat thickness [µm]				
		according to ISO 4042 ①			Practice values ②	
		Screw length			Screw length	
		< 5d	5d – 10d	10d – 15d	< 5d	5d – 15d
1 – 2	0.2 – 0.4	3	3	3	–	–
2.5 – 7	0.45 – 1	5	3	3	3	(3)
8	1.25	5	5	3	5	3
10 – 16	1.5 – 2	8	5	5	5	3
18 – 22	2.5	10	8	5	(8)	5
24 – 27	3	12	8	8	8	5
30 – 33	3.5	12	10	8	8	8
36 – 52	4 – 5	15	12	10	10	8
56 – 60	5.5	15	15	12	12	10
64	6	20	15	12	12	10

① mathematical limiting value according to ISO 4042, Tab. 2

② recommended limiting value from practice in due consideration of manufacturing and procedural faults according to ISO 6157-1, –3

For electroplated coatings on high-strength fasteners with tensile strengths from approx. 1000 N/mm² (e.g. 10.9 ... 12.9) and hardened fasteners with hardnesses of approx. 320 HV or more, the danger of hydrogen embrittlement cannot be ruled out with any certainty, even with well-known methods. (ISO 4042 Abs.6/attachment A/ISO 15330).

(Alternative coatings → Tab. 3)



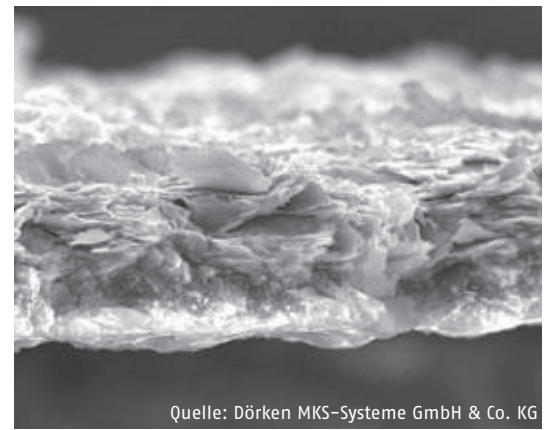
A coating of zinc flakes is a "paint" made of many small flakes that primarily protects components of different types against corrosion. Zinc flake coatings mostly contain a combination of zinc and aluminium flakes that are linked by an inorganic matrix.

The zinc flake coatings typically consist of a base coat as per DIN EN ISO 10683 and a top coat which can be organic or inorganic in accordance with the requirements.

Protective effects from 480 to more than 1,000 hours against base metal corrosion (red rust) as per DIN EN ISO 9227 can now be achieved with extremely thin layers of base and top coat of 5 – 12 µm. The key requirements on the fastening and corrosion are regulated by the standard in accordance with the designation system – this concerns:

- Corrosion resistance
- Friction coefficients

No hydrogen is generated in the coating process, hence there is no danger of hydrogen embrittlement. For this reason, the zinc flakes are also ideally suited for high strength steels in classes 10.9 and 12.9 or from 1,000 MPa.



REM of a zinc lamella coat (20 µm)

Designation example as per DIN EN ISO 10683

Zinc flake	nc	480h	L
			Subsequently applied lubrication
			Corrosion resistance to red rust in the NSS salt spray test
			Specification for CrVI sustainability nc ... without chromate yc... with chromate
General designation "zinc flake" Non-electrolytically applied zinc flake coating			

(e.g. ISO 4014 – M 16 x 60 – 8.8 flZnnc-480h-L)

REYHER goods in stock

flZnnc – 480h – L with 0.09 – 0.14µm set friction coefficient as per VDA

Properties of zinc flake technology at a glance:

- No hydrogen embrittlement as a result of the application process
- Virtually all systems are now CrVI-free in accordance with RoHS and EU End-of-Life Vehicle Directives
- Extremely thin coatings of typically 5 – 12 µm
- Caution, however, with cropped parts with internal drive and small diameters ≥ M 6
- High cathodic corrosion protection in comparison to zinc plating

Further possible setting by special selection of the systems

If you have any questions in this field, please contact REYHER REM application technology

- Pleasing appearance and possibility of colouring scheme through top coats (silver and black as standard)
- Friction values for threaded parts can be set accordingly for the majority of customer requirements
- Low burn-in temperatures possible (from 90 °C standard to 320 °C)
- Generally electrically conductive, but also insulating through special top coats and for reducing contact corrosion
- Excellent chemical resistance of special systems
- Technical application possibilities also as rack or spray process

Attention

Please select the tightening parameter based on the set friction coefficients
see also **TI-231**



Table 9: Product overview

Manufacturer	Product examples	
MAGNI EUROP	Basecoat:	MAGNI FLAKE
	Topcoat:	MAGNI TOP
ATOTECH	Basecoat:	ZINKTEK
	Topcoat:	TECHSEAL
DÖRKEN	Basecoat:	DELTA-PROTEKT®
	Topcoat:	DELTA-SEAL®, DELTACOLL®
NOF	Basecoat:	GEOMET
	Topcoat:	PLUS L®, PLUS VL®



For hot dip galvanized fasteners, the technical conditions of delivery apply according to ISO 10684.

The minimum layer thickness of at least 40 µm at the point of measurement stipulated by this standard requires that the thread dimensions be adjusted (see Table 10).

The undersize is usually to be found in the screw thread with the tolerance group 6az so that the hot dip galvanized screw thread does not exceed the (ISO-compatible) zero line (h tolerance). These screws are also identified with a "U". Rethreading the screw is not permitted.

For high-strength structural bolting assemblies-system HV-according to EN 14399-4, a non-rethreaded screw (g tolerance) is coated which means that the screw thread with hot dip galvanization is above the zero line. In this case the necessary oversize is in the nut thread (= 6 az).

The nut thread is later cut into the hot dip galvanized castings. The corrosion protection of the bare nut thread comes from the zinc coating of the screw thread with remote cathodic protection.

Table 10: Basic measurements of the screw thread before hot dip galvanization – tolerance group 6az according to ISO 10684/ISO 965-4

Thread	M 6*	M 8	M 10	M 12	M 14 M 16	M 18 M 22	M 24 M 27	M 30 M 33	M 36 M 39	M 42 M 45	M 48 M 52	M 56 M 60	M 64
Upper limit dimension es [µm]	-290	-295	-330	-335	-340	-350	-360	-370	-380	-390	-400	-410	-420

* not regulated by standards

After hot dip galvanization, the requirements of ISO 898-1 and ISO 898-2 apply to hot dip galvanized screws and nuts ≥ M 12. For thread sizes M 8 and M 10, reduced resilience applies according to ISO 10684.

Table 11: Min. tensile strength [N] for screws of the 6az tolerance

Property class Marking	4.6 4.6 U	5.6 5.6 U	8.8 8.8 U	10.9 10.9 U
M 6*	7 075	8 844	14 150	17 687
M 8	13 300	16 600	26 600	34 500
M 10	21 400	26 800	42 900	55 700
M 12	33 700	42 200	67 400	87 700
M 16	62 800	78 500	125 000	163 000
M 20	98 000	122 000	203 000	255 000
M 24	141 000	176 000	293 000	367 000
M 30	224 000	280 000	466 000	583 000
M 36	327 000	408 000	678 000	850 000

* not regulated by standards, reference values

Table 12: Proof loads [N] for nuts of the tolerance class 6az

Property class Marking	5 5 Z	6 6 Z	8 8 Z	10 10 Z
M 6*	7 969	9 962	15 934	19 923
M 8	17 300	20 000	25 500	30 600
M 10	28 600	33 000	42 200	50 400
M 12	51 400	59 000	74 200	88 500
M 16	95 800	109 900	138 200	164 900
M 20	154 400	176 400	225 400	259 700
M 24	222 400	254 200	324 800	374 200
M 30	353 400	403 900	516 100	594 700
M 36	514 700	588 200	751 600	866 000

* not regulated by standards, reference values

When assembly hot dip galvanized screws and nuts, especially with additional lubrication of the threading, different friction coefficients and tightening torques need to be reckoned with. EN 1993-1-8 NA need to be considered for hot dip galvanized high-strength structural bolting assemblies! (→ TI-attachment)

The zinc coating may give a small excess to the outer measurements (head, shaft).

Articles with hollow sections (e.g. keys for hexagon socket screws, cap nuts, etc.) are not suitable for hot dip galvanizing.

The grey appearance of the hot dip galvanizing is dependent on the material and not characteristic for the quality of the corrosion protection. White rust and/or whitish to dark corrosion points (zinc-oxide) which can occur after hot dip galvanization, e.g. through dampness, do not usually impair the corrosion protection and no reason for rejection (→ ISO 1461, Section 6.1).

A certain surface rawness and small dents in the thread tips are dependent on the procedure. For this reason, an assembly tool may be required for initial screwing.



The mechanical properties of steel metric screws as well as their quality inspection and marking are set in ISO 898-1.

Designation system for the property classes

The most important mechanical properties for steel screws are given a two-number combination name – here's an example:

The first number gives 1/100 of the

minimum tensile strength

in N/mm² stress area.

Tensile strength 8 x 100 = 800 N/mm².

← **8.8** →

The second number specifies the 10-fold ratio

of the lower yield strength limit (R_{el} or $R_{p0.2}$) for nominal tensile strength R_m (yield strength ratio).

Multiplying the two numbers results in 1/10

of the minimum yield strength in N/mm².

Stress at 0.2% non-proportional elongation

8 x 8 x 10 = 640 N/mm².

Table 1: Mechanical properties of screws, bolts and studs

Properties		Property classes		3.6	4.6	4.8	5.6	5.8	6.8	8.8		10.9	12.9
										≤ M 16	> M 16*		
Tensile strength** R_m in N/mm ²	Nominal value			300	400		500		600	800		1000	1200
	min.			330	400	420	500	520	600	800	830	1040	1220
Yield stress** R_{el} in N/mm ²	Nominal value			180	240	320	300	400	480	–	–	–	–
	min.			190	240	340	300	420	480	–	–	–	–
Stress at 0,2 % non-proportional elongation** $R_{p0.2}$ in N/mm ²	Nominal value			–						640	640	900	1080
	min.			–						640	660	940	1100
Lower yield stress R_{el} / Stress at 0.2% non-proportional elongation at higher temperatures in N/mm² (ISO 898-1 Issue 11/99, Tab. A1)	Continuous use at increased temperatures can lead to significant tensile relaxation.	+ 100 °C	–	–	–	270	–	–	–	590		875	1020
		+ 200 °C	–	–	–	230	–	–	–	540		790	925
		+ 250 °C	–	–	–	215	–	–	–	510		745	875
		+ 300 °C	–	–	–	195	–	–	–	480		705	825
Elongation after fracture A in %**	min.			25	22	–	20	–	–	12		9	8
Vickers hardness ($F \leq 98$ N)**	HV min.–max.			95–220	120–220	130–220	155–220	160–220	190–250	250–320	255–335	320–380	385–435
	***			250	250	250	250	250	–	–	–	–	–
Brinell hardness ($F = 30$ D2)**	HB min.–max.			90–209	114–209	124–209	147–209	152–209	181–238	238–304	242–318	304–361	366–414
	***			238	238	238	238	238	–	–	–	–	–
Rockwell hHardness**	HRB min.–max.			52–95	67–95	71–95	79–95	82–95	89–99,5	–	–	–	–
	***			99.5	99.5	99.5	99.5	99.5	–	–	–	–	–
	HRC min.–max.			–	–	–	–	–	–	22–32	23–34	32–39	39–44

* construction steel bolts from M 12

** values apply at room temperature approx. +20 °C

*** max. value at the screw end

Marking screws, bolts and studs

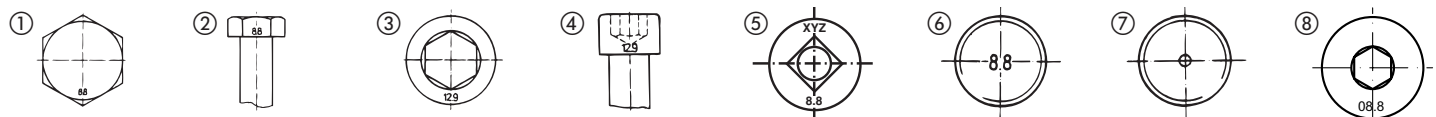
According to the standard, fasteners from a thread diameter of M 5 onward are to be marked with the manufacturer's identification marks and the property class marking as follows*:

- ① ② **Hexagon and hexalobular head screws and bolts** in all property classes. The marking shall be made preferably on the top of the head by indenting or embossing, or on the side of the head by indenting.
- ③ ④ **Hexagon and hexalobular socket head cap screws** in all property classes. The marking shall be made preferably on the side of the head by indenting, or on the top of the head by indenting or embossing.
- ⑤ **Cup head square neck bolts** in all property classes. The marking shall be made on the head by indenting or embossing.
- ⑥ ⑦ **Studs** 5.6 of property classes 5.6, 8.8, 9.8, 10.9 and 12.9. The marking shall be on the unthreaded part of the stud. If this is not possible, marking of the property class shall be on the nut end, and the manufacturer's identification mark may be omitted. Alternative marking symbols are 5.6 = –, 8.8 = p, for 10.9 = l and for 12.9 = g
- ⑧ **Marking of fasteners which have reduced loadability**, i.e., hexagon socket head cap screws with low head for example (DIN 7984): Fasteners shall be marked with the property class, except that the marking symbol for property class shall be preceded by the digit "0" (e.g. "08.8"). The requirement to add a marking is regulated in the product standards. Other screws with reduced loadability are, for example, hexagon socket countersunk head screws acc. to ISO 10642.



Threaded rods acc. to DIN 976 (DIN 975) are marked with the property class from 5.6. The manufacturer's identification is not required. Alternatively, the following colour marking is allowed:

Property class/ Material	Colour
steel/4.6/4.8/5.8/brass/plastic	none
5.6	brown
5.8	blue
8.8	yellow
10.9	white
12.9	black
A2-70	green
A4-70	red



* if there is a lack of space, a marking based on the clock system can be used (→ analogue Table 3)



The DIN product and function standards for nuts are being converted to ISO standards. Accordingly, during the transition period standards for previous DIN and new ISO nut designs shall be on the market together.

Information about standards conversion, "Standards conversion DIN → ISO", see [TI-7](#):

The properties of nuts with coarse threads is specified in ISO 898-2 (EN 20898-2/DIN 267-4) and for nuts with fine threads in ISO 898-6. The loadability of a nut is set by the hardness & nut height and defined by the proof load.

It is regulated that specific nut types must be marked with the property class.

The type of marking as well as the place where it needs to appear is prescribed in the standards ISO 898-2, DIN 267-24 and DIN 267-13, among others.

The key number specifies a direct assignment of property classes of the screws, bolts and studs (→ Table 2).

Nuts with nominal height $\geq 0,8 D$

The first number of the property class of the screw/bolt/stud is the assignment of the property class of the nut. For nuts with a nominal height of $\sim 0,8 D$, e.g. nuts according to DIN 555 and DIN 934, the marking is a number, for instance (8 = 1/100 of the proof stress in N/mm²). The marking of two vertical bars (| |) refers to the applicable proof loads according to DIN 267-4.

For nuts with a nominal height of $\geq 0,8 D$, e.g. nuts according to ISO 4032, ISO 8673, the marking is a number, for instance (8 = 1/100 of the proof stress in N/mm²), without marking of two vertical bars (| |), here the proof loads apply according to ISO 898-2.

Marking: Hexagon head nuts of this group are to be marked from a thread diameter of $\geq M 5$ with the manufacturer's identification mark and the property class in accordance with Table 2 or Table 3.

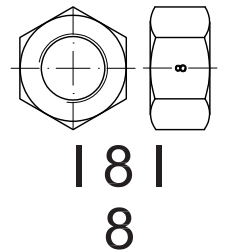


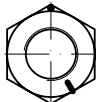
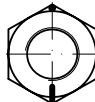
Table 2: Assignment of the nut property classes to the screw property classes

Property class of the nut	Associated screw/bolt/stud		Nut - Thread range	
	Property class	Thread range	Type 1 ¹⁾	Type 2 ¹⁾
4	4.6 4.8	> M 16	> M 16	
5	4.6 4.8 5.6 5.8	$\leq M 16$ $\leq M 39$	$\leq M 39$	
6	6.8	$\leq M 39$	$\leq M 39$	
8	8.8	$\leq M 39$	$\leq M 39$	> M 16 $\leq M 39$
10	10.9	$\leq M 39$	$\leq M 39$	
12	12.9	$\leq M 39$	$\leq M 16$	$\leq M 39$

1) The type determines the necessary proof loads in ISO 898-2.

Note in accordance with ISO 898-2: In general, nuts from the higher property class can be used instead of nuts from the lower property class. This is recommended for a screw-nut fastening with loads above the yield stress or above the proof stress.

Table 3: Alternative marking of the property class with symbols (clock system)

Property class	4	5	6	8	10	12 ²⁾
Marking						

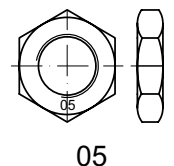
2) The marking placement cannot be replaced by the manufacturer's identification mark

Nuts with nominal height $\geq 0,5 D < 0,8 D$

For nuts with a nominal height of $\geq 0,5 D < 0,8 D$, e.g. nuts according to ISO 4035, ISO 8675 and DIN 439-2 the marking is a number prefixed with "0", e.g. (05 = 1/100 of the proof stress in N/mm²).

The prefixed 0 shows that nuts from this group cannot or can only limitedly take on the loads of a screw due to the low nut height.

Marking: Hexagon head nuts of this group are to be marked from a thread diameter of $\geq M 5$ with the manufacturer's identification mark and the property class.



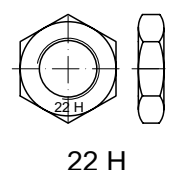
Nuts with nominal height $< 0,5 D$

For nuts with nominal height $< 0,5 D$, for example, nuts according to DIN 936, there is a marking of 1/10 of the minimum hardness according to Vickers, e.g. 22 H (= 220 HV).

Nuts for easy fastenings without specified proof load values are included in this group.

The hardness classes for these nuts are specified in DIN 267-24.

Marking: Nuts of the hardness class 22 H are to be marked with a hardness class if the thread diameter $\geq M 5$.





The properties of fasteners as per American ASME standards are regulated in the following standards among others:

- Hexagon head and square head screws: ASME B18.2.1-2010
- Hexagon socket head cap screws: ASME B18.3-2012
- Nuts: ASME B18.2.2-2010
- Plain washers: ASME B18.22.1-1965

The property classes/mechanical properties for these fasteners are regulated in different norms and standards that are partly included in the product standards. A clear and strict separation as in the field of DIN/EN/ISO standards in product and function standards is not present in the field of ASME standards.

Properties of hexagon head screws as per ASME B18.2.1-2010 Table 6

The ASME B18.2.1-2010 standard regulates the properties of hexagon head and square head screws with inch thread. The standard specifies 8 different product geometries here. An important difference is the difference between so-called "bolts" and "screws". Unfortunately there is no generally valid definition of "bolts" and "screws". In the area of hexagon head screws, "bolts" are always screws without a pronounced washer face; in contrast "screws" always have a washer face. The properties of hex cap screws (ASME B18.2.1-2010 Table 6) are dealt with in more detail in the following. There is no difference between partial and full thread in this standard; screws up to a specific length are supplied with full thread, longer products with partial thread.

Table 4: Overview of full thread/partial thread as per ASME B18.2.1-2010

Diameter in inches	Dimensions with full thread (R 83933)	Dimensions with partial thread (R 83931)	Minimum and maximum length of partial thread in inch	
	Length to in inch	Length from to in inch	min.	max.
1/2	1 1/8	1 1/4 to 6	3/4	1,000
5/16	1 1/4	1 5/16 to 6	7/8	1,153
3/8	1 3/8	1 1/2 to 6	1	1,312
7/16	1 5/8	1 3/4 to 6	1 1/8	1,482
1/2	1 3/4	1 7/8 to 6	1 1/4	1,635
9/16	2	2 1/8 to 6	1 3/8	1,792
5/8	2 1/8	2 1/4 to 6	1 1/2	1,955
3/4	2 1/2	2 5/8 to 6	1 3/4	2,250
7/8	2 3/4	2 7/8 to 6	2	2,556
1	3	3 1/8 to 6	2 1/4	2,875

Diameter in inches	Dimensions with full thread (R 83933)	Dimensions with partial thread (R 83931)	Minimum and maximum length of partial thread in inch	
	Length to in inch	Length from to in inch	min.	max.
1 1/8	3 1/2	3 5/8 to 6	2 1/2	3,214
1 1/4	3 3/4	3 7/8 to 6	2 3/4	3,464
1 3/8	4 1/4	4 5/16 to 6	3	3,833
1 1/2	4 1/2	4 5/8 to 6	3 1/4	4,083
1 3/4	5 1/8	5 1/4 to 6	3 3/4	4,75
2	5 3/4	5 7/8 to 6	4 1/4	5,361
2 1/4	6 1/2	6 5/8 to 12	5	5,861
2 1/2	7 1/8	7 1/4 to 12	5 1/2	6,500
2 3/4	7 5/8	7 3/4 to 12	5 3/4	7,000
3	8 1/8	8 1/4 to 12	6 1/2	7,500

REYHER nevertheless offers a separation here, item 83931 corresponds to the longer dimensions with partial thread and item 83933 corresponds to the shorter dimensions with full thread.

The thread tolerances for inch screws are regulated in the ASME B18.1.1 standard where the following tolerances apply:

- Tolerance limit 2A prior to galvanic coating,
 - Tolerance limit 3A (go-master ring) and 2A (no-go gauge) after the coating
- unless otherwise agreed.

The mechanical properties for screws as per ASME B18.2.1 are defined in accordance with the SAE J429 standard (see Table 5). Strengths are normally specified there in psi (pound-force per square inch), 1000 psi = 6,895 N/mm².

Table 5: Mechanical properties of hexagon head screws as per ASME B18.2.1/SAE J429

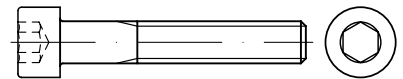
Property class Properties	Grade 5 (~ 8.8)		Grade 8 (~ 10.9)
	Ø > 1/4 - 1	Ø > 1 - 1 1/2	Ø > 1/4 - 1
Tensile strength N/mm ² psi	827 120.000	724 105.000	1034 150.000
0.2 % yield strength N/mm ² psi	634 92.000	558 81.000	896 130.000
Elongation at fracture in %	Min. 14%		Min. 12%
Rockwell core hardness in HRC min.-max.	25 - 34	19 - 30	33 - 39
Marking of the property class			

Screws as per ASME B18.2.1 should be marked with the manufacturer's mark and the property class as per SAE J429.



Properties of hexagon socket head cap screws as per ASME B18.3-2012 Table 1

The ASME B18.3-2012 standard regulates the properties of hexagon socket head cap screws with inch thread. The 1936 version of the standard was thoroughly revised in 1960. The head geometry had also changed. The goods supplied by REYHER comply fully with the "1960 series"; the "1936 series" can be obtained on request. The ASME B18.3 standard specifies 5 different product geometries here (including countersunk head and lower head height). The hexagon socket head cap screws (comparable to DIN 912/ISO 4762) are described in detail in the following.



The thread tolerances for inch screws are regulated in the ASME B18.1.1 standard where the following tolerances apply:

- Up to and including 1 inch: Class 3A,
- Above 1 inch: Class 2A.

The mechanical properties for screws as per ASME B18.3-2012 Table 1 are only defined in accordance with the ASTM A574 standard (see Table 6). Strengths are normally specified there in psi (pound-force per square inch), 1000 psi = 6.895 N/mm².

These screws should only be marked with the manufacturer's mark as only one property class is provided for this product. The head of the hexagon socket head cap screw can be knurled at the choice of the manufacturer. A galvanic coating should be avoided due to the high tensile strength and the associated danger of hydrogen embrittlement.

Table 6: Mechanical properties of hexagon socket head cap screws as per ASME B18.3/ASTM A574

Properties	Steel as per ASTM A574 (~ 12.9)	
	Ø ≤ 1/2	Ø > 1/2
Tensile strength N/mm ² psi	1241 180.000	1172 170.000
0.2 % yield strength N/mm ² psi	1054 153.000	
Elongation at fracture in %	Min. 10%	
Rockwell core hardness in HRC min.-max.	39 - 45	37 - 45

Properties of nuts as per ASME B18.2.2-2010 Table 7

The ASME B18.2.2 standard regulates the properties of nuts with inch thread. On the other hand, this standard specifies 14 different product types, thus "hex nuts" are the products that are listed as item 83934 in this catalogue.

The thread tolerances for nuts are also regulated in the ASME B18.1.1 standard; the nuts are supplied in tolerance class 2B unless agreed otherwise. These nuts can be screwed together with zinc plated and non zinc plated products.

The mechanical properties for nuts as per ASME B18.2.2 are defined in accordance with the SAE J995 standard (see Table 7). Strengths are normally specified there in psi (pound-force per square inch), 1000 psi = 6.895 N/mm².

Table 7: Mechanical properties of "hex nuts" as per ASME B18.2.2/SAE J 995

Property class Properties	Grade 5 (~ 8)		Grade 8 (~ 10)		
	Ø > 1/4 - 1 UNC	Ø > 1 - 1 1/2 UNC	Ø > 1/4 - 5/8 UNC	Ø > 5/8 - 1" UNC	Ø > 1 - 1 1/2 UNC
Tension under test force N/mm ² psi	827 120.000	723 105.000	1034 150.000		
Rockwell core hardness in HRC min.-max.	≤ 32		24 - 32	26 - 34	26 - 36
Marking of the property class					

Nuts as per ASME B18.2.2 should be marked with the manufacturer's mark and the property class.

Properties of washers as per ASME B18.22.1-1965 Type A

The ASME B18.22.1 standard regulates the properties of washers for screws with inch thread. The standard essentially differentiates 2 versions: "Narrow " and "Wide". The difference between the two versions is in the larger outside diameter for the washers of the "wide" version (see table of dimension pages).

There are no requirements on mechanical properties for the "plain" version washers; they should only be produced from steel materials. An overview of washer properties is given in Table 8.

Table 8: Mechanical properties of washers as per ASME B18.22.1/ASTM F436

Properties	Plain washers ASME B18.22.1	Hardened washers as per ASTM F436		
		Hardened, bare or ZP	Hardened, HDG	Case hardened
Rockwell core hardness in HRC min.-max.	No specification	38 - 45	26 - 45	Min. 30 HRC
Case hardness depth/case hardness HR15N - Bare/ZP - HDG				0.015"/79 - 83 0.015"/73 - 83



The mechanical properties of fasteners made from corrosion-resistant stainless steel as well as their quality inspection and marking are set in ISO 3506.

Table 9: Mechanical properties for fasteners of the steel groups A 1 – A 5 at approx. + 20 °C

Property class	Diameter range	Screws				Nuts	
		Tensile strength R _m N/mm ² min.	stress at 0.2% non-proportional elongation N/mm ² min.		Elongation after fracture A mm min.	Proof stress Sp/N/mm ² min.	
						m ≥ 0,8 d	0,5 d ≤ m < 0,8 d
50 soft (turned)	≤ M 39	500	210	Lower yield strength R _{el} or stress at 0.2% elongation at 100 °C = 85% at 200 °C = 80% at 300 °C = 75% at 400 °C = 70%	0.6 d	500	250 (Prop. cl. – 025)
70 cold- worked	≤ M 24	700	450		0.4 d	700	350 (Prop. cl. – 035)
80 high strength	≤ M 24	800	600		0.3 d	800	400 (Prop. cl. – 040)

For hexagon head, hexagon/hexalobular socket head cap and slotted/cross recessed screws, property class 70 is the usual. Fasteners made from stainless steels are tough and well suited for sub-zero temperatures (screws with head as low as –60 °C, screws without head as low as –200 °C according to DIN 267-13).

Austenitic materials cannot be hardened with heat treatment – Fasteners from austenitic materials (A 1 – A 5) have a different assembly behaviour than quenched and tempered steel fasteners. Improper assembly can lead to failure (cold shut/fretting/breakage).

Magnetic properties: The magnetic properties are described by their permeability μ_r . Fasteners made from stainless steels are generally not magnetisable – magnetisation can occur through the manufacturing process: when particular requirements of magnetisability are set, this needs to be arranged accordingly.

A 2: $\mu_r \approx 1,8$
A 4: $\mu_r \approx 1,015$
A 4L: $\mu_r \approx 1,005$

Extract from ISO 3506-1
attachment H

Finish of fasteners made from stainless steels shall be supplied clean and bright.
(passivation → ISO 16048)

Marking: Hexagon head screws/bolts, hexagon/hexalobular socket head cap screws, studs and nuts from a nominal thread diameter of ≥ M 5 (studs from ≥ M 6) are to be marked with the manufacturer's identification mark, the steel group and the property class.

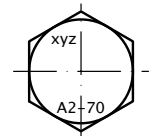


Table 10: Chemical composition in % acc. to ISO 3506/EN 10088-3.

Steel group	Usual materials for screws/bolts/studs/nuts		Cr	Ni	Mo	C	Si	Mn	P	S	Other additions
	Material No. (AISI-No.)	Material designation acc. EN 10088-3/ DIN 17006. 17440									
						max.	max.	max.	max.	max.	(ISO 3506, Tab. 1)
A 1	1.4305 (303)	X8CrNiS 18-9	16-19	5-10	0.7	0,12	1.0	6.5	0,20	0,15-0,35	Cu, – Sulphur may be replaced by selenium
A 2	1.4301 (304) 1.4303 (305)	X5CrNi 18-10 X4CrNi 18-12	15-20	8-19	*	0,10	1.0	2.0	0,05	0,03	* Mo permitted
A 3	1.4541 (321)	X6CrNiTi 18-10	17-19	9-12	*	0,08	1.0	2.0	0,045	0,03	* Mo permitted – must contain Ti, Nb or Ta for stabilisation
A 4	1.4401 (316)	X5CrNiMo 17-12-2	16-18,5	10-15	2.0-3.0	0,08	1.0	2.0	0,045	0,03	
A 5	1.4571 (316 Ti)	X6CrNiMoTi 17-12-2	16-18,5	10.5-14	2.0-3.0	0,08	1.0	2.0	0,0450	0,03	Must contain Ti, Nb or Ta for stabilisation
A –	1.4439	X2CrNiMoN 17-13-5	16.5-18.5	12.5-14.5	4.0-5.0	0,03	1.0	2.0	0,045	0,015	Austenitic/Austenitic-ferritic steels with particular resistance against chloride-induced stress corrosion cracking e.g. in indoor swimming pools
A –	1.4539	X1NiCrMoCu 25-20-5	19-21	24-26	4.0-5.0	0,02	0.7	2.0	0,03	0,01	
A –	1.4529	X1NiCrMoCuN 25-20-7	19-21	24-26	6.0-7.0	0,02	0.5	1.0	0,03	0,01	
A/F – FA	1.4462	X2CrNiMoN 22-5-3	21-23	4.5-6.5	2.5-3.5	0,03	1.0	2.0	0,035	0,015	
C –	1.4034 (420)	X46Cr 13	12.5-14.5			0,43-0,50	1.0	1.0	0,040	0,03	Materials for spring parts – e.g. acc. to DIN 127, 128, 471, 472, 2093, 6797, 6798, 6799, 7967, 7980
C –	1.4122	X39CrMo 17-1	15.5-17.5	≤ 1.0	0.80-1.30	0,33-0,45	1.0	1.5	0,040	0,03	(Caution: Reduced spring load as opposed to spring steel)
A –	1.4310 (301)	X10CrNi 18-8	16-18	6-9.5	≤ 0.8	0,05-0,15	2.0	2.0	0,045	0,015	
C –	1.4568 (301)	X7GNiAl 17-7	16-18	6.5-7.8		0,09	0.7	1.0	0,040	0,015	Al 0.70-1.5



The combination of high strength and high corrosion resistance continually constitutes a challenge for fastenings. To date, self-sacrificing anti-corrosive coatings are used for this that last between 10 and 20 years depending on ambient conditions and continuously reach the limits in terms of usability.

With BUMAX 88 and BUMAX 109, screws and nuts are now available which combine both requirements with one another without the need to compromise. Even more is also offered.

Fasteners made of BUMAX 88 and BUMAX 109 are suitable for a temperature range from -196 °C to +600 °C. At low temperatures, a notched impact strength of 29.5 J is still achieved. At temperatures from +600 °C, the 0.2 % minimum yield strength is reduced by not more than 30 % relative to the value at room temperature. This results in a wide field of applications, especially for applications that are subject to large temperature fluctuations.

The low permeability means that use in research and high-end industries is also possible.

In contrast to commercially available fasteners from A 2 and A 4, lubricating the fasteners makes it possible to apply specific preload forces in the connection using the tightening torque method.

As a further add-on, screws and nuts made of BUMAX 88 are used in a diameter range of M 6 – M 36 and a minimum length of 3xd in the pressure vessel area as per the 97/23/EC Pressure Equipment Directive. The suitability is confirmed by test certificate 3.1. The requirements are specified in an individual appraisal by TÜV Nord (PMA no. 1326W101430_rev_01).

Advantages of fasteners made of BUMAX 88/BUMAX 109 at a glance

- Load-bearing capacity as for screws of property classes 8.8 and 10.9
- Corrosion resistance greater than A4
- Use in a wide temperature range of -196 °C to +600 °C
- Lower permeability (magnetism) than A2 and A4
- Use in pressure vessels as per Pressure Equipment Directive
- Defined tightening torques and preload forces due to adjusted friction coefficients

Table 11: Mechanical properties

Designation	Property class	Ø range	Tensile strength R_m [N/mm ²]	0.2% yield strength $R_{p0.2}$ [N/mm ²]	Breakage elongation
BUMAX 88	80	≤ M 36	800	640	0.3 x d
BUMAX 88, PED	80	M 6 – M 30	800	640	0.4 x d
BUMAX 109	100	≤ M 12	1000	900	0.2 x d
BUMAX 109	100	M 14 – M 20	1000	800	0.2 x d

Table 12: Mechanical properties

Designation	C max.	Cr	Ni	Mo
BUMAX 88	0.03	16.5 – 18.5	11.0 – 14.5	2.5 – 3.0
BUMAX 109	0.03	16.5 – 18.5	11.0 – 14.5	2.5 – 3.0

Table 13: Notched impact strength

Designation	Notched impact strength in Joule [J]				
	20 °C	-50 °C	-100 °C	-140 °C	-196 °C
BUMAX 88	79.5	74.5	69.0	60.0	47.4
BUMAX 109	36.0	34.0	32.9	31.0	29.5

Table 14: Mechanical properties at elevated temperatures

Designation	Remaining yield strength $R_{p0.2}$ in % relative to $R_{p0.2}$ at room temperature					
	100 °C	200 °C	300 °C	400 °C	500 °C	600 °C
BUMAX 88	90	90	85	80	75	70
BUMAX 109	95	95	95	90	90	85

Table 15: Permeability

Designation	$R_{p0.2}$ N/mm ²	Maximum relative permeability k_m
BUMAX 88	640	1006
BUMAX 109	900	1007



Chemical resistance of stainless steel fasteners A 2 and A 4

In practice, the resistance specifications can change; the pure agents rarely have an effect, admixtures often strengthen or weaken the attack. Residue on the part can also change the conditions. The safest approach is always to check the operating conditions.

Table 16: Extract from the resistance list

(Further information on request and from www.Reyher.de)

Agents Degree of resistance			Agents Degree of resistance			Agents Degree of resistance		
A 2 A 4			A 2 A 4			A 2 A 4		
Acetic acid, cold	1	1	Creosote	1	1	Potassium bichromate (25%)	1	1
Acetone, all conc.	1	1	Developer (photo)	1	1	Potassium bitartrate, cold	1	1
Al (10%), cold	1	1	Ethyl acetate	1	1	Potassium chlorate	1	1
Alum saturated solution, boiling	3	1	Ethyl alcohol, all conc.	1	1	Potassium cyanide	1	1
Aluminium acetate	1	1	Ethylether, boiling	1	1	Potassium hydroxyde (caustic potash)	1	1
Aluminium saturated, cold	2	1	Fatty acid, 150 °C	1	1	Potassium nitrate	1	1
Aluminium sulphate (10%), cold	1	1	Formalin	1	1	Potassium permanganate	1	1
Ammonium carbonate	1	1	Formic acid, cold	1	1	Potassium sulphate	1	1
Ammonium nitrate	1	1	Fruit juices	1	1	Salicylic acid	1	1
Ammonium sulphate, cold	1	1	Glue oil	1	1	Salt water, 20 °C	1L	1L
Ammonium sulphite	1	1	Glycerine	1	1	Soap	1	1
Aniline	1	1	Hydrogen cyanide	1	1	Sodium aluminate	1	1
Azotic acid up to 60%, cold	1	1	Hydrogen peroxide	1	1	Sodium bisulphate, boiling	1	1
Beer	1	1	Hydrogen sulphide	1	1	Sodium bisulphide, boiling	1	1
Benzene	1	1	Iron nitrate	1	1	Sodium carbonate (soda)	1	1
Benzoic acid	1	1	Iron sulphate	1	1	Sodium hydroxide, cold	1	1
Benzol	1	1	Lactic acid (80%), boiling	3	2	Sodium nitrate	1	1
Boric acid	1	1	Lactic acid all conc., cold	1	1	Sodium perchlorate	1	1
Butyl acetate	1	1	Latex	1	1	Sodium phosphate	1	1
Calcium bisulphite, boiling	3	1	Lime milk	1	1	Sodium silicate	1	1
Calcium bisulphite, cold	1	1	Liquid ammonia	1	1	Sodium sulphide	1	1
Calcium hydroxyde (10–50%), cold	1	1	Liquid gases (propane, butane)	1	1	Sodium sulphite	1	1
Calcium nitrate	1	1	Magnesium sulphate	1	1	Sulphur (molten)	1	1
Camphor	1	1	Maleic acid	1	1	Sulphur chloride, waterless	1	1
Carbon dioxide	1	1	Mercury	1	1	Sulphur dioxide	1	1
Carbon disulphide	1	1	Mercury amalgam	1	1	Sulphuric acids, saturated, 20 °C	1	1
Carbon tetrachloride, waterless	1	1	Mercury nitrate	1	1	Tannic acid	1	1
Chlorine, dry	1	1	Methyl alcohol	1	1	Tar	1	1
Chloroform, waterless	1	1	Molasses	1	1	Tartaric acid	1	1
Chromic acid (10%), cold	1	1	Nickel sulphate	1	1	Treacle	1	1
Chromic boiling	2	2	Nitrous acid	2	1	Trichloroethylene, waterless	1	1
Citric acid 50%, boiling	3	2	Oils (lubricating and vegetable oils)	1	1	Viscose	1	1
Citric acid saturated, cold	1	1	Oxalic acid, 5%, cold	1	1	Waste waters without acid sulphur	1	1
Copper acetate	1	1	Phenol, boiling	2	1	Wine	1	1
Copper arsenite	1	1	Phosphoric acid up to 70%, cold	1	1	Zinc sulphate	1	1
Copper nitrate	1	1	Photograph. Developer/Fixer	1	1			
Copper sulphate	1	1	Potash	1	1			

1 – resistant (substance loss less than 0.1 g/m² x h)

2 – conditionally resistant (substance loss of 0.1 to 1.0 g/m² x h)

3 – not very resistant (substance loss of 1.0 to 10.0 g/m² x h)

4 – not resistant (substance loss over 10.1 g/m² x h)

L – danger of hole, crack or stress corrosion

Fasteners in indoor swimming pool environments	
Field of application	Materials
Non-loaded fasteners with occasional refilling/areas which come into contact with pool water which have to be cleaned regularly (e.g. section at the side of the pool, decorative linings)	1.4401 1.4404 1.4571
Non-loaded fasteners with occasional refilling/areas which come into contact with pool water which do not have to be cleaned regularly (e.g. overflow basins, steel gratings and slides)	1.4439 1.4539 1.4462
Non-loaded fasteners with occasional refilling/areas which come into contact with pool water which do not have to be cleaned regularly (e.g. overflow basins, steel gratings and slides)	1.4539* 1.4529* 1.4565* 1.4547*

* general technical approval Z-30.3-6 (DIBT/Germany)

On the blue catalogue pages: The large REYHER article range of stainless steels.



The mechanical properties of fasteners from non-ferrous materials as well as their quality inspection and marking are set in ISO 8839.

Table 17: Metallic non-ferrous materials (Cu, MS, Al, Ti) for fasteners and special parts

(Extract from ISO 8839/DIN 267-18)

Material			Tensile strength R_m N/mm ²	Stress at 0.2% non-proportional elongation N/mm ²	Elongation after fracture A %	Notes
Marking	Material code	Material no.	min.	min.	min.	
CU 1	E-Cu57	2.0060	240	160	14	–
CU 2	CuZn37 (MS 63)	2.0321	370–440	250–340	19–11	Storage of compressed parts
CU 3	CuZn39Pb3 (MS 58)	2.0401	370–440	250–340	19–11	Storage of turned parts
CU 4	CuSn6	2.1020	400–470	200–340	33–32	–
CU 5	CuNi1, 5Si	2.0853	590	540	12	saltwater-proof
CU 6	CuZn40MnPb	2.0580	440	180	18	–
CU 7	CuAl10Ni	2.0966	640	270	15	–
AL 1	AlMg3	3.3535	250–270	180–230	4–3	conditionally saltwater-proof
AL 2	AlMg5	3.3555	280–310	200	6	saltwater-proof
AL 3	AlMgSi1	3.2315	310	250	10–7	–
AL 4	AlCuMg1	3.1325	380–420	260–290	10–6	–
AL 5	AlZnMgCu0,5	3.4345	460	380	7	–
AL 6	AlZnMgCu1,5	3.4365	510	440	7	–
Ti 1	Titanium (Titanium 99.5)	3.7025	290	180	30	Storage (→ yellow catalogue pages)
Ti 2	TiAl6V4	3.7165	890	820	10	–

Table 18: Saltwater-proof copper alloys for fasteners and special parts

(Extract from DIN 17660, 17664, 17666)

Description	Material no.	Composition approx. %	Tensile strength R_m approx N/mm ²	Stress at 0.2% nonproportional elongation $R_{p0,2}$ approx N/mm ²	Elongation after fracture A_s approx %
SO-MS 59	2.0540	Cu 59/Zn 36/Ni 2/Mn 1,5	500	300	18
RESISTIN	–	Cu 85/Mn 14/Fe 1	520	400	17–12
CuNiSi	2.0853	Cu 98/Ni 1,5/Si 0,5	590	540	10
CUNIFER	2.0872	Cu 88/Ni 10/Fe 1/Mn 0,5	280–360	100–250	30–10
CUNIFER	2.0882	Cu 69/Ni 30/Fe 0,5/Mn 0,5	340–420	120–300	35–14

Table 19: Plastic materials (thermoplastics) fasteners and special parts

(General values – Further details – Spec. coarse tolerances → VDI 2544 or on request)

Material code	Material group (trade name)	Density g/cm ³	Yield stress dry-humid approx. N/mm ²	Elongation after fracture approx. %	Modulus of elasticity dry-humid approx. N/mm ²	Operating temperature –/+ approx. °C
PA 6	Polyamide 6 (Ultramide)	1.14	80–30	130–220	2700–1800	–40/+80–130
PA 66	Polyamide 6.6 (Ultramide A)	1.14	85–50	40–170	3000–1900	–20/+80–140
POM	Polyacetal (Delrin 150)	1.42	69	30	3000	–40/+100–130
PP	Polypropylene (Hostalen PPH)	0.91	30–35	15	1000–1300	–10/+100–120
PA 12	Polyamide 12	1.01	55–48	150–350	1800–1300	–0/+100
PC	Polycarbonate	1.2	60	80–100	2100	–0/+130
PA 66 (gfv)	with 35% glass fibre	1.39	190–140	5	9500–8500	–40/+100–140

Fasteners in stock = PA 6/PA 66 natural-colour/milky-white, if not specified otherwise.

From the other materials, fasteners can be supplied on short notice, other materials on request.



General information and tightening methods

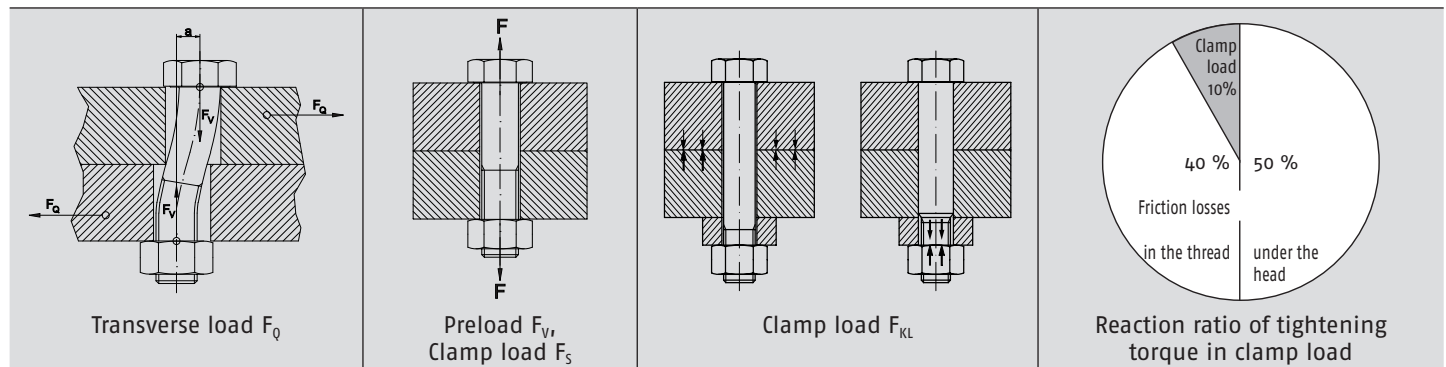
General information

Functional quality and fatigue limit of fasteners are mainly determined with the following factors:

- Mechanical properties (tensile strength, yield strength, elongation)
- Operating conditions (static/dynamic...)
- Service conditions (temperature, corrosion)
- Dimensioning (diameter, length)
- Locking against loosening and unscrewing if necessary
- Assembly (tightening method, preload/clamp load, tightening torque...)

While taking into account all requirements, the task of constructive planning is to determine the suitable fasteners, to define them with the standardised descriptions and to provide the necessary assembly instructions.

The VDI guideline 2230 is available as the recognised standard reference for the "systematic evaluation of highly stressed fasteners". Fasteners should be evaluated and assembled in such a way that transverse loads (F_Q) perpendicular to the centre of the screw do not have any effect because of the sufficiently intact clamp load under operating conditions. Here, loss of clamp load due to intrusions of parts into materials also needs to be taken into account. If the transverse loads are larger than the clamp load, this will lead to the screwed fastening loosening, and ultimately, to its failure.



Tightening method

Essential for the quality and fatigue limit of a fastening is the precise setting/adherence to the assembly preload. Thus alongside the size of the screw, the property class and the friction ratios, the tightening/assembly method is of vital importance during assembly. Numerous tests and theory observations have shown that 80–90% of the tightening torque is required to overcome the friction under the head and in the thread. Only a small part is actually put into generating preload.

Differentiations are made between the following methods:

Manual tightening

In general, tightening by feel with manual tools should not be done. Even with experienced workers, the spread is very large. Empirical values show that screws/bolts up to M 12 are usually tightened beyond the yield strength, while screws over M 14 are usually not tightened enough.

Torque-controlled tightening

Tightening with a torque wrench still shows quite a large spread in the preload due to the friction coefficient differences.

Impact-controlled tightening

When assembling with impact screwdrivers, the motor power of the screwdriver in the impact mechanism is converted into tangential angular momentum. This preloads the screw step-by-step. The advantage of using the impact screwdriver is that the worker absorbs hardly any reaction torque. The disadvantage is to be found in the numerous factors of influence on the screw preloading:

- Elasticity and friction coefficients of the screwed fastening
- Elasticity of the attached tool and the extensions
- Impact strengths and frequency duration or entire impact count

Elongation-controlled tightening

The preload can be calculated from the change in length of the screw, which, for example, can be determined using an ultrasound method during assembly. This method currently offers the highest level of accuracy. However, it is quite complex and expensive.

Angle controlled-tightening

With this method the screw is first preloaded by rotation torque then turned further by a mathematically calculated rotation angle until the ductile deformation starts. The method requires complex trials and is thus quite expensive. Furthermore, it can only be used for screwed fastenings with a long enough stretching length. The mostly ductile deformation of the screw makes it impossible to reuse.

Yield-controlled tightening

This method requires a screwing system consisting of a screwdriver, a control unit and a computer and uses the technical data for controlling, i.e. that upon reaching the yield strength of the screw, the tightening rotational torque no longer increases. The mostly ductile deformation of the screw makes it impossible to reuse.

Hydraulic tightening

Hydraulic preloading is done via the overlong end of the screw. The preloading device supports itself around the nut. The nut can be tightened in a form-fitting way or with a small amount of torque. The centre point of the hydraulic tightening is with large screws up to M 200 in system construction. For example, all screws of a flange can be tightened simultaneously which brings about a uniform distribution of load.



Table 1: Accuracy classes of the tightening methods
Influence of the friction ratios, spread of the preloads

Accuracy class	Spread of the preload %	Tightening factor	Influence of the friction coefficient?	Tightening method (tools)	Adjustment/Inspection method
–	± 2 to +10 ± 5 to ± 20	1.05 to 1.2 1.1 to 1.5	no	• elongation-controlled (ultrasound) • elongation measurement (mechanical)	Ultrasound sensor (→ PMT system) Set up and length measurement
I	± 9 to ± 17	1.2 to 1.4	no	• yield-controlled • angle-controlled (power-assisted or manually)	Empirical specification of pre-tightening torque/rotation angle
II	± 9 to ± 23	1.2 – 1.6	no	• hydraulic tightening	Length/pressure measurement
III	± 17 to ± 23	1.4 – 1.6	yes	• torque-controlled (torque wrench, extension measurement, precision screwdriver)	Empirical specification of the reference tightening torque/dynamic torque measurement
IV	± 23 to ± 33	1.6 – 2.0	yes	• torque-controlled	Reference tightening torque according to estimated friction coefficient
V	± 26 to ± 43	1.7 – 2.5	yes	• torque-controlled (screwdriver) • impulse-controlled (impact wrench)	with post-tightening torque, taken from reference tightening torque (according to estimated friction coefficient) + extra
VI	± 43 to ± 60	2.5 – 4.0	yes	• impulse-controlled (impact wrench) • manually (wrench)	without (via post-tightening torque if necessary)

Table 2: Friction coefficients $\mu_{ges.}$ for steel screws/nuts*

Surface condition		$\mu_{ges.}$ for condition		
Male thread (screw)	Internal thread (nut/component)	non-lubricated	oiled	MoS ₂ -lubricated
without coating (black)	without coating	0.12 – 0.18	0.10 – 0.17	0.06 – 0.12
Mn-phosphated		0.14 – 0.18	0.14 – 0.15	0.06 – 0.11
Zn-phosphated		0.14 – 0.21	0.14 – 0.17	0.06 – 0.12
zinc plated		0.12 – 0.20	0.10 – 0.18	Attention! The friction coefficient can considerably differ depending on the type/extent of the lubrication! Protection with screw connect test recommended!
cadmium plated	zinc plated	0.08 – 0.14	0.08 – 0.11	
zinc plated		0.12 – 0.20	0.10 – 0.18	
cadmium plated	cadmium plated	0.12 – 0.16	0.12 – 0.14	

Table 3: Friction coefficients μ_g and μ_k for screws/nuts* from stainless steel

Screw/bolt and material of screwed part	nut material	lubricants		Resilience of the joint	Friction coefficients	
		in the thread	under the head		in the thread μ_g	under the head μ_k
A2 (~ A4)	A2 (~ A4)	without	without	very big	0.26 – 0.50	0.35 – 0.50
		Special lubricating agent (chlorine-paraffin basis)			0.12 – 0.23	0.08 – 0.12
		Corrosion protection grease			0.26 – 0.45	0.25 – 0.35
		without	without	small	0.23 – 0.35	0.08 – 0.12
		Special lubricating agent (chlorine-paraffin basis)			0.10 – 0.16	0.08 – 0.12
	AlMgSi	without		very big	0.32 – 0.43	0.08 – 0.11
		Special lubricating agent (chlorine-paraffin basis)			0.32 – 0.43	0.08 – 0.11
					0.28 – 0.35	0.08 – 0.11

* Typical values according to VDI 2230-1, issue 07.86, tab. 5–6 for screws/nuts with standard contact surfaces, e.g. according to DIN 912, 931, 933, 934/ISO 4762, 4014, 4017, 4032

Blind hole thread – minimum engagement depth

The minimum engagement depth is dependent on the strength of the nut thread and the thread pitch. Reference values see table 4

Table 4: Reference values for minimum engagement depth in blind hole threads

Property class screws/bolts		8.8	8.8	10.9	10.9	12.9
Proportion $\emptyset$ thread pitch d/P		< 9	≥ 9	< 9	≥ 9	< 9
Nut material	hard Al-alloy	1.1 <i>d</i>	1.4 <i>d</i>			–
	grey iron	1.1 <i>d</i>	1.25 <i>d</i>			1.4 <i>d</i>
	steel $R_m \leq 400$ MPa	1.0 <i>d</i>	1.25 <i>d</i>			1.4 <i>d</i>
	steel $R_m \leq 500$ MPa	0.9 <i>d</i>	1.0 <i>d</i>			1.2 <i>d</i>
	steel $R_m \leq 800$ MPa	0.8 <i>d</i>	0.9 <i>d</i>			1.0 <i>d</i>

Source: Dabel book for the mechanical engineering



Preloads and tightening torque for fasteners of steel

Preloads and tightening torque for steel shank screws with full loadability with head contact area sizes like DIN 912, 931, 933, 934, ISO 4762, 4014, 4017, 4032 ...*

The following are taken into account in table values for M_A :

- a) Friction coefficient $\mu_{\text{total}} = 0.14$ *
 - b) Utilisation of the minimum yield strength = 90%
 - c) Torsion torque when tightening
- (* The friction coefficient of $\mu_{\text{total}} = 0.14$ is generally assumed for screws and nuts in standard commercial deliveries)

Additional lubrication of the thread considerably changes the friction coefficient and brings about unspecified tightening ratios! Tightening methods and tools have different spreads (→ Tab. 1/VDI 2230-1, Tab. A8).

Table 5: Typical values for shank screws/bolts with coarse thread, friction coefficient $\mu_{\text{total}} = 0.14$

Dimensions P	Stress area AS (mm ²)	Preloads F_y (kN) for property class					Tightening torque M_A (Nm) for property class				
		4.6	5.6	8.8	10.9	12.9	4.6	5.6	8.8	10.9	12.9
M 4 0.7	8.78	1.28	1.71	4.30	6.30	7.40	1.02	1.37	3.3	4.8	5.6
M 5 0.8	14.2	2.10	2.79	7.00	10.3	12.0	2.0	2.7	6.5	9.5	11.2
M 6 1.0	20.1	2.96	3.94	9.90	14.5	17.0	3.5	4.6	11.3	16.5	19.3
M 8 1.25	36.6	5.42	7.23	18.1	26.6	31.1	8.4	11.0	27.3	40.1	46.9
M 10 1.5	58.0	8.64	11.5	28.8	42.2	49.4	17.0	22.0	54.0	79.0	93.0
M 12 1.75	84.3	12.6	16.8	41.9	61.5	72.0	29.0	39.0	93.0	137.0	160.0
M 14 2.0	115.0	17.3	23.1	57.5	84.4	98.8	46.0	62.0	148.0	218.0	255.0
M 16 2.0	157.0	23.8	31.7	78.8	115.7	135.4	71.0	95.0	230.0	338.0	395.0
M 18 2.5	193.0	28.9	38.6	99.0	141.0	165.0	97.0	130.0	329.0	469.0	549.0
M 20 2.5	245.0	37.2	49.6	127.0	181.0	212.0	138.0	184.0	464.0	661.0	773.0
M 22 2.5	303.0	46.5	62.0	158.0	225.0	264.0	186.0	250.0	634.0	904.0	1057.0
M 24 3.0	353.0	53.6	71.4	183.0	260.0	305.0	235.0	315.0	798.0	1136.0	1329.0
M 27 3.0	459.0	70.6	94.1	240.0	342.0	400.0	350.0	470.0	1176.0	1674.0	1959.0
M 30 3.5	561.0	85.7	114.0	292.0	416.0	487.0	475.0	635.0	1597.0	2274.0	2662.0
M 33 3.5	694.0	107.0	142.0	363.0	517.0	605.0	645.0	865.0	2161.0	3078.0	3601.0
M 36 4.0	817.0	125.0	167.0	427.0	608.0	711.0	1080.0	1440.0	2778.0	3957.0	4631.0
M 39 4.0	976.0	151.0	201.0	512.0	729.0	853.0	1330.0	1780.0	3597.0	5123.0	5994.0
M 42 4.5	1117.0	212.0	265.0	584.0	832.0	974.0	1605.0	2006.0	4413.0	6285.0	7354.0
M 45 4.5	1302.0	249.0	311.0	684.0	974.0	1140.0	2005.0	2506.0	5512.0	7851.0	9187.0
M 48 5.0	1468.0	280.0	350.0	770.0	1096.0	1283.0	2424.0	3030.0	6667.0	9495.0	11112.0
M 52 5.0	1753.0	335.0	419.0	922.0	1314.0	1537.0	3116.0	3896.0	8570.0	12206.0	14284.0
M 56 5.5	2024.0	387.0	484.0	1064.0	1516.0	1774.0	3883.0	4854.0	10678.0	15208.0	17797.0
M 60 5.5	2356.0	452.0	565.0	1242.0	1770.0	2071.0	4818.0	6022.0	13249.0	18870.0	22082.0
M 64 6.0	2669.0	511.0	639.0	1406.0	2003.0	2344.0	5802.0	7252.0	15955.0	22724.0	26592.0
M 68 6.0	3047.0	585.0	732.0	1610.0	2293.0	2683.0	7012.0	8765.0	19282.0	27462.0	32137.0
M 72 6.0	3451.0	665.0	831.0	1828.0	2603.0	3046.0	8379.0	10474.0	23043.0	32819.0	38405.0
M 76 6.0	3881.0	749.0	936.0	2059.0	2933.0	3432.0	9903.0	12378.0	27232.0	38785.0	45387.0
M 80 6.0	4335.0	838.0	1047.0	2304.0	3282.0	3840.0	11610.0	14514.0	31930.0	45476.0	53216.0
M 90 6.0	5580.0	1083.0	1353.0	2977.0	4240.0	4962.0	16796.0	20995.0	46188.0	65783.0	76980.0
M 100 6.0	6983.0	1359.0	1698.0	3736.0	5322.0	6227.0	23381.0	29226.0	64297.0	91574.0	107161.0

Table 6: Typical values for shank screws/bolts with fine pitch thread, friction coefficient $\mu_{\text{total}} = 0.14$

Dimensions P	Stress area AS (mm ²)	Preloads F_y (kN) for property class			Tightening torque M_A (Nm) for property class		
		8.8	10.9	12.9	8.8	10.9	12.9
M 8 1.0	39.2	19.7	28.9	33.9	29.2	42.8	50.1
M 10 1.25	61.2	30.8	45.2	52.9	57.0	83.0	98.0
M 12 1.25	92.1	46.8	68.7	80.4	101.0	149.0	174.0
M 12 1.5	88.1	44.3	65.1	76.2	97.0	143.0	167.0
M 14 1.5	125.0	63.2	92.9	109.0	159.0	234.0	274.0
M 16 1.5	167.0	85.5	126.0	147.0	244.0	359.0	420.0
M 18 1.5	216.0	115.0	163.0	191.0	368.0	523.0	613.0
M 20 1.5	272.0	144.0	206.0	241.0	511.0	728.0	852.0
M 22 1.5	333.0	178.0	253.0	296.0	692.0	985.0	1153.0
M 24 2.0	384.0	204.0	290.0	339.0	865.0	1232.0	1442.0
M 27 2.0	496.0	264.0	375.0	439.0	1262.0	1797.0	2103.0
M 30 2.0	621.0	331.0	472.0	552.0	1756.0	2502.0	2927.0
M 33 2.0	761.0	407.0	580.0	678.0	2352.0	3350.0	3921.0
M 36 2.0	915.0	490.0	698.0	817.0	3082.0	4390.0	5137.0
M 39 2.0	1082.0	581.0	828.0	969.0	3953.0	5631.0	6589.0

Tables 5 and 6: up to M 39 extract from VDI 2230-1: 2003-02, above M 39 calculation based on VDI guideline 2230-1: 2003-02



Preloads and tightening torques for fasteners of steel

Preloads and tightening torques for steel screws full loadability with head contact sizes like DIN 912, 931, 933, 934, ISO 4762, 4014, 4017, 4032 and zinc flake coating*

* for zinc flake coated fasteners from REYHER Catalogue typically applies a coefficient of friction of $\mu_{ges} = 0.09$, unless otherwise specified

Table 7: Typical values for shank screws/bolts

with coarse thread, friction coefficient $\mu_{ges} = 0.09$ and utilisation of the minimum yield strength of 90%

Dimensions P	Stress area A (mm ²)	Preloads F_v (kN) for property class			tightening torques M_A (Nm) for property class		
		8.8	10.9	12.9	8.8	10.9	12.9
M 5 0.8	14.2	7.47	10.97	12.7	4.82	7.08	8.0
M 6 1.0	20.1	10.56	15.51	17.9	8.37	12.3	14.0
M 8 1.25	36.6	19.31	28.36	32.9	20.17	29.63	34.0
M 10 1.5	58.0	30.7	45.1	52.3	39.7	58.3	67.0
M 12 1.75	84.3	44.7	65.1	76.3	68.3	100.0	115.6
M 14 2.0	115.0	61.3	90.0	104.6	109.0	160.0	183.8
M 16 2.0	157.0	83.8	123.0	143.2	167.0	245.0	282.1
M 18 2.5	193.0	106.0	150.0	174.9	241.0	343.0	394.7
M 20 2.5	245.0	135.0	192.0	223.9	337.0	480.0	553.0
M 22 2.5	303.0	168.0	239.0	278.9	458.0	652.0	753.3
M 24 3.0	353.0	194.0	277.0	322.5	580.0	825.0	952.9
M 27 3.0	459.0	255.0	363.0	422.9	847.0	1207.0	1398.7
M 30 3.5	561.0	310.0	442.0	514.9	1154.0	1644.0	1905.5
M 33 3.5	694.0	385.0	549.0	639.9	1552.0	2211.0	2565.8
M 36 4.0	817.0	453.0	645.0	752.0	2001.0	2850.0	3307.3
M 39 4.0	976.0	543.0	773.0	901.6	2578.0	3672.0	4263.2

Preloads and tightening torques for steel shank screws from material 25CrMo4 +QT (1.7218) with head dimensions like ISO 4762, 4014, 4017, 4032

Table 8: Typical values for shank screws/bolts with coarse thread from 25CrMo4 +QT ($R_m \geq 600$ MPa, $R_{p0.2} \geq 440$ MPa) and utilisation of the minimum yield strength of 90%

Dimensions P	Stress area A (mm ²)	Preloads F_v (kN) for μ_{ges}			Tightening torques M_A (Nm) for μ_{ges}		
		0.10	0.12	0.14	0.10	0.12	0.14
M 8 1.25	36.6	13.0	12.7	12.3	14.6	16.6	18.4
M 10 1.5	58.0	20.7	20.2	19.6	28.9	32.8	36.5
M 12 1.75	84.3	30.1	29.4	28.6	49.8	56.7	63.0
M 14 2.0	115.0	41.2	40.3	39.3	79.3	90.2	100.3
M 16 2.0	157.0	56.6	55.3	53.9	122.0	139.3	155.5
M 18 2.5	193.0	69.2	67.5	65.7	170.3	194.0	216.0
M 20 2.5	245.0	88.6	86.5	84.2	239.1	273.2	304.9
M 22 2.5	303.0	110.4	107.8	105.1	326.3	373.9	418.2
M 24 3.0	353.0	127.6	124.5	121.3	412.0	470.8	525.4
M 27 3.0	459.0	167.3	163.5	159.3	606.1	694.9	777.7
M 30 3.5	561.0	203.7	198.9	193.9	825.0	944.7	1056.2
M 33 3.5	694.0	253.3	247.5	241.3	1112.6	1277.0	1430.4
M 36 4.0	817.0	297.6	290.7	283.4	1433.1	1642.9	1838.5
M 39 4.0	976.0	356.9	348.8	340.1	1849.6	2124.8	2381.5

Preloads and tightening torques for bolts with waisted shank made from material 21CrMoV5-7 +QT (1.7709) acc. to DIN 2510

Table 9: Typical values for bolts with waisted shank with coarse thread from 21CrMoV5-7 +QT ($R_m \geq 700$ MPa, $R_{p0.2} \geq 550$ MPa) utilisation of the minimum yield strength of 70%

Dimensions P	Shank Ø	Preloads F_v (kN) for μ_{ges}		Tightening torques M_A (Nm) for μ_{ges}	
		0.10	0.12	0.10	0.12
M 12 1.75	8.5	21.6	21.6	38.0	44.0
M 16 2.0	12.0	43.5	43.5	98.0	115.0
M 20 2.5	15.0	67.8	67.8	190.0	220.0
M 24 3.0	18.0	97.8	97.8	320.0	370.0
M 27 3.0	20.5	126.5	126.5	465.0	545.0
M 30 3.5	23.0	160.0	160.0	650.0	770.0
M 33 3.5	25.5	196.5	196.5	870.0	1000.0
M 36 4.0	27.5	228.5	228.5	1100.0	1300.0
M 39 4.0	30.5	281.0	281.0	1450.0	1750.0
M 42 4.5	32.5	319.0	319.0	1800.0	2100.0
M 45 4.5	35.5	381.0	381.0	2300.0	2700.0
M 48 5.0	37.5	425.0	425.0	2750.0	3250.0



Preloads and tightening torques for fasteners from steel

Preloads and tightening torques for fasteners with reduced loadability like e.g. DIN 6912, 7984, ISO 7380 -1/-2, 10642

Fasteners with reduced loadability are standardized or non-standardized fasteners with material and mechanical properties according ISO 898-1, due to its geometry, does not fulfil the test requirements for full loadability fasteners.

Fasteners with reduced loadability does not normally break in the free threaded length.

Basically, there are two geometrical reasons for reduced loadability of fasteners:

- head design which applies to
 - bolts and screws with low head with or without external driving feature, or
 - with low round or cylindrical head with internal driving feature or
 - countersunk head with internal driving feature.
- shank design: e.g. screws with waisted shank.

The identification of screws and bolts with reduced loadability is a "0" before the property class, e.g. 08.8 or 010.9.

Fasteners according to above mentioned product standards can hold about 80% of the preloads of fasteners with full loadability.

Table 10: Typical values for fasteners according DIN 6912, 7984, ISO 7380 -1/-2, 10642, total friction coefficient $\mu_{ges} = 0.14$

Dimensions		Preloads F_v (kN) for property class		Tightening torque M_A (Nm) for property class	
		08.8	010.9	08.8	010.9
M 3		1.9	2.9	1.1	1.6
M 4		3.4	5.0	2.6	3.8
M 5		5.5	8.1	5.1	7.4
M 6		7.8	11.0	8.8	13.0
M 8		14.0	21.0	21.0	31.0
M 10		23.0	34.0	42.0	62.0
M 12		33.0	49.0	73.0	108.0
M 14		46.0	67.0	117.0	171.0
M 16		63.0	92.0	181.0	266.0
M 18		79.0	112.0	259.0	370.0
M 20		101.0	144.0	366.0	521.0
M 22		126.0	180.0	502.0	715.0
M 24		146.0	207.0	630.0	898.0
M 30		233.0	331.0	1 267.0	1 805.0
M 36		340.0	484.0	2 206.0	3 140.0

Preloads and tightening torques for fasteners with shank from steel, with UNC/UNF thread acc. to ASME B18.2.1, ASME B18.3 and ASME B18.2.2

Table 11: Typical values for fasteners with UNC thread and total friction coefficient $\mu_{ges} = 0.14$

Dimensions $\varnothing$ G		Preloads F_A for property class						Tightening torque M_A for property class					
		Grade 5*		Grade 8*		ASTM A 574		Grade 5*		Grade 8*		ASTM A 574	
		[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[Nm]	[ft-lbs]	[Nm]	[ft-lbs]	[Nm]	[ft-lbs]
#2	56	1.2	262	1.7	370	1.9	435	0.5	0.4	0.7	0.5	0.8	6.0
#4	40	1.9	423	2.7	598	3.1	704	1.1	0.8	1.5	1.1	1.8	1.3
#5	40	2.5	565	3.6	798	4.2	940	1.6	1.2	2.2	1.6	2.6	1.9
#6	32	2.8	636	4.0	899	4.7	1058	2.0	1.5	2.8	2.1	3.3	2.4
#8	32	4.5	1000	6.3	1413	7.4	1663	3.6	2.7	5.1	3.8	6.1	4.5
#10	24	5.5	1232	7.8	1741	9.1	2050	5.3	3.9	7.4	5.5	8.7	6.4
1/4	20	10.1	2260	14.2	3194	16.7	3759	12.1	8.95	17.1	12.6	20.2	14.9
5/16	18	16.7	3764	23.7	5319	27.8	6260	25.7	18.9	36.3	26.7	42.7	31.5
3/8	16	24.9	5594	35.2	7904	41.4	9303	44.6	32.9	63.0	46.4	74.1	54.7
7/16	14	34.2	7684	48.3	10858	56.8	12780	70.9	52.3	100.0	73.9	117.9	87.0
1/2	13	45.8	10300	64.7	14554	76.2	17131	109.0	80.3	154.0	114.0	181.1	133.6
5/8	11	73.2	16464	103.0	23265	121.8	27384	213.0	157.0	301.0	222.0	354.5	261.4
3/4	10	109.0	24485	154.0	34599	181.2	40725	383.0	283.0	541.0	399.0	637.2	470.0
7/8	9	151.0	33891	213.0	47889	250.7	56368	614.0	453.0	868.0	640.0	1021.5	753.4
1	8	198.0	44499	280.0	62879	329.2	74012	922.0	680.0	1303.0	961.0	1533.3	1130.9
1 1/8	7	219.0	49326	252.0	79166	414.5	93183	1153.0	850.0	1850.0	1364.0	2178.0	1606.4
1 1/4	7	280.0	62934	449.0	101005	528.8	118888	1618.0	1194.0	2597.0	1916.0	3057.2	2254.9
1 3/8	6	333.0	74796	534.0	120043	628.5	141297	2121.0	1565.0	3405.0	2511.0	4007.4	2955.7
1 1/2	6	406.0	91358	652.0	146624	767.7	172585	2806.0	2070.0	4504.0	3322.0	5301.5	3910.2

Table 12: Typical values for fasteners with UNF thread and total friction coefficient $\mu_{ges} = 0.14$

Dimensions $\varnothing$ G		Preloads F_A for property class						Tightening torque M_A for property class					
		Grade 5*		Grade 8*		ASTM A 574*		Grade 5*		Grade 8*		ASTM A 574*	
		[kN]	[lbf]	[kN]	[lbf]	[kN]	[lbf]	[Nm]	[ft-lbs]	[Nm]	[ft-lbs]	[Nm]	[ft-lbs]
1/4	28	11.8	2653	16.7	3749	19.6	4413	13.8	10.2	19.5	14.4	22.9	16.9
5/16	24	18.9	4252	26.7	6008	31.5	7071	28.3	20.9	40.0	29.5	47.0	34.7
3/8	24	28.9	6486	40.8	9165	47.9	10788	50.0	36.9	70.7	52.2	83.2	61.4
7/16	20	39.0	8758	55.0	12375	64.8	14566	78.6	57.9	111.0	81.9	130.7	96.4
1/2	20	52.8	11861	74.6	16760	87.8	19727	122.0	89.7	172.0	127.0	202.2	149.1
5/8	18	84.7	19050	120.0	26918	140.9	31684	239.0	176.0	337.0	249.0	396.6	292.5
3/4	16	124.0	27814	175.0	39302	250.8	46261	423.0	312.0	597.0	441.0	703.0	518.5
7/8	14	170.5	38321	240.8	54150	283.5	63737	677.3	499.6	957.1	705.9	1126.6	830.9
1	12	221.5	49803	313.0	70373	368.5	82833	1008.6	743.9	1425.2	1051.1	1677.5	1237.2
1 1/4	12	360.7	81088	509.68	114581	599.9	134868	2030.6	1497.7	2869.4	2116.4	3377.4	2491.1
1 1/2	12	533.28	119886	753.5	169404	886.9	199398	3568.9	2632.3	5043.0	3719.6	5935.9	4378.1

* Grade 5 (~ 8.8) and Grade 8 (~ 10.9) acc. to SAE J 429, ASTM A 574 for hexagon head cap screws (~ 12.9)



Preloads and tightening torques of screwed fastenings from steel with locking elements

Table 13: Typical values for preloads F_V and tightening torques for screws and nuts with lock ribs under the flange
(REYHER articles 88913 and 88914)

Material of screwed part	Property class 100/10																				
	M 5		M 6		M 8		M 10		M 12		M 14x1.5		M 16								
	F _V [N]	M _A [Nm]	F _V [N]	M _A [Nm]	F _V [N]	M _A [Nm]	F _V [N]	MA[Nm]	F _V [N]	M _A [Nm]	F _V [N]	M _A [Nm]	F _V [N]	M _A [Nm]							
Steel R _m < 800 MPa	9000	11	19	12600	18	23200	37	85	80	54000	120	250	74000	240	102000	310					
Steel R _m ≥ 800 MPa		10	18														37	80	120	240	310
malleable cast iron		9	16														35	75	115	230	300

Table 14: Typical values for preloads F_V and tightening torques F_V for hexagon socket cap screws with lock ribs under the flange
(REYHER articles 88912)

Material of screwed part	Property class 100/10									
	M 5		M 6		M 8		M 10		M 12	
	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]
Steel $R_m < 800$ MPa		13		24		45		90		150
Steel $R_m \geq 800$ MPa	9000	11	12600	20	23200	42	37000	85	54000	140
malleable cast iron		10		19		39		80		120

Table 15: Typical values for preloads and tightening torques of locking screws and nuts
(REYHER articles 88933 und 88934)

Material of screwed part	Property class 100/10								Property class 100/10			
	M 5		M 6		M 8		M 10		M 12		M 16	
	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]	F_V [N]	M_A [Nm]
Steel	6350	9		16		34		58		120		280
malleable cast iron		7	9000	13	16500	28	26200	49	54000	105	102000	260

Table 16: Typical values for tightening torques and prestressing forces of screwed fastenings with NORD-LOCK washers
(REYHER article 88132)

NL washers for threads	Preloads F_V (kN) for property class					Tightening torque M_A (Nm) for property class				
	8.8 ¹⁾	10.9 ²⁾	12.9 ³⁾	A 4-70 ⁴⁾	A 4-80 ⁴⁾	8.8 ¹⁾	10.9 ²⁾	12.9 ³⁾	A 4-70 ⁴⁾	A 4-80 ⁴⁾
M 4	3.5	5.9	7.1	2.6	3.4	3.1	4.1	4.6	2.0	2.7
M 5	5.6	9.6	11.5	4.1	5.5	6.0	8.1	9.1	3.9	5.3
M 6	8.0	13.6	16.3	5.9	7.8	10.2	14.1	15.8	6.9	9.2
M 8	15.0	25.0	30.0	11.0	14.0	25.0	34.0	38.0	17.0	22.0
M 10	23.0	39.0	47.0	17.0	23.0	50.0	67.0	75.0	33.0	43.0
M 12	33.0	57.0	68.0	25.0	33.0	85.0	115.0	128.0	56.0	75.0
M 14	46.0	78.0	94.0	34.0	45.0	136.0	183.0	204.0	89.0	119.0
M 16	62.0	106.0	127.0	46.0	61.0	208.0	279.0	311.0	136.0	181.0
M 18	76.0	130.0	156.0	56.0	75.0	291.0	391.0	437.0	191.0	254.0
M 20	97.0	165.0	198.0	72.0	95.0	408.0	547.0	610.0	267.0	356.0
M 22	120.0	205.0	246.0	89.0	118.0	557.0	745.0	831.0	364.0	485.0
M 24	140.0	238.0	286.0	103.0	137.0	703.0	942.0	1052.0	460.0	613.0
M 27	182.0	310.0	372.0	134.0	179.0	1028.0	1375.0	1533.0	671.0	895.0
M 30	222.0	378.0	454.0	164.0	219.0	1401.0	1875.0	2091.0	915.0	1220.0
M 33	275.0	468.0	562.0	-	-	1889.0	2526.0	2815.0	-	-
M 36	324.0	551.0	662.0	239.0	319.0	2436.0	3259.0	3633.0	1591.0	2121.0
M 39	387.0	659.0	790.0	-	-	3145.0	4203.0	4683.0	-	-
M 42	445.0	757.0	908.0	-	-	3890.0	5202.0	5799.0	-	-

Source: www.nordlock.com

- 1) Screw zinc plated, dry, thread friction $\mu_g = 0,15$, friction coefficient of the lock washer $\mu_w = 0,18$, utilisation of the minimum yield strength = 62%
- 2) Screw uncoated, oiled, thread friction $\mu_g = 0,13$, friction coefficient of the lock washer $\mu_w = 0,14$, utilisation of the minimum yield strength = 71%
- 3) Screw uncoated, oiled, thread friction $\mu_g = 0,13$, friction coefficient of the lock washer $\mu_w = 0,12$, utilisation of the minimum yield strength = 71%
- 4) Screw lubricated with graphite paste, thread friction $\mu_g = 0,14$, friction coefficient of the lock washer $\mu_w = 0,15$, utilisation of the minimum yield strength = 65%

Table 17: Typical values for tightening torques of screwed fastenings with lock washers

REYHER-articles	Property class Screws	Tightening torque M _A in Nm													
		M 4	M 5	M 6	M 8	M 10	M 12	M 14	M 16	M 18	M 20	M 22	M 24	M 27	M 30
88123 type S	5.8	2.0	4.0	7.0	16.5	32	57	-	-	-	-	-	-	-	-
88124 type M	8.8	3.3	6.7	11.5	27	54	92	145	225	320	460	620	790	1160	1550
	10.9	4.9	9.8	16.5	40	79	135	215	330	460	650	890	1120	1650	2250
88125 type B	10.9	-	-	16.5	40	79	135	-	-	-	-	-	-	-	-
	12.9	-	-	19.5	47	92	158	-	-	-	-	-	-	-	-

Source: www.teckentrup.de

Typical values for tightening torques of screwed fastenings with SCHNORR washers

REYHER article 88120 and REYHER article 88121:

As a typical value, 10% should be added to the normal tightening torque M_A according to **TI-230**, Tables 4 and 5.



Assembly of fastenings in steel constructions

Systematic preloaded connections with HV sets

The following two assembly methods for achieving the preload force are permitted in Germany for the assembly of HV sets.

Standard	Preload	Assembly method	k class
EN 1090-2	$F_{p,c}$ (full preload force)	Combined method	K1
DIN EN 1993-1-8 NA	$F_{p,c}^*$ (modified preload force)	Modified torque method	K1

Preload forces and tightening torques for the respective methods for k -class K1 and property class 10.9 are listed in the following table. Refer to EN 1090-2 for the corresponding assembly steps required.

Table 18: Preloads and tightening torques for HV fastenings of property class 10.9 as per EN 14399-4 or DAST Directive 012 with k -class K1

$\emptyset$	EN 1090-2			DIN EN 1993-1-8 NA		
	Reference preloads $F_{p,c}$ in kN	Reference torques $M_{r,1}$ in Nm	Pre-tightening torques for combined method $0,75 M_{r,1}$ in Nm	Modified preloads $F_{p,c}^*$ in kN	Modified torques M_A in Nm	Pre-tightening torques for modified combined method M_A, MKV in Nm
M 12	59	92	69	50	100	75
M 16	110	229	172	100	250	190
M 20	172	447	335	160	450	340
M 22	212	606	455	190	650	490
M 24	247	771	578	220	800	600
M 27	321	1127	845	290	1250	940
M 30	393	1533	1150	350	1650	1240
M 36	572	2677	2008	510	2800	2100
M 39*				610	3500	
M 42*				710	4500	
M 45*				820	5500	
M 48*				930	6500	
M 56*				1280	10000	
M 64*				1680	15000	

*as per DAST Directive 021; these values only apply to hot dip galvanized HV sets

Table 19: Prevailing angle for combined assembly method

Standard	Prevailing angle in °		
	t = grip length with washers, d = screw diameter		
	$t < 2d$	$2d \leq t < 6d$	$6d \leq t \leq 10d$
EN 1090-2	60	90	120
DIN EN 1993-1-8/NA	45	60	90

Securing of HV connection against loosening

By means of the Nord-Lock NL SC self-locking washer, an HV fastening can be secured against loosening in accordance with National Technical Approval Z-14.4-629.

Table 20: Preload forces and tightening torques for HV fastenings with NL SC self-locking washers

$\emptyset$	Modified preloads $F_{p,cr,NL}^*$ in kN	Modified torques $M_{A,NL}$ in Nm	Pre-tightening torques for modified combined method $M_{A,MKV,NL}$ in Nm
M 12	45	130	100
M 16	90	330	250
M 20	145	660	490
M 22	170	850	640
M 24	200	1100	825
M 27	260	1600	1220
M 30	315	2150	1650
M 36	460	3750	2800

Non-preloaded structural bolting assemblies (SB)

For the area of non-preloaded fastenings, SB sets such as ISO 4014/4017/4032/7090 but also for DIN 7990 and more in future are used that – contrary to the HV system – are only hand-tightened. Screws and nuts must also be marked with “SB” for “structural bolting”.

Table 21: Recommended “hand tight” tightening torques for non-preloaded fastenings independent of the property class of the screws

$\emptyset$	M 12	M 16	M 20	M 22	M 24	M 27	M 30	M 36
$M_{A, hand\ tight}$ in Nm	15	35	60	90	110	165	220	350



Preloads and tightening torques for fasteners from stainless steel

Preloads and tightening torques for fasteners with full loadability from stainless steel

For fasteners from stainless steel, the friction coefficients in the thread and on the contact surfaces are much higher than with quenched and tempered steel screws. Even the spread of the friction coefficients is much higher here (up to and over 100%). To finally determine the correct torque it is recommended that testing should be carried out under operating conditions.

While it is possible to reduce friction coefficients by using lubricating agents, the very high spread will remain.

The table lists non-binding typical values for various friction coefficients, valid for screws and nuts according to DIN 912, 931, 933 and 934/ISO 4762, 4014, 4017, 4032 made from stainless steels A 1–A 5, in property classes –50, –70 and –80 at room temperature (approx. +20 °C) and utilisation of the minimum yield stress of 90%.

Table 22: Typical values for fasteners from A2/A4

Ø	Prop. Class	Assembly preload in kN for $\mu_{ges} =$								Tightening torque in Nm for $\mu_{ges} =$							
		0.10	0.12	0.14	0.16	0.18	0.20	0.30	0.40	0.10	0.12	0.14	0.16	0.18	0.20	0.30	0.40
M 4	50	1.47	1.48	1.39	1.35	1.31	1.26	1.07	0.91	0.8	0.9	1.0	1.1	1.2	1.3	1.6	1.8
	70	3.14	2.71	2.97	2.89	2.80	2.71	2.30	1.95	1.8	2.0	2.2	2.4	2.6	2.8	3.4	3.8
	80	4.19	4.08	3.96	3.85	3.73	3.61	3.06	2.61	2.4	2.7	3.0	3.3	3.5	3.7	4.6	5.1
M 5	50	2.39	2.33	2.27	2.20	2.14	2.07	1.76	1.50	1.7	1.9	2.1	2.3	2.4	2.6	3.2	3.6
	70	5.13	5.00	4.86	4.72	4.58	4.44	3.77	3.21	3.5	4.0	4.5	4.9	5.2	5.6	6.8	7.6
	80	6.84	6.66	6.48	6.29	6.10	5.91	5.02	4.28	4.7	5.4	5.9	6.5	7.0	7.4	9.1	10.2
M 6	50	3.39	3.30	3.21	3.11	3.02	2.93	2.48	2.11	2.9	3.3	3.6	3.9	4.2	4.5	5.5	6.2
	70	7.26	7.07	6.87	6.67	6.47	6.27	5.32	4.53	6.2	7.0	7.7	8.4	9.1	9.7	11.9	13.2
	80	9.68	9.43	9.13	8.90	8.63	8.36	7.09	6.04	8.2	9.3	10.3	11.3	12.1	12.9	15.8	17.7
M 8	50	6.21	6.05	5.88	5.72	5.54	5.37	4.57	3.89	7.0	7.9	8.8	9.6	10.3	11.0	13.6	15.2
	70	13.30	12.96	12.61	12.25	11.88	11.51	9.79	8.34	15.0	17.0	18.8	20.6	22.2	23.6	29.1	32.5
	80	17.74	17.29	16.81	16.33	15.84	15.35	13.05	11.11	19.9	22.6	25.1	27.4	29.5	31.5	38.8	43.4
M 10	50	9.87	9.62	9.37	9.10	8.83	8.56	7.28	6.20	13.8	15.7	17.4	19.0	20.5	21.8	27.0	30.2
	70	21.16	20.63	18.40	19.50	18.92	18.34	15.60	13.29	29.5	33.5	37.3	40.7	41.9	46.8	57.8	67.7
	80	28.21	27.50	26.76	25.99	25.22	24.45	20.79	17.72	39.4	44.7	49.7	54.3	58.5	62.4	77.1	86.2
M 12	50	14.38	14.03	13.65	13.27	12.87	12.48	10.62	9.05	23.8	27.1	30.1	32.9	35.4	37.8	46.8	52.3
	70	30.83	30.06	29.26	28.43	28.59	26.75	22.76	19.40	51.0	58.0	64.5	70.5	76.0	81.0	100.2	112.1
	80	41.10	40.08	39.01	37.90	36.78	35.66	30.35	25.87	68.0	77.3	85.9	93.9	101.0	108.0	133.6	149.5
M 14	50	19.74	19.25	18.74	18.21	17.68	17.14	14.59	12.44	37.8	43.0	47.9	52.4	56.5	60.2	74.6	83.5
	70	42.31	41.26	40.16	39.03	37.88	36.73	31.27	26.65	81.1	92.2	103.0	112.0	121.0	129.0	160.0	179.0
	80	56.41	55.01	53.54	52.04	50.50	48.97	41.69	35.54	108.0	123.0	137.0	150.0	161.0	172.0	212.0	238.5
M 16	50	27.04	26.39	25.71	25.01	24.29	23.56	20.10	17.16	58.2	66.5	74.2	81.4	87.9	94.0	117.0	131.0
	70	57.94	56.55	55.09	53.58	52.04	50.49	43.08	36.77	125.0	143.0	159.0	174.0	188.0	201.0	251.0	282.0
	80	77.25	74.40	73.46	71.44	69.39	67.33	57.44	49.03	166.0	190.0	212.0	233.0	251.0	269.0	334.0	375.0
M 18	50	33.01	32.20	31.35	30.47	29.58	28.68	24.43	20.83	81.3	92.6	103.0	113.0	122.0	130.0	161.0	180.0
	70	70.73	69.00	67.17	65.29	63.38	61.46	52.34	44.64	174.0	198.0	221.0	242.0	261.0	278.0	345.0	387.0
	80	94.31	92.00	89.56	87.05	84.51	81.95	69.79	59.52	232.0	265.0	295.0	322.0	348.0	371.0	460.0	515.0
M 20	50	42.27	41.26	40.20	39.10	37.79	36.84	31.34	26.83	114.0	130.0	146.0	160.0	173.0	184.0	230.0	258.0
	70	90.58	88.40	86.14	83.78	81.37	78.95	67.35	57.49	245.0	280.0	312.0	342.0	370.0	395.0	492.0	552.0
	80	120.80	117.90	114.90	111.70	108.50	105.30	89.80	76.70	326.0	373.0	416.0	456.0	493.0	527.0	656.0	736.0
M 22	50	52.67	51.45	50.15	48.80	47.42	46.02	39.32	33.59	156.0	178.0	200.0	219.0	237.0	254.0	318.0	257.0
	70	112.87	110.24	107.46	104.56	101.61	98.61	84.25	~	334.0	382.0	428.0	470.0	508.0	544.0	680.0	~
	80	150.80	147.40	144.00	140.60	137.20	133.80	114.00	~	421.0	482.0	537.0	589.0	637.0	680.0	848.0	~
M 24	50	60.88	59.43	57.90	56.30	54.69	53.01	45.27	38.64	197.0	225.0	251.0	275.0	297.0	318.0	396.0	444.0
	70	130.50	127.40	124.10	120.70	117.20	113.70	97.00	~	421.0	482.0	537.0	589.0	637.0	680.0	848.0	~
	80	180.00	176.00	172.00	168.00	164.00	160.00	136.00	~	421.0	482.0	537.0	589.0	637.0	680.0	848.0	~
M 27	50	79.86	78.02	76.05	74.01	71.93	69.82	59.67	50.98	289.0	332.0	371.0	408.0	442.0	473.0	591.0	666.0
	70	171.00	167.00	163.00	159.00	154.00	150.00	128.00	~	620.0	711.0	795.0	873.0	946.0	1013.0	1267.0	~
	80	240.00	235.00	230.00	225.00	220.00	215.00	183.00	~	620.0	711.0	795.0	873.0	946.0	1013.0	1267.0	~
M 30	50	97.23	94.96	92.54	90.04	87.48	84.90	72.50	61.90	394.0	451.0	504.0	553.0	599.0	640.0	800.0	900.0
	70	208.00	203.00	198.00	193.00	187.00	182.00	155.00	~	844.0	966.0	1080.0	1186.0	1283.0	1373.0	1715.0	~
	80	280.00	274.00	268.00	262.00	256.00	250.00	214.00	~	844.0	966.0	1080.0	1186.0	1283.0	1373.0	1715.0	~
M 33	50	121.00	118.00	115.00	112.00	109.00	106.00	90.00	77.00	531.0	610.0	683.0	751.0	813.0	871.0	1092.0	1230.0
M 36	50	142.00	139.00	135.00	132.00	128.00	124.00	106.00	91.00	684.0	784.0	876.0	964.0	1044.0	1117.0	1398.0	1573.0
M 39	50	170.00	166.00	162.00	158.00	154.00	149.00	128.00	109.00	883.0	1014.0	1137.0	1250.0	1355.0	1452.0	1822.0	2054.0

Preloads and tightening torques for fasteners with reduced loadability from stainless steel

Fasteners according to DIN 6912, 7984, ISO 7380-1/-2 and 10642 have a reduced loadability due to their head geometry. As a guideline for preloads and tightening torques of 80% of the values of the upper table (table 22) can be accepted.



The prevailing torque type hexagon nuts from stainless steel sometimes tend to jam in the locking element due to the high thread flank pressure when inserting the screw thread. Here, treating the screw thread with an anti-friction agent usually helps. Accordingly, the changed friction coefficients are to be taken into account when assembling the screwed fastening.



Tightening torque for fasteners made from BUMAX 88/109 brass, polyamide

Tightening torques and preloads for fasteners made from stainless steel BUMAX 88/109

Fasteners made from BUMAX 88/109 have an adjusted coefficient of friction by a specific lubrication.

Table 23: Typical values for fasteners made from BUMAX88/109

Dimensions P			Stress area A _s (mm²)	Preloads F _V (kN) for BUMAX		Tightening Torques M _A (Nm) for BUMAX	
				88	109	88	109
M 3	0.5		5.03	2.1	2.9	1.3	1.7
M 4	0.7		8.78	3.6	5.2	2.9	4.1
M 5	0.8		14.2	5.9	8.6	5.7	8.1
M 6	1.0		20.1	8.4	12.0	9.8	14.0
M 8	1.25		34.4	15.0	21.0	25.0	34.0
M 10	1.5		58.0	24.0	34.0	47.0	66.0
M 12	1.75		84.3	35.0	49.0	82.0	115.0
M 14	2.0		115.0	48.0	60.0	129.0	161.0
M 16	2.0		157.0	65.0	81.0	198.0	248.0
M 18	2.5		192.0	80.0	100.0	275.0	344.0
M 20	2.5		245.0	102.0	128.0	385.0	481.0
M 24	3.0		353.0	181.0	-	665.0	-
M 27	3.0		459.0	235.0	-	961.0	-
M 30	3.5		561.0	287.0	-	1310.0	-
M 36	4.0		817.0	418.0	-	2280.0	-

Preloads and tightening torque for fasteners made from brass

For fasteners made from brass, the friction coefficients in the thread and on the contact surfaces are much higher than with quenched and tempered steel screws. In order to determine the correct torque, it is recommended that experiments should be carried out under operating conditions. It is possible to reduce friction coefficients by using lubricating agents.

Table 24 lists non-binding typical values for various friction coefficients, valid for screws and nuts according to DIN 912, 931, 933 and 934/ISO 4762, 4014, 4017, 4032 made from brass with a minimum stress at 0.2% non-proportional elongation of 250 N/mm² (e.g. MS 58 and MS 63) and utilisation of the yield stress of 90%.

The tightening torques listed in the table may **only be used as very rough and non-binding typical values**.

Tabelle 24: Typical values for fasteners made from brass

Ø	Assembly preloads in kN for μ_{ges}								Tightening torque in Nm for μ_{ges}							
	0.10	0.12	0.14	0.16	0.18	0.20	0.30	0.40	0.10	0.12	0.14	0.16	0.18	0.20	0.30	0.40
M 4	1.75	1.70	1.65	1.60	1.55	1.51	1.28	1.09	1.0	1.1	1.2	1.4	1.5	1.6	1.9	2.1
M 5	2.85	2.78	2.70	2.62	2.54	2.46	2.09	1.78	2.0	2.2	2.5	2.7	2.9	3.1	3.8	4.2
M 6	4.03	3.93	3.82	3.71	3.59	3.48	2.96	2.52	3.4	3.9	4.3	4.7	5.0	5.4	6.6	7.4
M 8	7.39	7.20	7.01	6.84	6.60	6.40	5.44	4.63	8.3	9.4	10.5	11.4	12.3	13.1	16.2	18.1
M 10	11.75	11.46	11.15	10.83	10.51	10.19	8.66	7.38	16.4	18.6	20.7	22.6	24.4	26.0	32.1	35.9
M 12	17.13	16.70	16.25	15.79	15.33	14.86	12.64	10.78	28.3	32.2	35.8	39.1	42.2	45.0	55.7	62.3
M 14	23.50	22.92	22.31	21.68	21.04	20.40	17.37	14.81	45.0	51.2	57.0	62.3	67.2	71.7	88.8	99.4
M 16	32.19	31.42	30.61	29.77	28.91	28.05	23.93	20.43	69.3	79.2	88.4	96.9	105.0	112.0	139.0	156.0
M 18	39.30	38.33	37.32	36.27	35.21	34.15	29.08	24.80	96.8	110.0	123.0	134.0	145.0	155.0	192.0	215.0
M 20	50.32	49.12	47.86	46.54	45.21	43.86	37.42	31.94	136.0	155.0	173.0	190.0	205.0	219.0	273.0	307.0
M 22	62.71	61.25	59.70	58.09	56.45	54.79	46.81	40.00	185.0	212.0	238.0	261.0	282.0	302.0	378.0	425.0
M 24	72.48	70.75	68.93	67.04	65.11	63.17	53.89	46.00	234.0	268.0	299.0	327.0	354.0	378.0	471.0	529.0
M 27	95.07	92.88	90.54	88.11	85.63	83.12	71.03	60.70	344.0	395.0	442.0	485.0	526.0	563.0	704.0	793.0
M 30	116.00	113.00	110.00	107.00	104.00	101.00	86.31	73.70	469.0	537.0	600.0	659.0	713.0	762.0	953.0	1071.0
M 33	144.00	141.00	137.00	133.00	130.00	126.00	108.00	92.00	632.0	726.0	813.0	894.0	968.0	1036.0	1300.0	1464.0
M 36	169.00	165.00	161.00	157.00	152.00	148.00	126.00	108.00	814.0	934.0	1045.0	1148.0	1243.0	1330.0	1664.0	1873.0
M 39	203.00	198.00	193.00	188.00	183.00	178.00	152.00	130.00	1051.0	1207.0	1353.0	1488.0	1613.0	1728.0	2169.0	2445.0

Tightening torques for polyamide screws and nuts

Table 19 includes non-binding typical values for appropriate tightening torques for screws and nuts made from polyamide 6.6 at 20 °C after storage in a normal climate.

The preload can ease off somewhat as a result of relaxation processes.

Table 25

Ø	M 3	M 4	M 5	M 6	M 8	M 10	M 12	M 16
Tightening torque Nm	0.1	0.25	0.5	0.8	1.8	3.5	6.0	12



General assembly instructions

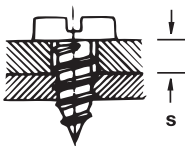
Screwing in of thinner sheet metal with continuous tapping holes or ones enlarged with a drift.



Sheet metal thickness lower/upper limit* $s_{\min./\max.}$
($a_{\max.} = s_{\min.}$)



Screwing in of thicker sheet metal with drilled or punched tapping holes



Screwable plate thickness

Ø/ST	2.2	2.9	3.5	3.9	4.2
$s_{\min.} = a_{\max.}$	0.8	1.1	1.3	1.3	1.4
$s_{\max.}$	1.8	2.2	2.8	3	3.5

Ø/ST	4.8	5.5	6.3	8	
$s_{\min.} = a_{\max.}$	1.6	1.8	1.8	2.1	
$s_{\max.}$	4	4.5	5	6.5	

s = sheet thickness

a = distance from head to thread

* With very thin metal sheets (< $a_{\max.}$) the usage of special thin tapping screws or clamping nuts (spring nuts) is recommended.

Drilling hole diameters for tapping screws

The tapping hole diameters in the following tables are non-binding approximate values for round holes.

The values may differ depending on the material or assembly conditions – this applies in particular to screws made from non-hardenable, stainless steels of the austenitic material groups A 2/A 4 (→ ISO 3506-4).

When using synthetic-based screws, the following conditions apply.

Table 26: Drilling hole für tapping screws

Nominal thread diameter d_n	Drilling hole-Ø (Tol. H 12) for tapping screws from material							
	for sheet thickness s		Hardened steel (min. 450 HV)				Stainless steels A 2/A 4 (ca. 250 HV)**	
			Drift-enlarged/Continuous hole Sheet from material		Drilled/Punched hole Sheet from material		Sheet from material	
	>	≤	St, Ni, MS, Cu, Monel	Al	St, Ni, MS, Cu, Monel	Al	Baustahl St. 37	Al
2.2 mm	–	0.56	–	–	1.60	–	–	–
	0.56	0.75	–	–	1.70	1.60	–	–
	0.75	0.88	–	–	1.80	1.60	–	–
	0.88	1.13	–	–	1.85	1.60	–	–
	1.13	1.38	–	–	1.85	1.70	–	–
	1.38	1.50	–	–	1.90	1.80	–	–
2.9 mm	–	0.56	2.20	–	2.20	–	–	–
	0.56	0.63	2.50	2.20	2.25	–	2.30	2.40
	0.63	0.75	2.50	2.20	2.25	2.20	2.30	2.40
	0.75	0.88	2.50	2.20	2.40	2.20	2.30	2.40
	0.88	1.25	–	2.20	2.40	2.20	2.30	2.40
	1.25	1.38	–	–	2.40	2.20	2.30	2.40
	1.38	1.75	–	–	2.50	2.25	2.30	2.40
	1.75	2.50	–	–	2.60	2.40	2.40	2.50
3.5 mm	–	0.56	2.80	–	2.60	–	2.70	2.80
	0.56	0.75	2.80	2.80	2.70	–	2.70	2.80
	0.75	0.88	2.80	2.80	2.70	2.65	2.70	2.80
	0.88	1.25	–	2.80	2.80	2.65	2.70	2.80
	1.25	1.38	–	–	2.80	2.65	2.70	2.80
	1.38	1.75	–	–	2.90	2.75	2.80	2.90
	1.75	2.50	–	–	3.00	2.85	2.80	2.90
	2.50	3.00	–	–	3.20	3.00	2.90	3.00
	3.00	6.00	–	–	–	3.00	2.90	3.00
	–	0.50	3.00	–	2.95	–	3.00	3.10
3.9 mm	0.50	0.63	3.00	3.00	2.95	–	3.00	3.10
	0.63	0.88	3.00	3.00	2.95	2.90	3.00	3.10
	0.88	1.13	3.00	3.00	2.95	2.95	3.00	3.10
	1.13	1.25	3.00	3.00	3.00	2.95	3.00	3.10
	1.25	1.38	–	–	3.00	2.95	3.00	3.10
	1.38	1.75	–	–	3.20	3.00	3.00	3.10
	1.75	2.00	–	–	3.20	3.50	3.00	3.10
	2.00	2.50	–	–	3.50	3.50	3.10	3.20
	2.50	3.50	–	–	3.60	3.50	3.20	3.30
	–	0.50	3.50	–	–	–	–	–
4.2 mm	0.50	0.63	3.50	3.50	3.20	–	–	–
	0.63	0.88	3.50	3.50	3.20	2.95	–	–
	0.88	1.13	3.50	3.50	3.20	3.00	3.20	3.30
	1.13	1.38	3.50	3.50	3.30	3.20	3.20	3.30
	1.38	2.50	–	–	3.50	3.50	3.30	3.40
	2.50	3.00	–	–	3.80	3.70	3.30	3.40
	3.00	3.50	–	–	3.90	3.80	3.40	3.50
	3.50	10.00	–	–	–	3.90	3.5–3.6	3.6–3.7
	–	0.50	4.00	–	–	–	–	–
	0.50	0.75	4.00	4.00	3.70	–	–	–
4.8 mm	0.75	1.13	4.00	4.00	3.70	3.70	–	–
	1.13	1.38	4.00	4.00	3.90	3.70	3.70	3.90
	1.38	1.75	–	–	3.90	3.70	3.70	3.90
	1.75	2.50	–	–	4.00	3.80	3.80	3.90
	2.50	3.00	–	–	4.10	3.80	3.80	3.90
	3.00	3.50	–	–	4.30	3.90	3.90	4.00
	3.50	4.00	–	–	4.40	3.90	3.90	4.00
	4.00	4.75	–	–	4.40	4.00	4.00	4.10
	4.75	10.00	–	–	–	4.20	4.1–4.2	4.2–4.3
	–	1.13	4.70	–	4.20	–	–	–
5.5 mm	1.13	1.38	4.70	–	4.30	4.10	–	–
	1.38	1.50	–	–	4.30	4.10	–	–
	1.50	1.75	–	–	4.50	4.20	–	–
	1.75	2.25	–	–	4.60	4.40	4.50	4.60
	2.25	3.00	–	–	4.70	4.60	4.50	4.60
	3.00	3.50	–	–	5.00	4.60	4.60	4.70
	3.50	4.00	–	–	5.00	4.80	4.60	4.70
	4.00	4.75	–	–	5.10	4.80	4.70	4.80
	4.75	10.00	–	–	–	4.90	4.7–4.9	4.8–5.0
	–	1.38	5.30	–	4.90	–	–	–
6.3 mm	1.38	1.75	–	–	5.00	5.00	–	–
	1.75	2.00	–	–	5.20	5.00	–	–
	2.00	3.00	–	–	5.30	5.20	5.30	5.40
	3.00	4.00	–	–	5.80	5.30	5.40	5.50
	4.00	4.75	–	–	5.90	5.40	5.50	5.60
	4.75	5.00	–	–	–	5.60	5.50	5.60
	5.00	10.00	–	–	–	5.80	5.6–5.7	5.7–5.8
	–	1.38	–	–	–	–	–	–



For "Mechanical fasteners" (screws, nuts and accessory parts), all function-relevant external and internal characteristics are regulated in detail in DIN, ISO or EN standards, these include:

- **Product standards** (e.g. DIN 931/ISO 4014)
Specifications on the figure of the product, assigned version and product class (tolerance group), usual strength classes and/or materials and nominal sizes. Furthermore, each product standard contains "normative references" to relevantly applicable basic function standards.

Basic/Function standards (e.g. DIN 13, 267/ISO 898, 4759, 3269...) Regulations for joint characteristics of the various products like, for example, thread, tolerances, surface versions, corrosion protection, mechanical properties and corresponding factory test programme as well as acceptance testing conditions.

By naming an article with a product standard number, all referred basic standards are automatically included and applicable as "Technical Delivery Conditions". This also applies for non-standardised thread and form parts when no particular arrangements have been made between the orderer and the supplier.

Standards always can only regulate just one general standard for products "for general use", this also applies for "Mechanical fasteners" (→ ISO 3269/8992). For higher requirements for specific cases exceeding these normative regulations, it is the job of the user to define these requirements and specify necessary additional inspection requirements.

1. Quality checks during manufacture:

For basic/functional standards, testing programmes and procedures are given within which the manufacturer has to ensure the compliance with the proper standards quality of its products by carrying out constant sample checks. Alongside the obligatory checks for dimensional accuracy and surface condition, the following checks are also listed, among others:

- for screws and similar thread parts (→ ISO 898-1)
 - hardness testing, proof load testing
 - bolt head impact/diagonal pull testing
 - surface decarburisation testing
- for nuts (→ ISO 898-2)
 - hardness test, proof load test
 - expansion test

The procedure to be used in arbitration is specified in the standards. All standardised mechanical properties are generally valid at room temperature (approx. +20 °C).

2. Additional tests – Certificates according to EN 10204

For particular requirements and/or safety-related use-cases, additional articles or use-specific tests can be carried out either in the factory or by a commissioned factory independent technical expert or testing institute. The results of these extra tests shall be documented in a Certificate (inspection document), which the orderer shall receive as either an original or an unmodified copy.

The type and scope of these additional tests and who is to carry out and document them is to be determined by the user due to his knowledge on the use and particular requirements, and specified accordingly on ordering.

Inspection contents – according to DIN 11204

If there are no specifications on the scope of the test contents agreed in the order, DIN 11204 shall apply.

This standard regulates the test contents of certificates according to EN 10204 for fasteners.

Tab. 1: Test contents for screws according to DIN 11204

Section designation	Details
Tensile test: shape of test pieces	Tensile test of the entire screw: For the screws M 6 to M 39 according to ISO 898-1, ISO 3506-1, ISO 8839 or DIN 267-13, as long as the geometry of the screws is suited for the tensile test on the entire screw. In case a tensile test should be carried out on the cylindrical sample, this needs to be arranged at the time of ordering.
Tensile test: tensile strength	–
Hardness testing: test method	Symbol denoting test method
Hardness testing: individual values	Does not apply for ISO 8839 and austenitic steels of the types A1 to A5 according to ISO 3506-1 or ISO 3506-2
Torsion test: breaking torque	For screws ≤ M 5. For all property classes according to ISO 898-1, for austenitic steels of the types A1 to A5 according to ISO 3506-1 and for non-ferrous metals according to ISO 8839 as long as the geometry of the screw is suited to the torsion test according to ISO 898-7
Chemical composition	Cast analysis/product analysis according to the product specifications

Tab. 2: Test contents for nuts according to DIN 11204

Section designation	Details
Proof load test	For nuts M 6 to M 39 according to ISO 898-2, ISO 898-6, ISO 3506-2, ISO 8839 and DIN 267-13, if specified.
Hardness test: test method	Code of the hardness testing procedure
Hardness testing: individual values	Does not apply for ISO 8839 and austenitic steels of the types A1 to A5 according to ISO 3506-1 or ISO 3506-2.
Chemical composition	Cast analysis/product analysis according to the product specifications

Costs for additional testing are not contained in the product price.

Table 3 provides information on types of test certificates which have proven themselves as requirements for screws, nuts and other form and accessory parts.

General information:

- The values determined by additional testing and documented in certificates are not "committed properties" or "guarantees of quality" according to Section 267 of the German Civil Code (BGB) and do not mean that the user does not have to perform the proper inspection of incoming goods (Section 377 of the German Commercial Code (HGB)).
- All tests named in 1 and 2 are carried out in general on samples. While their results are representative for the most part of the delivery batch of a load, a 100% guarantee for each part of the batch can be derived from this just as little as its suitability for a specific purpose can be.



Tabelle 3: Overview of the usual inspection documents for screws, bolts, studs, nuts and accessory parts
Extract from EN 10204 – Jan 2005 (previously DIN 50049)

Standard marking	2.1 ^①	2.2 ^①	3.1	3.2
Certification	Declaration of compliance with the order		Test report	
Type of inspection	Not specific, no testing/evaluation of testing results of the delivery batch/parts of the delivery itself		Specific ② = Testing is done on the delivery batch/parts of the delivery itself	
Content of the certification	No test results (= informal manufacturer confirmation, that the delivered products correspond to the agreements made on ordering)		Test result on the basis of non-specific tests (= from current series manufacturing records and not from tests on parts of the delivery batch)	
Terms of delivery	According to the terms of the order		Test results on the basis of specific tests ② = Evaluation and documentation of actual values from testing of parts of the delivery batch itself ②	
Confirmation/ Certification by	The manufacturer		According to the delivery terms of the order ③ = specified testing requirements of the orderer (also according to the technical regulations AD/TRD)	The acceptance-testing officer independent of the processing department of the manufacturer
Order example: Addendum to article text: "... with test certification according to EN 10204-3.1"		As 3.1 + the technical expert commissioned (prescribed) by the orderer ④		

① not recommended since there is no specific statement on the delivered product

② the sample quantities required for destructive inspections are to be taken into account when deciding the order quantity

③ e.g. specification of the yield strength/impact testing with specified high and low temperatures, particular crack testing procedures, etc.

④ according to the specifications of the orderer, e.g. TÜV, GL, DB ...

3. Acceptance testing for "Mechanical fasteners"

Extract from ISO 3269 (previously DIN 267-5)

This standard is always included as applicable when "Mechanical fasteners" are ordered according to standard or similar form parts, if not expressly agreed otherwise beforehand.

It does not apply to fasteners which

- are intended for automatic screw-in,
- are supposed to fulfil particularly high requirements,
- require particular processing procedures/testing measures
- require specific traceability.

Here, special corresponding arrangements always need to be made on request, on ordering at the latest (.e.g. according to ISO 16426). In general, standard commercial stock is not suitable for these specific requirements.

Since the mass production of standard parts for general use cannot be assumed to be free of individual errors or defective parts for economic reasons, the expectation of zero-error deliveries is fundamentally not standard-compliant (→ ISO 3269, „Introduction“).

For sample test instructions during incoming goods inspections, ISO 3269 prescribes values for an "Acceptable Quality Level (AQL)" to which an acceptance number (Ac) is assigned. Ac is the highest count of defective parts in a sample test for which the test batch can still be accepted.

The assignment of AQL values is determined according to the following:

- Product type, e.g. screws, nuts, washers, bolts, pins, rivets
- Product (tolerance) classes: A, B or C
- Function-relevant characteristics = AQL value 1.5-1.0
- Other characteristics = AQL value 4.0-2.5
- Mechanical properties = AQL value 1.5-0.65

Details important for the functional compliance of the parts include, for example drive, thread. Other characteristics include, for example, minor measurement/type deviations which do not negatively affect the usability.

Table 4 shows the ratio of AQL value to the acceptance number for the same sample test extent as an example as well as the mathematical limit value (%) for the number of defective parts in the delivery batch (deliverer's risk max. 5%).

Table 4: Ratio AQL values : Acceptance numbers

Sample test scope Item	AQL value	= Acceptance number Ac Item	Limit value non-conforming fasteners %
125	0.65	2	1.6
125	1.0	3	2.4
125	1.5	4	3.2
125	2.5	6	4.8
125	4.0	8	6.4



The hardness measurement serves to determine the resistance of a material against the penetration of a test specimen which acts upon it with a specific type, force and time. Depending on the applied procedure, the hardness value is determined from the measured depth or size of the impression the test specimen makes on the workpiece.

The most common standardised methods are shown in Table 1. If in doubt, the Vickers Hardness test shall be applied for the mechanical fasteners. The measurements are taken on prepared samples. Here it needs to be differentiated between:

• "Routine testing"

The measurement is taken on an even cut on the surface of the sample. Common hardness test procedures are Rockwell (HRC) and Vickers (HV 10 – HV 30).

• "Arbitration testing"

The measurement is taken on a lengthwise or diagonal polished section of the cut-up specimen. The testing procedure according to ISO 898 is Vickers (HV).

With the acceptance test of "Mechanical fasteners" hardness measurements are only part of routine and comparative checks. They are not themselves decisive for determining mechanical characteristics.

For screws, the tensile test determines the tensile strength, yield strength limit and elongation. For nuts, proof load tests and expansion tests are applicable. (ISO 898-1, DIN 267-21, ISO 898-2).

Table 2 shows a conversion of the hardnesses according to Vickers, Rockwell and Brinell into each other and for the tensile strength of non-alloy to low-alloy steels in hot-formed or heat-treated conditions. Beside these, the hardness ranges of screws, nuts and washers of the various strength classes are specified according to the standard.

Low load-hardness testing

The low load-hardness test with test loads between 2 and 30 N (HV 0.2 to HV 3) is the link between the conventional hardness testing (HV 5 to HV 100) and micro-hardness testing. It is suitable for determining the hardness in surface layers and for absorbing hardness gradient curves. For fasteners, especially quenched and tempered screws from property class 8.8 or higher, the low load-hardness testing according to ISO 898-1 is used to determine the carburisation state in the thread range.

Impact testing

Impact testing is used to measure the toughness. This shows the extent of the damage which needs to be done in order to shatter a sample. Tough steels can absorb a lot. Brittle steels require less effort. The result of impact testing is used in particular to estimate the usability of steel at low temperatures.

For testing, quadratic test specimens with a defined chamfer are made out of the screws. ISO-V and ISO-U samples are distinguished from each other. In practice, using the ISO-V sample was approved as this reacts more sensitively to the embrittlement of the screw due to the stronger notch effect compared to the ISO-U sample.



ISO-V- and ISO-U-sample

Table 1: Comparison of hardness measuring procedures

Procedure, Marking	Vickers HV	Brinell HB	Rockwell	
			HRC	HRB
Norm, Standard	ISO 6507-1.2 (DIN 50133)	ISO 6506 (DIN 50351)	ISO 6508/EN 10004 (DIN 50103-1)	
Suitable for materials	Metallic materials with very low to very high hardness level (specification of medium hardness)	Metallic materials with very low to high hardness level (specification of partial hardness)	Hardened steels, hardened and tempered alloys	Materials of medium hardness, steels with low to medium C-content of brass, bronze ...
Tensile strength range approx. (R_m in N/mm ²)	< 250 – 2000	255 – 1520	770 – 2000	250 – 800 250 – 800
Penetrator	 Diamond pyramids, quadratic base area, surface angle 136° 	 Ball from hardened steel, diameter: 10/15/2.5 or 1 mm 	 Diamond cone, cone angle 120° Tip: Radius of curvature 0.2 mm 	 Ball from hardened steel Diameter: 1/16" = 1.5875 mm
General dwell time (for arbitration tests, min.)	Material-dependent 10 – 30 (30) sec.	Material-dependent 10 – 30 (30) sec.	Material-dependent 2 – 25 (30) sec. (two-stage impression Test load F_0 + Test load F_1 = Total test load F)	
Code (examples)	640 HV 30 applied test load $F = 294 \text{ N}/30 \text{ kp}$ Vickers Hardness determined hardness value 180 HV 50/30 Dwell time/sec	350 HB Hardness Brinell determined hardness value for ball diameter of 10mm Test load 29420 N/3000 kp Dwell time 10–15 sec. 120 HB 5/250/30 Dwell time/sec. Test load/kp Ball-Ø	45 HRC Hardness Rockwell procedure C determined hardness value	45 HRB Hardness Rockwell procedure B determined hardness value



Table 2: Hardness re-evaluation*/comparison
Hardness ranges of screws, bolts, studs, nuts, washers and rings

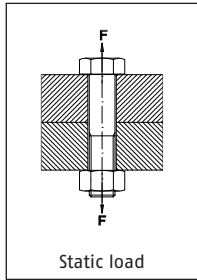
Vickers hard- ness	Brinell hard- ness	Rockwell hardness		~ Tensile strength	Rough hardness range (based on Vickers Hardness) for														Washers/Rings		
		HRB	HRC		Screws					Nuts m ≥ 0.5 d**					Nuts m < 0.5 d Set screws				St.	St. geh.	SSt.
HV 10	HB			MPa	4.6	5.6	8.8	10.9	12.9	5	6	8 04	10 05	12	14 H	17 H	22 H	45 H			
80	76.0			255																	
85	80.7	41.0		270																	
90	85.5	48.0		285																	
95	90.2	52.0		305																	
100	95.0	56.2		320															100		
105	99.8			335																	
110	105	62.3		350																	
115	109			370	120																
120	114	66.7		385																	
125	119			400						130/ 142											
130	124	71.2		415																	
135	128			430																	
140	133	75.0		450							150/ 170										
145	138			465																	
150	143	78.7		480											140						
155	147			495		155															
160	152	81.7		510																	
165	156			530																	
170	162	85.0		545																	
175	166			560																	
180	171	87.1		575																	
185	176			595																	
190	181	89.5		610																	
195	185			625																	
200	190	91.5		640																	
205	195	92.5		660																	
210	199	93.5		675																	
215	204	94.0		690																	
220	209	95.0		705																	
225	214	96.0		720																	
230	219	96.7		740																	
235	223			755																	
240	228	98.1	20.3	770																	
245	233		21.3	785																	
250	238	99.5	22.2	800																	
255	242		23.1	820	250	250													250		
260	247	(101)	24.0	835																	
265	252		24.8	850																	
270	257	(102)	25.6	865																	
275	261		26.4	880																	
280	266	(104)	27.1	900																	
285	271		27.8	915																	
290	276	(105)	28.5	930																	
295	280		29.2	950																	
300	285		29.8	965																	
310	295		31.0	995																	
320	304		32.2	1030																	
330	314		33.3	1060																	
340	323		34.4	1095																	
350	333		35.5	1125																	
360	342		36.6	1155																	
370	352		37.7	1190																	
380	361		38.8	1220																	
390	371		39.8	1255																	
400	380		40.8	1290																	
410	390		41.8	1320																	
420	399		42.7	1350																	
430	409		43.6	1385																	
440	418		44.5	1420																	
450	428		45.3	1455																	
460	437		46.1	1485																	
470	447		46.9	1520																	
480	456		47.7	1555																	
490	466		48.4	1595																	
500	475		49.1	1630																	
520	494		50.5	1700																	
540	513		51.7	1775																	
560	532		53.0	1845																	
580	551		54.1	1920																	
600	570		55.2	1195																	
ISO 18265 Table A.1					ISO 898-1					ISO 898-2					DIN 267-24 ISO 898-5				e.g DIN 125-1	e.g DIN 125-2	e.g DIN 267-26

* Limitations according to ISO 18265 need to be taken into consideration.

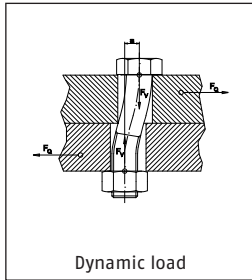
**Hardness ranges differ according to the dimension ranges in min./max. values



Screwed fastenings should be designed in such a way that the preload applied under working stress remains as intact as possible. While in some cases a clear drop in preload can indeed be tolerated, the screwed fastenings coming undone completely must be prevented. If and how a screwed fastenings can come loose depends mainly on the stress.



Static load



Dynamic load

With static loads in axial direction, settling, which is dependent on the number and shape of the separation joints between the tensile building components, can lead to a complete loss of preload. With this kind of load, loss of preload may be counteracted with certain constructive measures or by using screw-settling locks.

With dynamic loads which run laterally to the centre of the screw and are large enough to shift the stressed building components against each other, a loosening torque is generated which can overcome the self-retention of the joint. If this is the case, the joints will systematically loosen until they come apart or break the joint. These loads become especially critical when they occur a lot. Fastener and unscrew locking devices may provide assistance here.

Measures against losing preload with static loads

To keep settling losses in a screwed fastening as low as possible, the number of separation joints between the building components are to be kept to a minimum. Every unnecessary washer is an additional separation joint. Even the insertion of "soft" washers (e.g. DIN 125 with 140 HV) in a high-strength screwed fastening ($\geq$ property class 8.8) is to be avoided. By selecting a longer screw grip length, e.g. by using extension sleeves, preload losses can be absorbed by greater elastic elongation. The same effects are achieved by using shank expansion screws or screws with full thread or by using higher preloads from higher-strength materials.

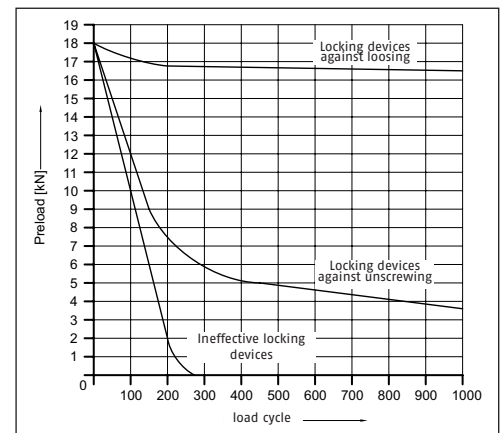
If these measures cannot be used, a curved washer can be used in accordance with DIN 6796 to partially balance out intrusions of parts into materials. Here, it should be made sure that the building component onto which the curved washer is placed is strong enough to not move under the strain and that the curved washer does not dig into the building component.

In contrast, DIN 127 and DIN 128 spring lock washers and DIN 137 spring washers are ineffective. Normally they are pressed flat, even at property class 5.6 and lower, as determined in the area of use of the product standards, and are not able to balance out any intrusions of parts into materials. For this reason, engineering standards organisations have made allowances for the latest technology and withdrawn these standards.

Additional invalid locking elements are

- DIN 6798 serrated lock washers,
- DIN 6797 toothed lock washers,
- DIN 93, DIN 432 and DIN 463 locking plates,
- DIN 526 safety cups,
- DIN 7967 self locking counter nuts.

In the past the products were assigned according to these standards to the category "Locking against unwinding under dynamic lateral load". However, they do not comply with the requirements. For this reason, the standards mentioned have also been withdrawn. Additionally, sufficient electrical contact, as described in the area of use of these standards, cannot be guaranteed for the serrated lock washers or toothed lock washers, which is why DIN 6797 and DIN 6798 have also been withdrawn.



Measures against losing preload with dynamic lateral loads

Locking devices against losing

While locking devices against losing do not prevent significant loss of preload, they do prevent the joint from coming apart completely. Usually, around 20% of the preload remains. The working principle is based on the gripping action in the thread.

Products included in this category are:

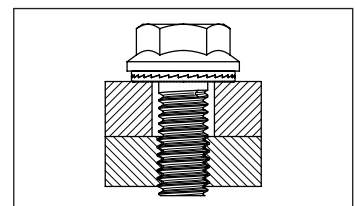
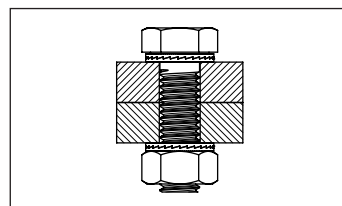
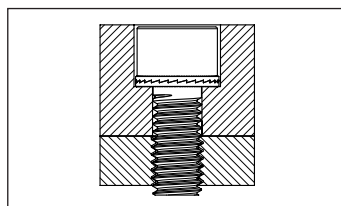
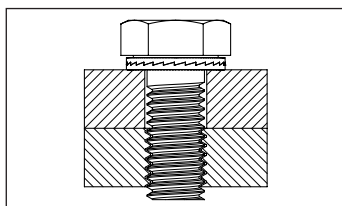
- Prevailing torque type nuts
- Screws with locking element/coating
- Screws with adhesive coating
- Thread rolling screws

Locking coatings are described in DIN 267-28 and serve as locking devices against losing for locking screwed fastenings by generating frictional contact. They come in the form of plastic all-over coating, strip coating or spot coating, which have a locking effect when being screwed in (→ TI-243, Table 1).

Locking devices against unscrewing

Unscrew locking devices describe elements and methods which are made fundamentally for maintaining the preload in the screwed fastening despite strong dynamic loads. Normally, this prevents the preload from dropping below 80% of the assembly preload. There are two basic locking methods possible (form-fitting and adhering).

Installation example of washers with locking serrations



Form-fitting locking devices against unscrewing

Form-fitting is achieved by using locking serrations or ribs on the supporting surfaces of the screw head or nut. The use of washers with locking serrations or ribs is also possible. Of particular importance here is that the surface hardness of the locking serrations/ribs be considerably stronger than the building components to be connected so that they can dig themselves into the surface. Fundamentally, during assembly it needs to be made sure that locking occurs both under the screw head and under the nut as one of the two parts (screw or nut) may otherwise loosen from the building components to be connected.

A product overview of form-fitting locking devices against unscrewing can be found in Table 3.

Furthermore, it should be noted that the friction coefficients are strongly affected by the locking serrations/ribs. As such, much higher friction coefficients (0.2 – 0.3) need to be reckoned with, when dealing with soft contact materials (aluminium alloys, construction steel), into which the serration dig. The tightening torques need to be determined accordingly. Ultimately, the optimum tightening torques are to be determined by testing in environments which reflect the actual conditions.

Typical values for tightening torques for form-fitting locking devices against unscrewing can be found in "Technical Information – Assembly **TI-233**".

Adhesive locking devices against unscrewing

A material bond can be created using an adhesive which is applied to the thread. Locking using an encapsulated adhesive is described in DIN 267-27.

The micro-capsules which are applied to the carrier material on the thread contain the adhesive and a hardening agent. The capsules break open during screwing and the adhesive begins to harden. The hardening process usually takes 24 hours to complete. A screwed fastening results which is locked against vibrations and loss of preload and which simultaneously acts as sealant.

Since the micro-capsules are applied to the thread in a special coating process, it is recommended that this be used especially with bulk amounts (→ Table 1).

When applying micro-capsule adhesives to zinc flake coatings, seals on thick layer passivations and coatings with lubricant additives, a reduction in the breakaway torques vis-à-vis DIN 267-27 may come about. In this case, the application should be safeguarded by carrying out initial sample inspections and by testing in application conditions before using in bulk. An aerobic hardening liquid adhesives which are applied to the thread when assembling the screwed fastening are suitable for universal use. These harden when atmospheric oxygen and metal (iron and copper ions) come into contact with each other. Table 4 provides an overview of which adhesives are suitable for which surface coating. Thread friction coefficients which are set by the corresponding surface coating remain fundamentally unchanged.

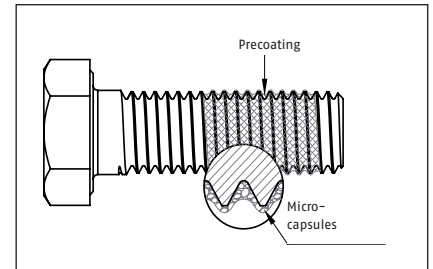


Table 1: Product overview of adhesive and locking coatings

Selection of product and brand names for locking coatings		Selection of product and brand names for adhesive coatings	
TufLok®	Klemm-tight®	LOCTITE®	METAFLUX®
S-Lok	Thermo-tight®	INBUS-Plus	OKS®
Long-Lok	Bio-Tec®	DELO	SCOTCH GRIP®
Hot-Lok		WEICONLOCK®	Klemm-tight®
		PRECOTE®	Heat-tight®
			ALU-tight®

Table 2: Help for selecting the correct locking device

Design objectives	Locking variations
Reusability	• Form-fitting locking elements
Defined/Constant friction co-efficients	• Nord-Lock washers, adhesive locking devices
Low assembly costs	• Flange screws and nuts with locking serrations/ ribs • Adhesive locking device
Readjustability of the fastenings	• Form-fitting locking elements
Assembly conditions	• Makes it inevitable that the threads to be coupled are free from oil and grease, as such, adhesive locking devices are ineffective. ALU-tight® and Heat-tight® can be used under these conditions.
Temperatures	• Adhesive and locking coatings are subject to restricted temperature ranges



Table 3: Overview of form-fitting locking devices against unscrewing in the REYHER product range

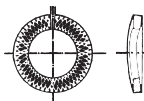
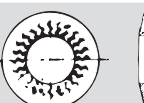
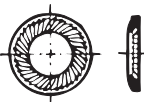
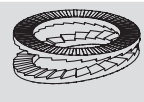
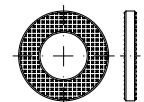
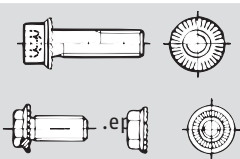
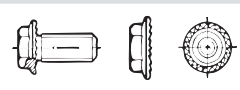
REYHER-article		Special features	
88130 – 88131	Lock rings		Duplex structured surface and bulging → this also balances out small intrusions of parts into materials
88123 – 88126	Lock washers		To a certain extent, bulging also balances out intrusions of parts into materials, similar to conical spring washers.
88120 – 88121	SCHNORR safety washers		Duplex serrated surface and bulging → this also balances out small intrusions of parts into materials
88132	Nord-Lock washers – standard – SP (enlarged outer Ø) – SC for HV bolts – X-series		Each consisting of one washer pair, stuck as a pair for simple assembly. The external surfaces have ridges which are embossed into the surface of the components. The interior surfaces are wedge-shaped. During assembly, the interior surfaces only slide on top of each other → this means that the friction coefficient remains constant, which makes it possible to determine a precise specification for the tightening torque. The x-series washers in addition are convex. → this also balances out small intrusions of parts into materials
88119	LOCKTIX-washers		Both sides stamped surfaces and large bearing area.
88912 88913 88914	Flange screws/Flange nuts with ribs		The assembly process is made easier thanks to the pressed flange with ribs as individual washers do not need to be used.
88933 88934	Locking screws/Locking nuts with serrations		The assembly process is easier thanks to the pressed flange with serrations as individual washers do not need to be used. The special design of the flange balances out intrusions of parts into materials to a limited degree.

Table 4: Product recommendation for anaerobic adhesives for locking screwed fastenings into place.

Material	Strength classification according to ISO 10964 – M 10		
	Low strength screw locking	Medium strength screw locking	High strength screw locking
Steel	Loctite 221, 222, 225	Loctite 241, 243, 245	Loctite 270, 272, 275
Brass	Loctite 222	Loctite 243	Loctite 270, 278
Stainless steel (A2 bis A5)	Loctite 222	Loctite 243	Loctite 2701, 278
Aluminium	Loctite 222	Loctite 243	Loctite 2701
Zinc plated and chromated	Loctite 221, 222, 225	Loctite 241, 243, 245	Loctite 270, 272, 275
Hot dip galvanized	Loctite 222	Loctite 243	Loctite 2701
Browned	Loctite 221, 222, 225	Loctite 241, 243, 245	Loctite 270, 272, 275
Nickel plated	Loctite 222	Loctite 243	Loctite 276
Geomet 321 Plus ML	Loctite 222	Loctite 243	Loctite 2701
Geomet 321 Plus VL	Loctite 222	Loctite 243	Loctite 2701
Geomet 500	Loctite 222	Loctite 243	Loctite 2701
Delta Protect KL 100–301 GZ	Loctite 222	Loctite 243	Loctite 2701
Delta Protect KL 105	Loctite 222	Loctite 243	Loctite 2701, 278
Delta Tone 9000 +DS GZ	Loctite 222	Loctite 243	Loctite 2701

Viscosities and further details can be found in the data sheets – www.loctite.de

Service temperature: –55 °C – 150 °C, exception: Loctite 278: –55 °C – 200 °C

Reducing the break-off strength of coatings and inactive materials is possible.

→ Preliminary experiments are recommended.

Source: **LOCTITE**



EC Directive 2000/53/EC on end-of-life vehicles (ELV Directive) (End-of-Life-Vehicles)

The aim of this European directive is to avoid having materials which are dangerous to health in vehicles or to prevent this from happening as much as possible.

All cars and utility vehicles up to 3.5 tonnes, which were put into operation from 1st July 2007 onwards are affected by this.

The following are banned from this date

1. Lead
2. Cadmium
3. Chromium (VI)
4. Mercury

Exceptional approval was granted until 1st July 2008 for hexavalent chromium in corrosion protection layers for screws and nuts to fasten parts of chassis frames.

The EU directive was adopted into German law through the end-of-life vehicles directive. The automotive industry implemented the requirements of the EU directive in the form of

1. VDA data sheet 232-101 (list of materials which must be declared)
2. International material data system (IMDS).

→ These products from the REYHER catalogue comply with this directive

All products made from steel, stainless steel and non-ferrous metals, uncoated or zinc plated with blue/transparent thick layer passivation, with zinc flake coatings without hexavalent chromates (fIZnnc) and hot dip galvanization

EC Directive 2002/95/EC on electrical and electronic equipment (ROHS directive) (Restriction of Hazardous Substances)

Through EU Directive 2011/65/EU (colloquially referred to as RoHS II) on the restriction of use of certain hazardous substances in electrical and electronic equipment, from 8th June 2011 the previous RoHS Directive 2002/95/EC is repealed.

It is implemented by the Hazardous Substances in Electrical and Electronic Equipment Ordinance (ElektroStoffV) in Germany. Accordingly, waste electrical and electronic equipment, including cables and spare parts that contain more than 0.1 percent by weight of lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers or more than 0.01 percent by weight of cadmium per homogeneous material may not be placed on the market.

The directive provides for a gradual extension to all electrical and electronic equipment by 22nd July 2019. Thus, in addition to the products already affected previously, it covers, among other things, medical devices and monitoring and control instruments after 22nd July 2014 and industrial monitoring and control instruments after 22nd July 2017.

→ These products from the REYHER catalogue comply with this directive

All products made from steel, stainless steel and non-ferrous metals, uncoated or zinc plated with blue/transparent thick layer passivation, with zinc flake coatings without hexavalent chromates (fIZnnc) and hot dip galvanization

ZEK 01.2-08 PAK (Polycyclic aromatic hydrocarbons)

This directive replaces directive ZEK 01-08. Products (technical work equipment and consumer products) must comply with legal requirements to avoid any risk to health, such as § 30, 31 LFGB, the Chemicals Prohibition Ordinance and § 4 the Equipment and Product Safety Act (GPSG), which is why the revised PAH test specifications as well as the new PAH maximum values were specified in this document. Materials that may contain PAHs are, for example, elastomers (plastics and rubber materials), black or dark-colored polymers, coatings and lacquers as well as materials treated with preservatives (naphthalene) such as natural bristles, leather products, bast and wood.

The main causes of PAH contamination in materials are the use of:

- PAH-contaminated softening oils in rubber and flexible plastics (soft plastics)
- PAH contaminated soot as a black pigment used in rubber, plastics and varnish

This shows that products we delivered which were made from steel, stainless steel and non-ferrous metals including all coatings are not affected by this regulation.

→ All products from the REYHER catalogue comply with this directive

HR 4040 – CPSIA (Consumer Product Safety Improvement Act)

The US Consumer Product Safety Improvement Act of 2008 (HR 4040/CPSIA), was passed in August 2008 and important provisions came into force in February 2009.

The phthalates DEHP, DBP and BBP are banned, the phthalate DINP, DIDP and DNOP are provisionally banned until an evaluation by the "Chronic Hazard Advisory Panel (CHAP)" has been carried out.

Lead in base material has also been banned in the form of a progressive stipulation of ≤ 600 ppm (10th February 2009) to ≤ 100 ppm (14th August 2011) and in colour coatings of ≤ 90 ppm.

From a technical point of view, this demand cannot be complied with due to nationally and internationally standardised fasteners. Thus, for example, all low strength classes up to class 6.8 can be manufactured from machining steel which can have a lead content of up to 350 ppm. With non-ferrous metals, the lead content can even be up to 4000 ppm.

EU-Directive EU 2006/122/EG (PFOS) (Perfluorooctansulfonate)

The EU Directive 2006/122/EC relates to the use of perfluorooctane sulfonates (PFOS) in the aerospace, semiconductor and electronics industries, as well as in the photographic trade. If emissions into the environment and exposure in the workplace can be reduced to a minimum, there is no serious threat to the environment or to human health. According to the directive, special attention need to be given to galvanic processes and surface treatment of metals and plastics. There are indications and experience shows that legislative measures are to be expected in this regard. By using the best technology available, it is expected that emissions shall be reduced accordingly. Another proposal is for restricting semi-finished products and products containing PFOS to which PFOS were intentionally added. The directive would apply only to new products and not to products that are already on the market. Since perfluoro-octanoic acid (PFOA) and its salts pose a similar risk, possible additions to this directive in regard to this group are to be expected. A fully galvanized product does not contain any measurable quantities of PFOS.

→ All products from the REYHER catalogue comply with this directive

EC Regulation 1907/2006 – Chemicals regulation (REACH) (Registration, Evaluation, Authorisation of Chemicals)

This EC regulation centralises and simplifies Europe-wide chemical laws through registration, evaluation and authorisation and came into effect on 1st June 2007. It is the declared objective to increase the level of knowledge of the dangers and risks which arise from chemicals. Here, companies are given more responsibility for the safe handling of their products. Although fasteners are in principle included as articles by the REACH regulation, most fall under exemptions and are thus exempt from the registration requirement.

According to Article 3 of the REACH regulation fasteners are articles. Articles are objects whose function is defined not by its chemical composition (e.g. by the metal components in the alloy), but by their external shape.

However, according to Article 7, Section 1 of the REACH regulation articles are only subject to registration if they also contain substances that are intended to be released. This is however, not the case for fasteners.

Even fasteners with corrosion protection coatings, which thus have a sacrificial coating, i.e. a coating which is sacrificed to protect the component part, is not subject to having to be registered. This is because the protective layer is not released as such, but only certain reaction products. What is relevant is the exemption under Article 2, Paragraph 7 (b) REACH regulation in conjunction with Annex V, Section 3 of the REACH regulation. According to this, substances which result from a chemical reaction occurring upon end use of other substances, mixtures or articles and which are not themselves manufactured, imported or placed on the market, are exempted from the obligation to register.

However, this does not affect provisions regarding substances of very high concern (Article 57, Article 59, Annex 14 REACH regulation) in articles under Article 7, paragraph 2 REACH regulation. These substances are not subject to registration, but must be reported, provided

- a) The substance is present in those articles in quantities totalling over one tonne per year per producer or importer
- b) The substance in these articles contain a concentration of more than 0.1% (by mass)

Which substances are subject to such a reporting requirement still needs to be determined by the European authorities. Substances such as cadmium, mercury, lead, chromium VI, as contained in corrosion protection coverings and alloying elements, are expected to be included.

For fasteners, however, this reporting requirement is unlikely to come into play in the provision, since the share by mass of the dangerous substance is likely to be much smaller than 0.1%. This must be checked accordingly in each individual case.

The statements above do not apply to chemical/technical products (e.g. aerosols, adhesives and sealants). These are preparations, not articles. For preparations it is not the preparations themselves, but the ingredients that are subject to registration. For products manufactured in the EU this obligation to register affects the manufacturer and the importer for imports from non-EU countries.

→ All products from the REYHER catalogue comply with this regulation

Construction Products Regulation 305/2011/EU (Construction products directive)

On 1st July 2013 this regulation repealed Construction Products Directive 89/106/EEC.

This regulation lays down the conditions for the marketing and provision of construction as well as their CE marking.

For more detailed information, please refer to the REYHER special publication "Fasteners Metal and Steel Construction".

→ These products from the REYHER catalogue comply with this directive*

- With CE marking: EN 14399-4, EN 14399-6, EN 14399-8, DIN 7968, DIN 7969, DIN 7989, DIN 7990, mountings from ISO 4014/4017 EN 15048, ISO 7042, DIN 6917, DIN 6918.



EC Directive 2006/42/EG (Machinery Directive)

The directive regulates a unified protection level for accident prevention when bringing machinery into circulation inside the European Economic Area (EEA).

This Machinery Directive is supposed to reduce non-tariff barriers in the Union. Like all directives decreed on the basis of the EC Treaty, the Machinery Directive does not have any direct effect. It needs to be adopted into national law. In Germany, this has been done by the Equipment and Product Safety Act (Geräte- und Produktsicherheitsgesetz (GPSG)) and the Machinery Directive based there on (9th GPSGV).

From 29th December 2009 the new Machinery Directive is to be applied in a binding fashion.

Essentially, the following changes were made:

- Clearer restriction of the scope of application for the low-voltage directive and for the lift directive
- Incomplete machinery are included in the scope of application. Which directive requirements were satisfied can be found in the related documents. Included in the scope of delivery are a declaration of installation and assembly instructions written in the language of the country.
- The basic health and safety requirements were modified to meet technical advances made
- Selection options for conformity assessment procedures for machinery with inherently dangerous machines (see Annex 4 of the directive)
- Safety components receive the CE marking
- Inclusion of household appliances also commercially used, provided they fulfil the machine definition

→ These products from the REYHER catalogue can be used to implement this directive

DIN 580, DIN 582, DIN 7964 and REYHER article numbers 88151, 88152 and 88153

Product Safety Act (ProdSG)

The German Product Safety Act, formerly the Equipment and Product Safety Act (GPSG), applies whenever products are made available on the market, exhibited on the market or used for the first time in the context of a commercial activity as well as to the erection and the operation of installations subject to mandatory inspection, which are used for commercial or economic purposes or which may put employees at risk, with the exception of installations subject to mandatory inspection.

The Product Safety Act (ProdSG) includes a number of regulations which have implemented a number of European directives into German law.

1. ProdSV – Regulation relating to making available on the market electrical equipment designed for use within certain voltage limits
2. ProdSV – Regulation relating to the safety of toys
6. ProdSV – Regulation relating to making available on the market simple pressure vessels
7. ProdSV – Appliances burning gaseous fuels regulation
8. ProdSV – Regulation relating to making available on the market personal protective equipment
9. ProdSV – Machinery regulation
10. ProdSV – Regulation relating to making available on the market recreation craft and transport using recreational craft
11. ProdSV – Explosion protection regulation
12. ProdSV – Lift regulation
13. ProdSV – Aerosol dispenser regulation
14. ProdSV – Pressure equipment regulation

EU Directive 97/23/EC (Pressure equipment directive)

The EU Directive is implemented by the 6th ProdSV – Regulation relating to making available on the market simple pressure vessels

The regulation is reflected in the Technical Regulations (standards), which include instructions on computation and construction, on approved materials (including materials and strength classes for bolts and nuts), on acceptance test provisions (factory inspection documents) and on selected and correspondingly recognised manufacturers.

In addition or if not otherwise specified, the Technical Regulations apply to bolts and nuts among others:

- | | |
|-------------------------|---|
| AD 2000 data sheet W 0 | = General principles for materials |
| AD 2000 data sheet W 2 | = For austenitic steel parts |
| AD 2000 data sheet W 7 | = For ferritic steel parts |
| AD 2000 data sheet W 10 | = For ferrous material parts for low temperatures |

The recognised manufacturer of bolts and nuts made from permitted materials must prove to the responsible authority that the requirements have been satisfied according to AD 2000 data sheet W0. Manufacturers who fulfil these requirements are listed in the VdTÜV data sheet for materials 1253/1. These manufacturers are subject to constant inspection.

→ These products from the REYHER catalogue comply with this directive*

DIN 938 (5.6), DIN 939 (5.6), DIN 28129 (C 35)
ISO 4014/4017 (5.6, 8.8, A 2-70, A 4-70, A 4-80, BUMAX 88), ISO 4032 (5, 8, A 2-70, A 4-70, A 4-80, BUMAX 88),
ISO 4762 (8.8, A 2-70, A 4-70, A 4-80, BUMAX 88)

* See the information on the corresponding products on the price pages

Fastener Quality Act (FQA)

This term stands for the legal initiative in the USA which requires that fasteners introduced to the US market be subject to extensive quality testing and certification carried out by inspection laboratories especially set up for this.

The reason this initiative was set up were a number of claims for damages as a result of fasteners failing in the 1980s. First of all, only vital fasteners were to be affected (= approx. 1% of all parts). However, during the first draft law, the affected article was expanded to such an extent that almost 70% of all fasteners became affected.

The first draft law was passed by the US Congress in November 1990 as PL (Public Law) 101-592. After some corrections and after amending the execution provisions "CFR part 280", "PL 104-113" emerged from this with a scheduled application date of 27th May 1997. The application date was postponed on numerous occasions due to objections from various organisations and because the required number of accredited inspection laboratories (min. 400) could not be set up on time: to 28th May 1998, 26th July 1998 and 25th October 1998. (PL105-234/PL 106-34).

The law (FQA – Amendments Act of 1999) was finally passed in simplified form, signed on 8th June 1999 by then President Clinton and came into force 180 days later on 6th December 1999.

Mechanical fasteners included in the FQA are bolts, nuts, screws and special load-showing clipped washers with a nominal diameter of 6 mm (0.25 inches) or larger, which have to be fully hardened and marked (property class) according to valid standards and correspond to valid standards.

Not included in this are, among others, mechanical fasteners which

- Are part of a composite whole
- Are parts which are to be used as spares, replacements or maintenance parts unless the part is in a package which contains more than 75 such parts at the point of sale
- The part is one from a construction set
- Parts which are manufactured according to the requirements of a quality assurance system for fasteners (certification according to ISO 9000ff, QS 9000 and VDA 6.1)
- Parts which are manufactured according to the requirements of the company's own standards

Additionally, digitally stored quality assurance documentation (declaration of conformity) is permitted in order to counteract the "mountains of paperwork".

→ All products exported to the USA can be delivered according to this directive.

