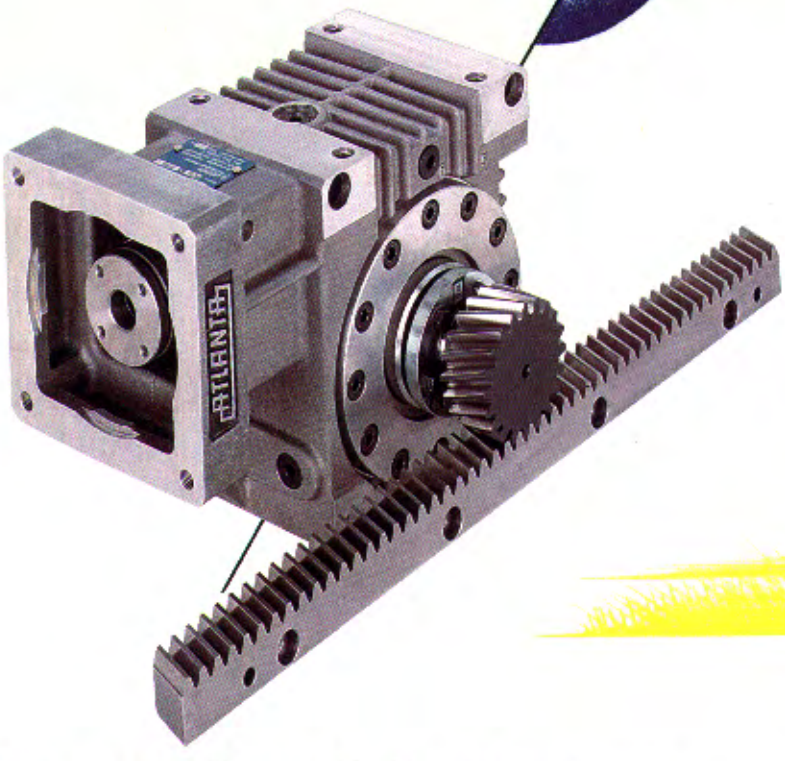
ATLANTA

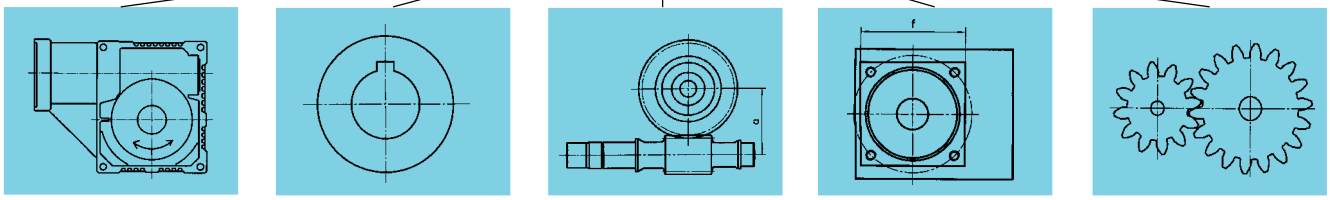


Servo-Antriebssystem

Servo Drive System

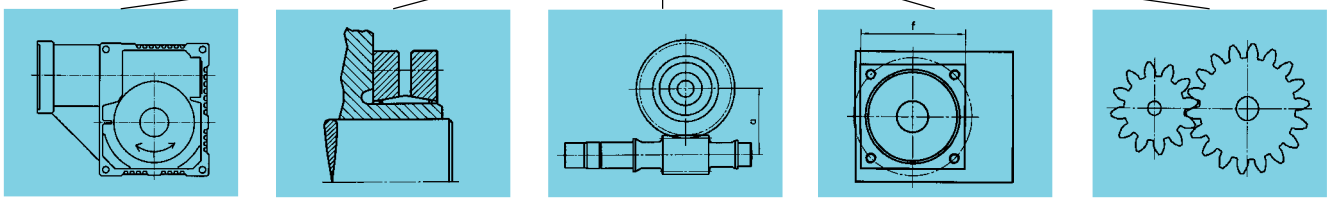
Example for Servo-Worm Reducers:

58 4 5 2 20



Servo-Worm Reducers	Keyway Output	Center Distance a = 80 mm	Motor Mounting Type	Ratio i = 19.5

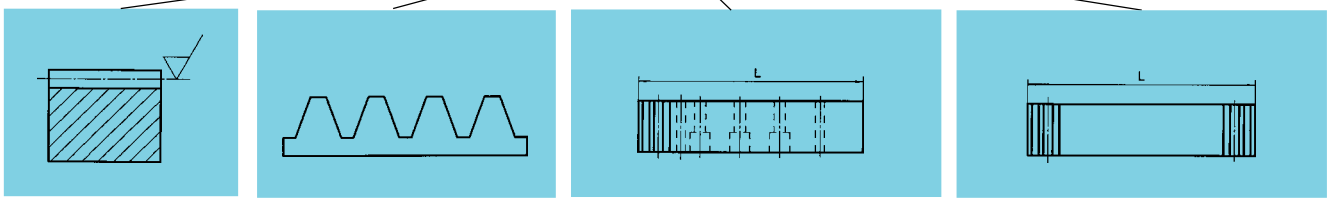
58 8 5 2 20



Servo-Worm Reducers	Compression Output	Center Distance a = 80 mm	Motor Mounting Type	Ratio i = 19.5

Example for Racks:

28 2 0 025



Style and Quality Level	Module (Pitch)	Mounting Holes	Rack Length

Standard Drive Elements

Chain Sprockets
With various number of teeth for precision roller chain, pitch between 6 mm and 1 ½", for single and multiple chains, as disks and with one-sided hub. Also sprockets with vecobloc tensioning bushings.

Mounting Hubs
For sprockets

Precision Roller Chains
In accordance with DIN 8180/87, angled side links, and sliding rails as chain guides.

Chain Tensioners
With special ball bearings, eccentric tensioning rings, etc.

Tensioning Units
With maintenance-free, silent rubber spring system.

Frictional Hubs
For limiting torque.

Milled Straight Pinions
In modules 1.0 to 8.0, with various number of teeth. Modules 1.0 to 3.0 also available in plastic.

Hardened & Ground Straight and Helical Pinions
Case-hardened and ground, in modules 2.0 to 8.0.

Milled Straight and Helical Racks
In modules 1.0 to 8.0, soft and induction-hardened, up to 2,000 mm in length. Module 1.0 to 3.0 also available in plastic.

Hardened & Ground Straight and Helical Racks
In modules 2.0 to 8.0, from 250 mm to 1,000 mm in length.

Bevel Gear Sets
In modules 1.0 to 5.0 in ratios from 1:1 to 5:1. Modules 1.0 and 1.5 also available in plastic.

Standard Worm Gearboxes
Center distances from 40 mm to 125 mm, and ratios from 7:1 to 109:1. Hardened & ground worm and special bronze wheel.

Splined Shafts, Straight and Involute Splines
Including corresponding sleeve and hubs.

Trapezoidal Thread Spindles
And nuts, from 12 mm to 70 mm thread diameter, left and right-hand threads, in standard lengths.

Ballscrew Spindles
And nuts, rolled and hardened, from 16 mm to 63 mm diameter, in standard lengths.

Shaft Couplings
Rigid and flexible, for torques from 0.1 to 3,100 lb.ft.

Universal Joints
Ball and universal joints in accordance with DIN 808. Single and double versions from 8 mm to 80 mm shaft diameter.

Timing Belt Drives
HTD profile and trapezoidal profile in accordance with DIN/ISO 5294/96. Various number of teeth and belt lengths available.

Worm Gearmotors
Available ready-to-mount. With output shafts or hollow bores, in center distances 40 mm to 125 mm, and ratios from 7:1 to 82:1. Also accessories for input and output drives.

Bevel Gearboxes
With single or dual output shafts, with straight and spiral-bevel gears. Ratios from 1:1 to 5:1.

Screw Jack Gearboxes
With fixed and rotating spindles, for lifting forces from 450 to 22,500 lb., oil-cooled or grease lubricated.

Linear Lifting Drives
For use in scissor-lift tables to replace hydraulic cylinders. Up to 22,500 lb. capacity.

Standard Elements for Servo-Systems
High-performance servo-worm reducers with low backlash and adjustable gearing, center distances 50 mm to 125 mm, ratios from 4.75:1 to 52:1. Accessories including input and output couplings, pinion output shafts and racks with straight and helical, hardened & ground teeth.

Special versions of all drive components according to customer drawings

And/or own design.

Gears and change gears
With milled or ground teeth up to module 12 and module 8.0 respectively.

Chain Sprockets
For precision roller chains, with 4 mm up to 1 ½" pitch in accordance with DIN 8180/8187/8188 BSA and ASA, for bushed roller chains according to DIN 8164, plate-link chains according to DIN 8150, and for special chains (transport and conveyor chains, etc.).

Bevel Gears
With straight teeth, crowned according to Gleason, up to module 8.0.

Worm Gear Sets
With milled or ground teeth, up to module 10.0.

Racks
In modules 1.0 to 8.0, up to 3,000 mm in length.

Splined shafts and sleeves
In accordance with DIN 5463/5472, milled and ground.

Involute spline shafts
In accordance with DIN 5480/5482.

Ring Gears with Internal Teeth
Up to module 5.0.

Cylindrical gearboxes

Bevel Gearboxes

Speed-change Gearboxes

Worm Gearboxes

Planetary Gearboxes

Spindle Lifting Gearboxes

Description

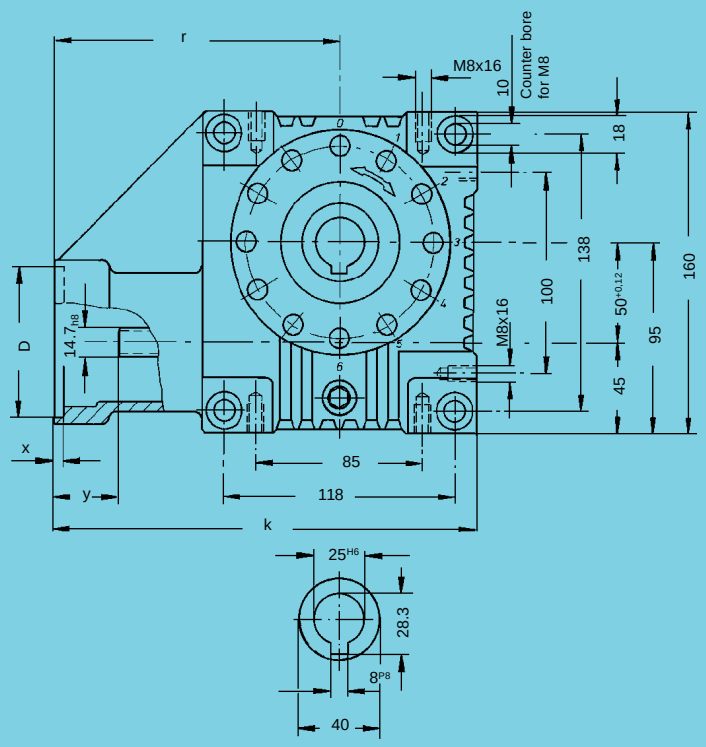
ATLANTA High-Performance Servo-Worm Reducers were specifically developed for use with the latest servo motor technology in applications that demand precise positioning and repeatability. Typical applications include traveling gantries, horizontal & vertical axis drives, pick & place robots, and replacements for long ball-screw axis drives. These applications often occur in the Material Handling, Automation, CNC Machine Tool and Robotics Industries.

To reach the high level of precision that servo systems demand, several design improvements over traditional worm gear reducers were required. The worm & wheel gear designs were improved by increasing their quality levels and optimizing their tooth profiles for minimum backlash. A simple method of adjusting the backlash of the gear set was also developed, which changed the centerline distance of the gear set by means of two eccentric output bearing covers. A pair of precision angular contact bearings were added to the input shaft to eliminate any axial play at the worm gear. Robust tapered roller bearings were added to the output shaft to allow for high radial and axial loads. With these design improvements, we can consistently offer our units with an angular backlash of less than 2 arc-minutes, and the advantage of ”in the field” adjustable backlash.

The assembled unit is comprised of precision-machined parts made from high-quality materials, which provide the unit with its high accuracy and quality level. The unit housing is aluminum – for its lightweight and good heat dissipation. All faces of the housing are machined to allow for unit mounting in any position. The worm is case-hardened steel; the wheel is bronze, shrunk on a steel splined hollow shaft. The internal lubricant is Shell Tivela synthetic oil (ISO V.G. 220) for minimal wear.

The servo motor connection is simple with a zero-backlash motor coupling, which adapts the servo motor shaft to the splined input shaft. The connection flange properly aligns the motor shaft with the input shaft, making mounting quick and easy. Various couplings and mounting flanges are available for assembly with virtually all servo motors. The output shaft of the worm reducer is available with a keyway or a compression-type coupling. We also offer a line of accessories to adapt this output to straight shafting, rack & pinions, or other gearing types; see page 25.

Size 3, Center Distance: a_o= 50 mm



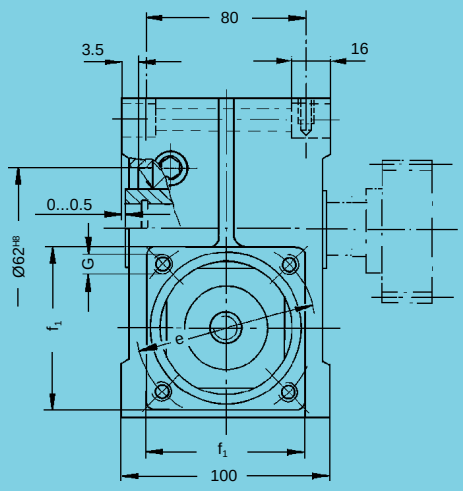
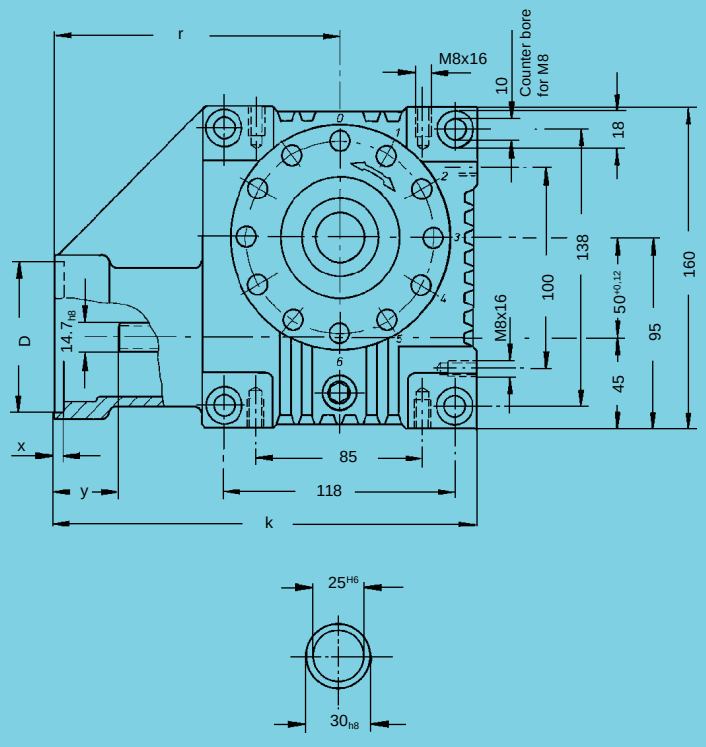


Fig. 1 Output bore with key connection



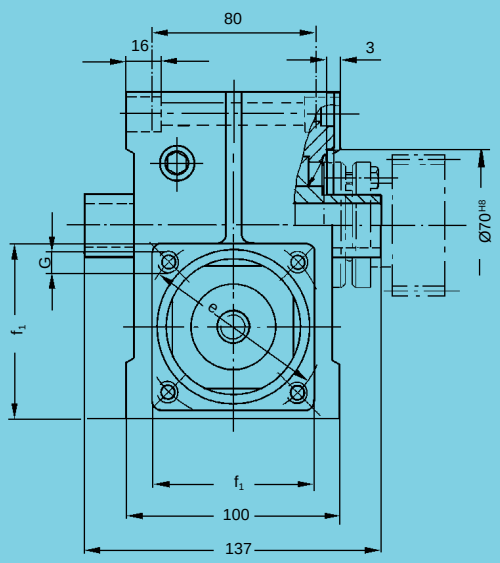


Fig. 2 Output bore with compression connection

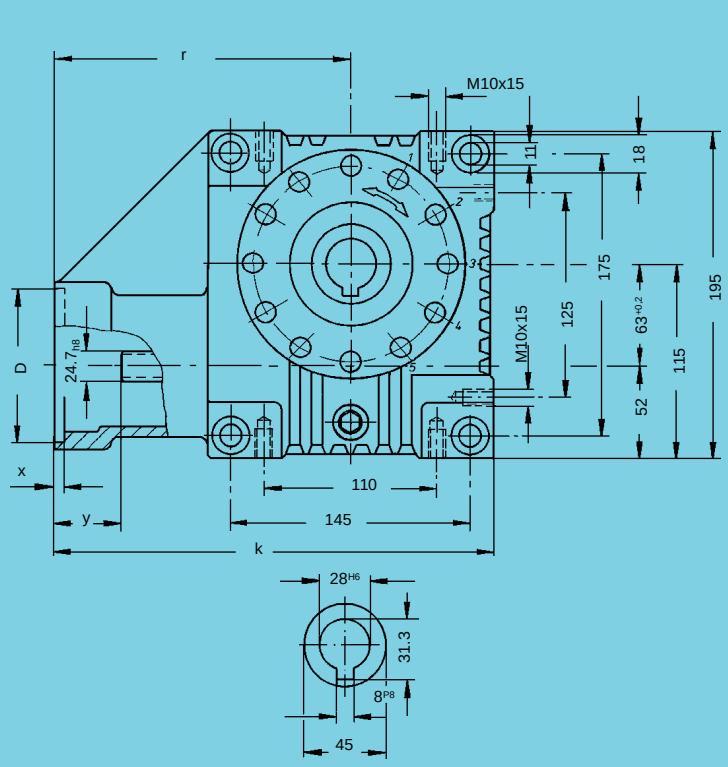
All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Size 3, Center Distance: a_o= 50 mm

Order code Fig.1	Fig. 2	Ratio i	D^{G7}	k	r	x	y	f_1	e	G	Wt. (lb)	J_{red} in.lb.s² x10^{-3}
58 43 105	**58 83 105**	4.75										0.427
58 43 107	**58 83 107**	6.75										0.366
58 43 109	**58 83 109**	9.25										0.309
58 43 115	**58 83 115**	14.50										0.248
58 43 120	**58 83 120**	19.50	95	222	152	5	42	100	115	M8	15.4	0.173
58 43 129	**58 83 129**	29.00										0.238
58 43 139	**58 83 139**	39.00										0.204
58 43 150	**58 83 150**	50.00										0.189
58 43 205	**58 83 205**	4.75										0.427
58 43 207	**58 83 207**	6.75										0.366
58 43 209	**58 83 209**	9.25										0.309
58 43 215	**58 83 215**	14.50	50	222	152	5	42	100	95	M6	15.4	0.248
58 43 220	**58 83 220**	19.50										0.173
58 43 229	**58 83 229**	29.00										0.238
58 43 239	**58 83 239**	39.00										0.204
58 43 250	**58 83 250**	50.00										0.189
58 43 305	**58 83 305**	4.75										0.427
58 43 307	**58 83 307**	6.75										0.366
58 43 309	**58 83 309**	9.25										0.309
58 43 315	**58 83 315**	14.50										0.248
58 43 320	**58 83 320**	19.50	80	222	152	5	42	100	100	M6	15.4	0.173
58 43 329	**58 83 329**	29.00										0.238
58 43 339	**58 83 339**	39.00										0.204
58 43 350	**58 83 350**	50.00										0.189
58 43 405	**58 83 405**	4.75										0.427
58 43 407	**58 83 407**	6.75										0.366
58 43 409	**58 83 409**	9.25										0.309
58 43 415	**58 83 415**	14.50	95	232	162	5	52	105	115	M8	15.4	0.248
58 43 420	**58 83 420**	19.50										0.173
58 43 429	**58 83 429**	29.00										0.238
58 43 439	**58 83 439**	39.00										0.204
58 43 450	**58 83 450**	50.00										0.189
58 43 505	**58 83 505**	4.75										0.427
58 43 507	**58 83 507**	6.75										0.366
58 43 509	**58 83 509**	9.25										0.309
58 43 515	**58 83 515**	14.50										0.248
58 43 520	**58 83 520**	19.50	60	234	164	4	54	100	75	M5	15.4	0.173
58 43 529	**58 83 529**	29.00										0.238
58 43 539	**58 83 539**	39.00										0.204
58 43 550	**58 83 550**	50.00										0.189
58 43 805	**58 83 805**	4.75										0.427
58 43 807	**58 83 807**	6.75										0.366
58 43 809	**58 83 809**	9.25										0.309
58 43 815	**58 83 815**	14.50										0.248
58 43 820	**58 83 820**	19.50	95	238	168	5	58	115	130	M8	17.6	0.173
58 43 829	**58 83 829**	29.00										0.238
58 43 839	**58 83 839**	39.00										0.204
58 43 850	**58 83 850**	50.00										0.189
58 43 905	**58 83 905**	4.75										0.427
58 43 907	**58 83 907**	6.75										0.366
58 43 909	**58 83 909**	9.25										0.309
58 43 915	**58 83 915**	14.50										0.248
58 43 920	**58 83 920**	19.50	110	238	168	5	58	115	130	M8	17.6	0.173
58 43 929	**58 83 929**	29.00										0.238
58 43 939	**58 83 939**	39.00										0.204
58 43 950	**58 83 950**	50.00										0.189

a_o = 40 mm and other ratios available upon request

Size 4, Center Distance: a_o= 63 mm



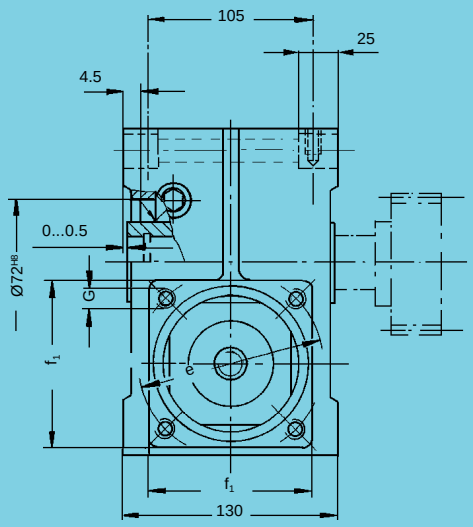
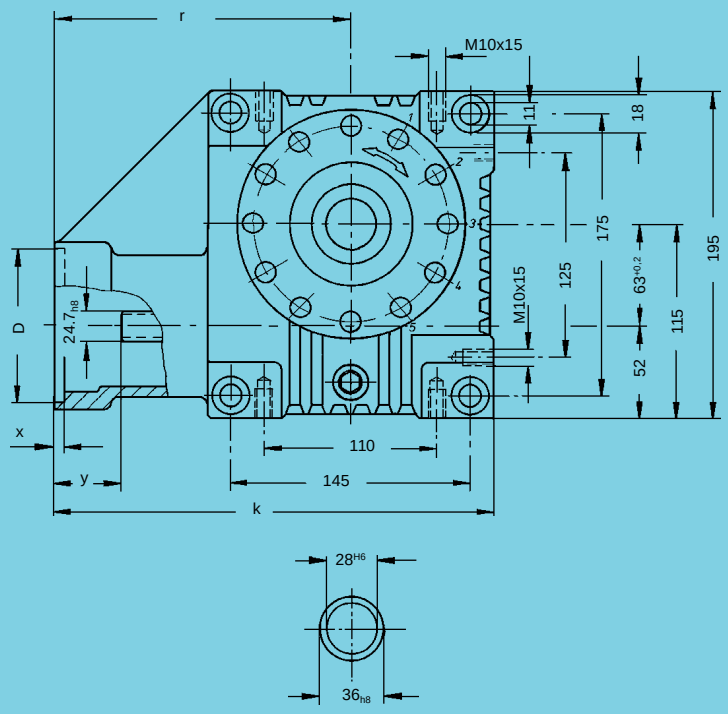


Fig. 1 Output bore with key connection



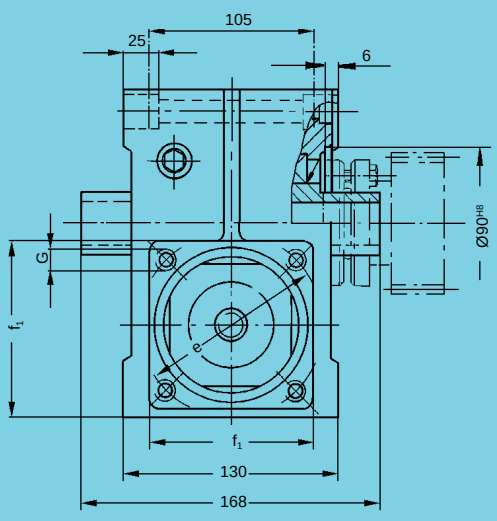


Fig. 2 Output bore with compression connection

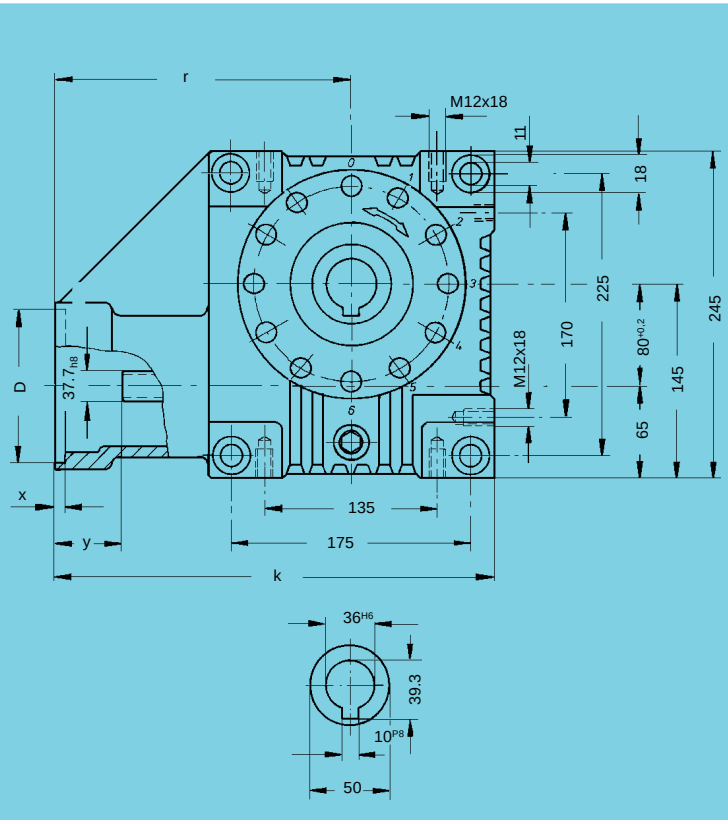
All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Size 4, Center Distance: a_o= 63 mm

Order code Fig.1	Fig. 2	Ratio i	D^{G7}	k	r	x	y	f_1	e	G	Wt. (lb)	J_{red} in.lb.s² x10⁻³
58 44 005	**58 84 005**	4.75										1.643
58 44 007	**58 84 007**	6.75										1.214
58 44 009	**58 84 009**	9.25										0.870
58 44 015	**58 84 015**	14.50	110	270	185	5	53	140	165	M10	27.5	0.849
58 44 020	**58 84 020**	19.50										0.614
58 44 029	**58 84 029**	29.00										0.882
58 44 039	**58 84 039**	39.00										0.894
58 44 052	**58 84 052**	52.00										0.469
58 44 105	**58 84 105**	4.75										1.643
58 44 107	**58 84 107**	6.75										1.214
58 44 109	**58 84 109**	9.25										0.870
58 44 115	**58 84 115**	14.50	95	265	180	5	48	100	115	M8	26.4	0.849
58 44 120	**58 84 120**	19.50										0.614
58 44 129	**58 84 129**	29.00										0.882
58 44 139	**58 84 139**	39.00										0.894
58 44 152	**58 84 152**	52.00										0.469
58 44 205	**58 84 205**	4.75										1.643
58 44 207	**58 84 207**	6.75										1.214
58 44 209	**58 84 209**	9.25										0.870
58 44 215	**58 84 215**	14.50	130	270	185	5	53	140	165	M10	27.5	0.948
58 44 220	**58 84 220**	19.50										0.614
58 44 229	**58 84 229**	29.00										0.882
58 44 239	**58 84 239**	39.00										1.894
58 44 252	**58 84 252**	52.00										0.469
58 44 305	**58 84 305**	4.75										1.643
58 44 307	**58 84 307**	6.75										1.214
58 44 309	**58 84 309**	9.25										0.870
58 44 315	**58 84 315**	14.50	95	265	180	5	48	115	130	M8	26.4	0.849
58 44 320	**58 84 320**	19.50										0.614
58 44 329	**58 84 329**	29.00										0.882
58 44 339	**58 84 339**	39.00										0.894
58 44 352	**58 84 352**	52.00										0.469
58 44 405	**58 84 405**	4.75										1.643
58 44 407	**58 84 407**	6.75										1.214
58 44 409	**58 84 409**	9.25										0.870
58 44 415	**58 84 415**	14.50	95	270	185	5	53	140	165	M10	27.5	0.849
58 44 420	**58 84 420**	19.50										0.614
58 44 429	**58 84 429**	29.00										0.882
58 44 439	**58 84 439**	39.00										0.894
58 44 452	**58 84 452**	52.00										0.469
58 44 505	**58 84 505**	4.75										1.643
58 44 507	**58 84 507**	6.75										1.214
58 44 509	**58 84 509**	9.25										0.870
58 44 515	**58 84 515**	14.50	110	265	180	5	48	115	130	M8	26.4	0.849
58 44 520	**58 84 520**	19.50										0.614
58 44 529	**58 84 529**	29.00										0.882
58 44 539	**58 84 539**	39.00										0.894
58 44 552	**58 84 552**	52.00										0.469
58 44 605	**58 84 605**	4.75										1.643
58 44 607	**58 84 607**	6.75										1.214
58 44 609	**58 84 609**	9.25										0.870
58 44 615	**58 84 615**	14.50	110	270	185	5	53	115	130	M8	27.5	0.849
58 44 620	**58 84 620**	19.50										0.614
58 44 629	**58 84 629**	29.00										0.882
58 44 639	**58 84 639**	39.00										0.894
58 44 652	**58 84 652**	52.00										0.469
58 44 905	**58 84 905**	4.75										1.643
58 44 907	**58 84 907**	6.75										1.214
58 44 909	**58 84 909**	9.25										0.870
58 44 915	**58 84 915**	14.50	130	290	205	5	73	195	215	M12	26.4	0.849
58 44 920	**58 84 920**	19.50										0.614
58 44 929	**58 84 929**	29.00										0.882
58 44 939	**58 84 939**	39.00										0.894
58 44 952	**58 84 952**	52.00										0.469

a_o = 40 mm and other ratios available upon request

Size 5, Center Distance: a_o= 80 mm



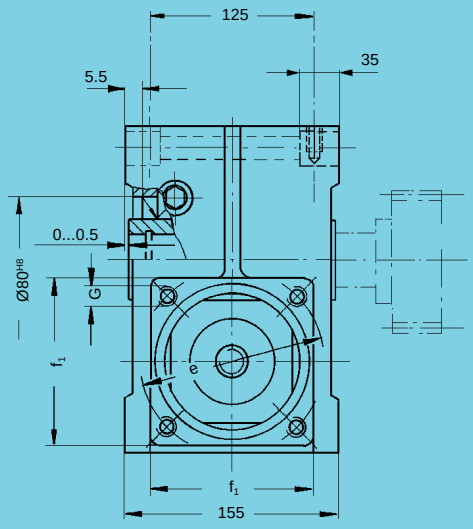
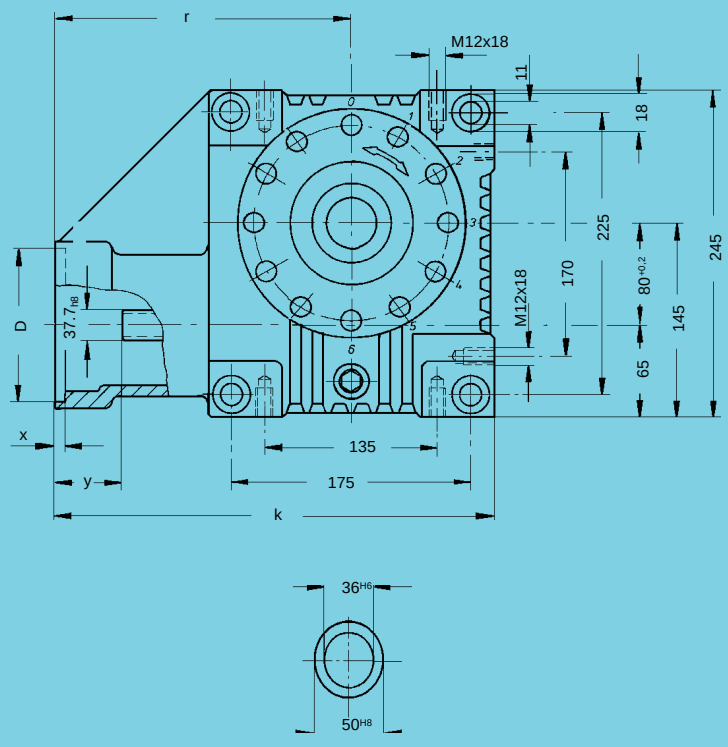


Fig. 1 Output bore with key connection



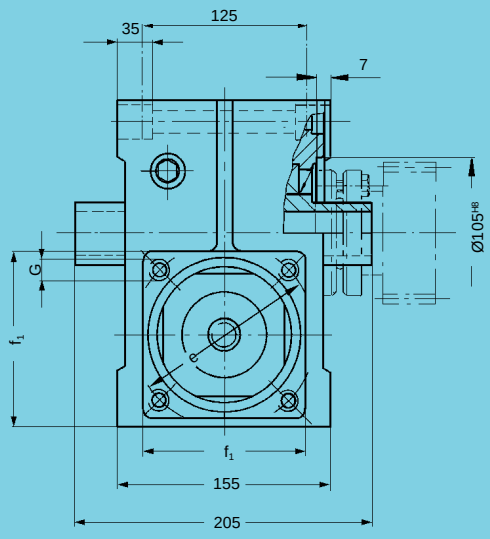


Fig. 2 Output bore with compression connection

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Size 5, Center Distance: a_o= 80 mm

Order code Fig.1	Fig. 2	Ratio i	D^{G7}	k	r	x	y	f_1	e	G	Wt. (lb)	J_{red} in.lb.s² x10⁻³
58 45 005	**58 85 005**	4.75										5.370
58 45 007	**58 85 007**	6.75										5.390
58 45 009	**58 85 009**	9.25										4.217
58 45 015	**58 85 015**	14.50										4.698
58 45 020	**58 85 020**	19.50	110	332.5	230	5	55	140	165	M10	50.6	3.482
58 45 029	**58 85 029**	29.00										3.584
58 45 039	**58 85 039**	39.00										3.699
58 45 052	**58 85 052**	52.00										3.287
58 45 105	**58 85 105**	4.75										5.370
58 45 107	**58 85 107**	6.75										5.390
58 45 109	**58 85 109**	9.25										4.217
58 45 115	**58 85 115**	14.50	180	362.5	260	5	85	193	215	M12	50.6	4.698
58 45 120	**58 85 120**	19.50										3.482
58 45 129	**58 85 129**	29.00										3.584
58 45 139	**58 85 139**	39.00										3.699
58 45 152	**58 85 152**	52.00										3.287
58 45 205	**58 85 205**	4.75										5.370
58 45 207	**58 85 207**	6.75										5.390
58 45 209	**58 85 209**	9.25										4.217
58 45 215	**58 85 215**	14.50	130	332.5	230	5	55	140	165	M10	50.6	4.698
58 45 220	**58 85 220**	19.50										3.482
58 45 229	**58 85 229**	29.00										3.584
58 45 239	**58 85 239**	39.00										3.699
58 45 252	**58 85 252**	52.00										3.287
58 45 405	**58 85 405**	4.75										5.370
58 45 407	**58 85 407**	6.75										5.390
58 45 409	**58 85 409**	9.25										4.217
58 45 415	**58 85 415**	14.50	130	352.5	250	5	75	155	165	M10	52.8	4.698
58 45 420	**58 85 420**	19.50										3.482
58 45 429	**58 85 429**	29.00										3.584
58 45 439	**58 85 439**	39.00										3.699
58 45 452	**58 85 452**	52.00										3.287
58 45 705	**58 85 705**	4.75										5.370
58 45 707	**58 85 707**	6.75										5.390
58 45 709	**58 85 709**	9.25										4.217
58 45 715	**58 85 715**	14.50	180	367.5	265	6	90	192	215	M12	66	4.698
58 45 720	**58 85 720**	19.50										3.482
58 45 729	**58 85 729**	29.00										3.584
58 45 739	**58 85 739**	39.00										3.699
58 45 752	**58 85 752**	52.00										3.287
58 45 805	**58 85 805**	4.75										5.370
58 45 807	**58 85 807**	6.75										5.390
58 45 809	**58 85 809**	9.25										4.217
58 45 815	**58 85 815**	14.50										4.698
58 45 820	**58 85 820**	19.50	180	352.5	250	5	75	193	215	M12	55	3.482
58 45 829	**58 85 829**	29.00										3.584
58 45 839	**58 85 839**	39.00										3.699
58 45 852	**58 85 852**	52.00										3.287
58 45 905	**58 85 905**	4.75										5.370
58 45 907	**58 85 907**	6.75										5.390
58 45 909	**58 85 909**	9.25										4.217
58 45 915	**58 85 915**	14.50	130	352.5	250	5	75	193	215	M12	55	4.698
58 45 920	**58 85 920**	19.50										3.482
58 45 929	**58 85 929**	29.00										3.584
58 45 939	**58 85 939**	39.00										3.699
58 45 952	**58 85 952**	52.00										3.287

a_o = 40 mm and other ratios available upon request

Size 6, Center Distance: a_o= 100 mm

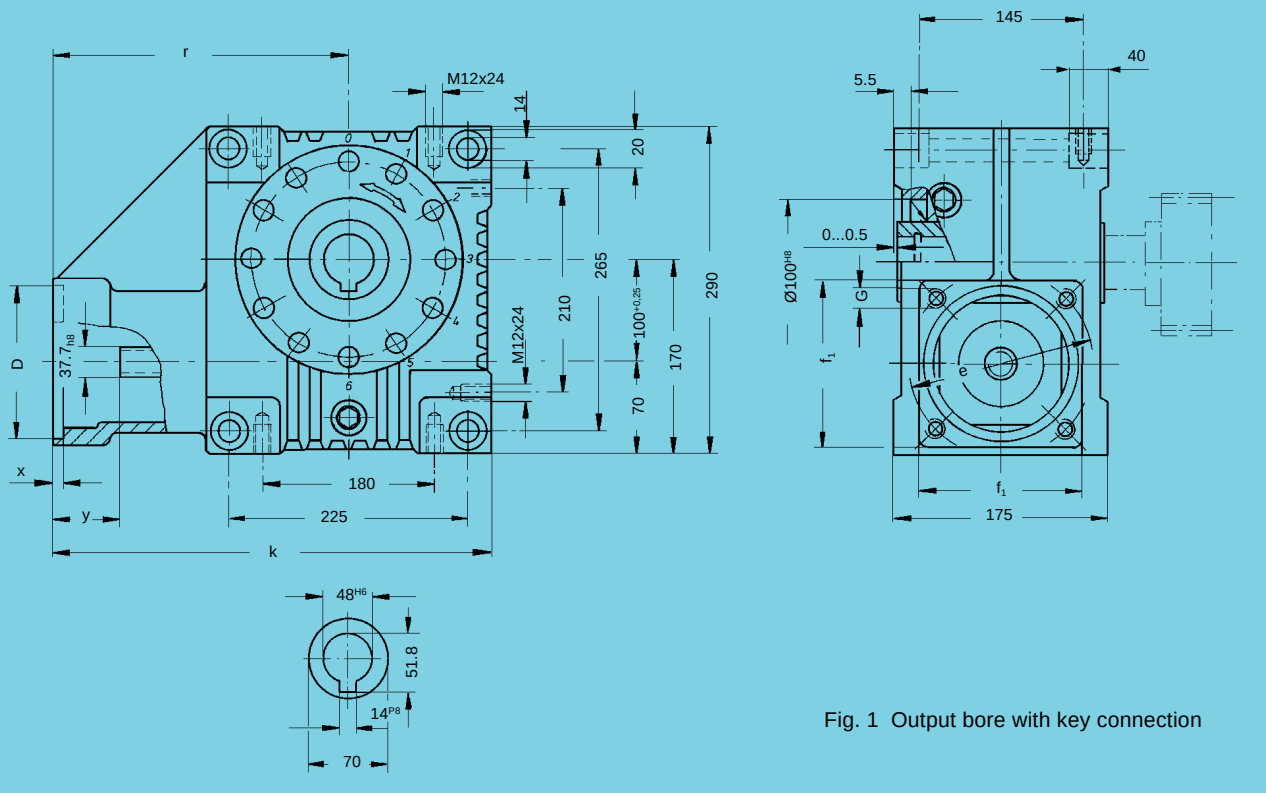


Fig. 1 Output bore with key connection

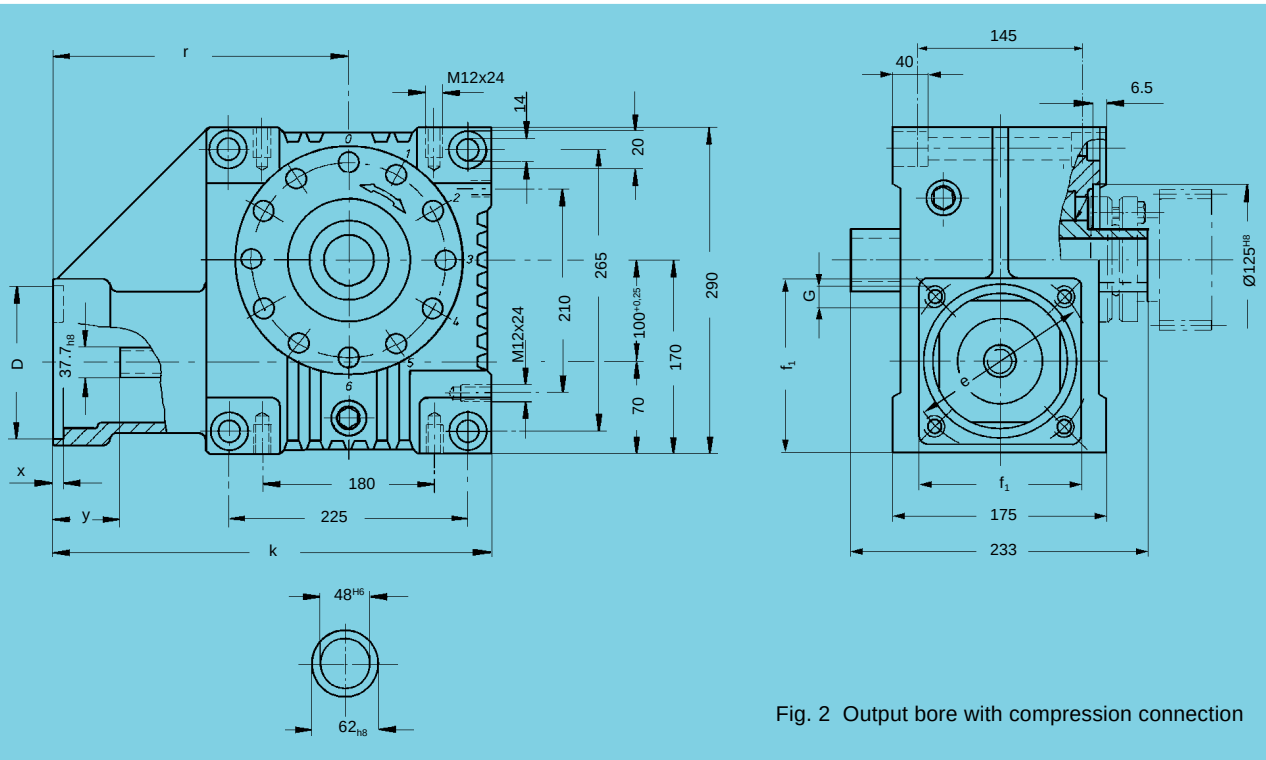


Fig. 2 Output bore with compression connection

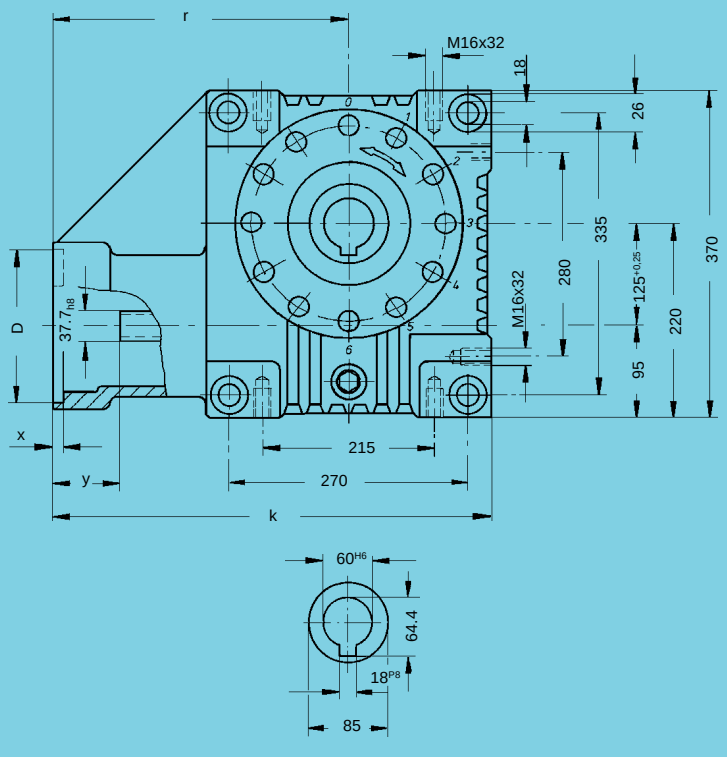
All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Size 6, Center Distance: a_o= 100 mm

Order code Fig.1	Fig. 2	Ratio i	D^{G7}	k	r	x	y	f_1	e	G	Wt. (lb)	J_{red} in.lb.s² x10⁻³
58 46 005	**58 86 005**	4.75										14.798
58 46 007	**58 86 007**	6.75										11.402
58 46 009	**58 86 009**	9.25										7.166
58 46 015	**58 86 015**	14.50	110	365	240	5	55	140	165	M10	66	6.389
58 46 020	**58 86 020**	19.50										4.782
58 46 029	**58 86 029**	29.00										4.178
58 46 039	**58 86 039**	39.00										7.461
58 46 052	**58 86 052**	52.00										8.620
58 46 205	**58 86 205**	4.75										14.798
58 46 207	**58 86 207**	6.75										11.402
58 46 209	**58 86 209**	9.25										7.166
58 46 215	**58 86 215**	14.50	130	365	240	5	55	140	165	M10	66	6.389
58 46 220	**58 86 220**	19.50										4.782
58 46 229	**58 86 229**	29.00										4.178
58 46 239	**58 86 239**	39.00										7.461
58 46 252	**58 86 252**	52.00										8.620
58 46 705	**58 86 705**	4.75										14.798
58 46 707	**58 86 707**	6.75										11.402
58 46 709	**58 86 709**	9.25										7.166
58 46 715	**58 86 715**	14.50	180	390	275	6	90	192	215	M12	77	6.389
58 46 720	**58 86 720**	19.50										4.782
58 46 729	**58 86 729**	29.00										4.178
58 46 739	**58 86 739**	39.00										7.461
58 46 752	**58 86 752**	52.00										8.620
58 46 805	**58 86 805**	4.75										14.798
58 46 807	**58 86 807**	6.75										11.402
58 46 809	**58 86 809**	9.25										7.166
58 46 815	**58 86 815**	14.50	180	385	260	5	75	190	215	M12	72.6	6.389
58 46 820	**58 86 820**	19.50										4.782
58 46 829	**58 86 829**	29.00										4.178
58 46 839	**58 86 839**	39.00										7.461
58 46 852	**58 86 852**	52.00										8.620
58 46 905	**58 86 905**	4.75										14.798
58 46 907	**58 86 907**	6.75										11.402
58 46 909	**58 86 909**	9.25										7.166
58 46 915	**58 86 915**	14.50	130	385	260	5	75	195	215	M12	72.6	6.389
58 46 920	**58 86 920**	19.50										4.782
58 46 929	**58 86 929**	29.00										4.178
58 46 939	**58 86 939**	39.00										7.461
58 46 952	**58 86 952**	52.00										8.620

a_o = 40 mm and other ratios available upon request

Size 7, Center Distance: a_o= 125 mm



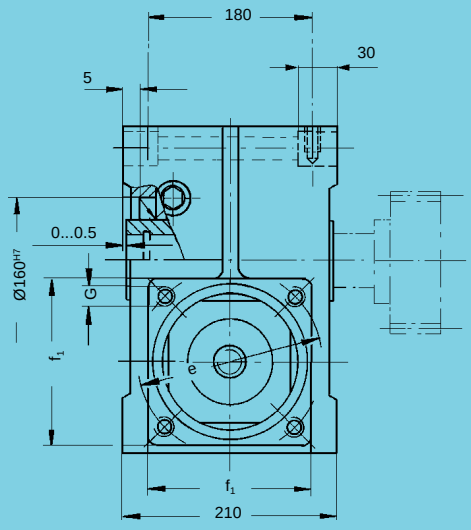
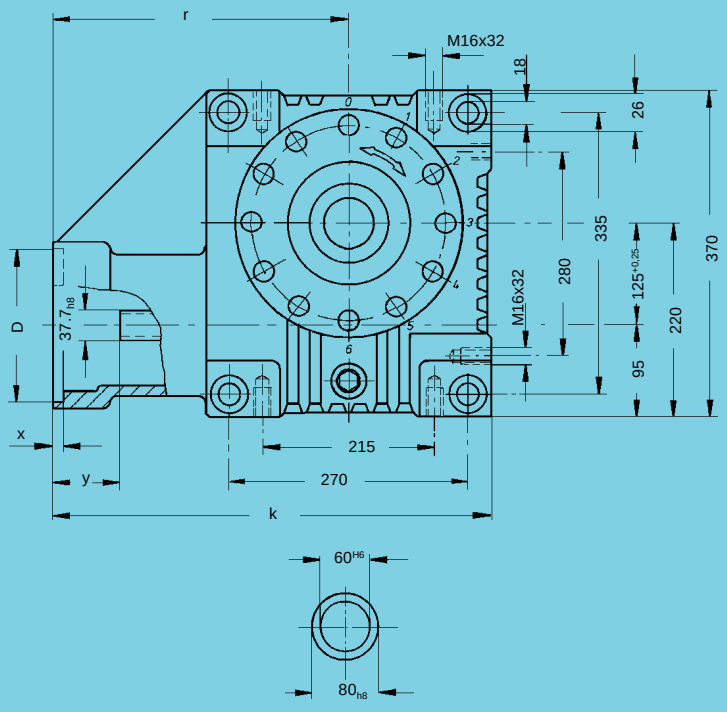


Fig. 1 Output bore with key connection



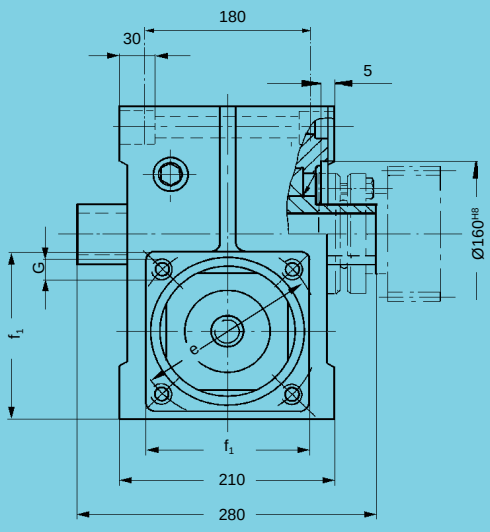


Fig. 2 Output bore with compression connection

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Size 7, Center Distance: a_o= 125 mm

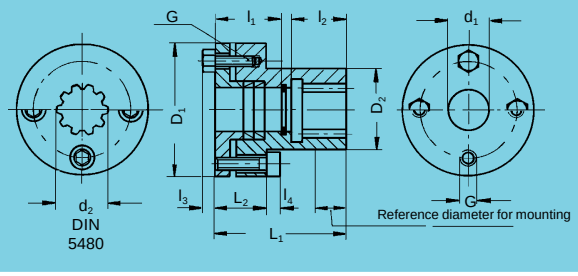
Order code Fig.1	Fig. 2	Ratio i	D^{G7}	k	r	x	y	f_1	e	G	Wt. (lb)	J_{red} in.lb.s² x10⁻³
58 47 005	**58 87 005**	4.75										41.186
58 47 007	**58 87 007**	6.75										31.788
58 47 009	**58 87 009**	9.25										20.643
58 47 015	**58 87 015**	14.50	180	468	315.5	6	75	200	215	M12	154	22.633
58 47 020	**58 87 020**	19.50										14.580
58 47 029	**58 87 029**	29.00										20.743
58 47 039	**58 87 039**	39.00										13.593
58 47 052	**58 87 052**	52.00										9.995
58 47 105	**58 87 105**	4.75										41.186
58 47 107	**58 87 107**	6.75										31.788
58 47 109	**58 87 109**	9.25										20.643
58 47 115	**58 87 115**	14.50	180	484	331.5	6	91	200	215	M12	154	22.633
58 47 120	**58 87 120**	19.50										14.580
58 47 129	**58 87 129**	29.00										20.743
58 47 139	**58 87 139**	39.00										13.593
58 47 152	**58 87 152**	52.00										9.995

a_o = 40 mm and other ratios available upon request

Input Couplings for Motor Connection

Rigid type, nitrided, preassembled for motor shafts without key

Bore on reducer side has involute spline corresponding to DIN 5480 for push-fitting



Bore on motor side has clamping elements to connect motor shaft to coupling.

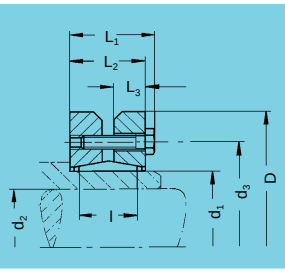
Order code Coupling	1)	d_1	d_2	D_1	D_2	l_1	l_2	l_3	l_4	L_1	L_2	G	Torque lb.ft.	J_{red} in.lb.s² x 10^{-3}	Wt. (lb)
65 43 110	9 71 80 010	10	15x1.25x10	48	29	22	17	–	5	44	18	4xM5	5.2	0.739	0.88
65 43 111	9 71 80 011	11	15x1.25x10	48	29	20.5	17	–	5	64	18	4xM5	5.2	0.864	1.10
65 43 114	9 71 80 014	14	15x1.25x10	48	29	24	19	–	5	50	18	4xM5	5.2	0.739	1.00
65 43 116	9 71 80 016	16	15x1.25x10	48	29	27	16	–	5	50	18	4xM5	5.2	0.729	1.00
65 43 119	9 71 80 019	19	15x1.25x10	48	29	24	16	–	5	40	18	4xM5	5.2	0.707	0.88
65 43 914	9 71 80 014	14	15x1.25x10	48	29	26	19	–	5	64	18	4xM5	5.2	0.872	1.10
65 43 919	9 71 80 019	19	15x1.25x10	48	29	23	17	–	5	55	18	4xM5	5.2	0.755	1.00
65 43 924	9 71 80 024	24	15x1.25x29	50	29	34	22	–	6	56	40	4xM6	7.4	0.921	1.14
65 44 024	9 71 80 024	24	25x1.25x18	50	29	41.5	24	–	6	66.5	59.5	4xM6	7.4	2.326	1.65
65 44 114	9 71 80 014	14	25x1.25x18	55	32	24	23.5	–	6	64	21	4xM6	7.4	1.456	1.10
65 44 116	9 71 80 016	16	25x1.25x18	55	32	34	23.5	–	6	64	21	4xM6	7.4	1.435	1.10
65 44 119	9 71 80 019	19	25x1.25x18	55	32	33	26.5	–	6	63	21	4xM6	7.4	1.414	1.10
65 44 219	9 71 80 019	19	25x1.25x18	55	32	27	26.5	–	6	74	21	4xM6	7.4	1.507	1.10
65 44 919	9 71 80 019	19	25x1.25x18	55	32	31	26.5	–	6	78	21	4xM6	7.4	1.555	1.21
65 44 928	9 71 80 028	28	25x1.25x18	70	48	48	26	–	6	83	25	5xM6	7.4	5.308	1.87
65 44 932	9 71 80 032	32	25x1.25x18	70	48	43	23	–	6	78	25	5xM6	7.4	5.240	1.76
65 46 024	9 71 80 024	24	38x1.25x29	55	–	38.5	31	4	6	72.5	–	5xM6	7.4	3.940	1.98
65 46 834	9 71 81 035	1 3/8"	38x1.25x29	80	58	63	34	–	6	100	40	6xM6	7.4	14.443	4.29
65 46 938	9 71 80 038	38	38x1.25x29	80	58	62	34	–	6	100	40	6xM6	7.4	14.372	4.14
65 46 928	9 71 80 028	28	38x1.25x29	70	48	47	34	–	6	90	25	5xM6	7.4	5.206	1.98
65 46 932	9 71 80 032	32	38x1.25x29	70	48	43	34	–	6	86	25	5xM6	7.4	5.119	1.87
65 47 948	9 71 80 048	48	38x1.25x29	103	74	58	31	–	8	89	42	6xM8	18.4	37.046	6.82

1) Spare part of clamping element

Output Compression Couplings

for Connecting Output Pinion Shafts to Servo-Worm series 58 8. …

Supplied as complete set



$$J_{red} = \frac{J}{i^2}$$

Order code	a_0	d_1	d_2	d_3	D	L_1	L_2	L_3	l	G	Torque lb.ft.	J in.lb.s² x 10^{-3}	Wt. (lb)
80 83 030	50 mm	30	25	44	60	25	21.5	9	16	7 x M5	3.0	1.545	0.66
80 84 036	63 mm	36	28	52	72	27.5	23.5	10	18	5 x M6	8.9	3.566	0.88
80 85 050	80 mm	50	36	70	90	31.5	27.5	12	22	8 x M6	8.9	10.020	1.76
80 86 062	100 mm	62	48	86	110	34.5	30.5	13	23	10 x M6	8.9	24.016	2.86
80 87 080	125 mm	80	60	100	145	38.0	32.5	14	25	7 x M8	22.1	78.650	4.18

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

The values in the table are based upon servo operation and 12,000 hour life at rated torque. For continuous operation, thermal limitations must be considered; please consult the factory. T2 max peak torque values are based on the ultimate strength of the gear teeth and should not be used solely in selecting a unit.

P1 = Input power in horsepower; T2 = Output torque in lb.ft.; η = Unit efficiency at input speed

Order code		a_0	i	$T_{2\,max.}$	Input speed (rpm) 500		750		1000		1500		3000		4000		5000		η
		(mm)	ratio	(lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	P_1 (hp)	T_2 (lb.ft.)	at 1500
58 43 _05	**58 83 _05**	50	4.75	400	1.09	47.9	1.61	47.9	2.28	51.6	3.38	51.6	6.71	51.6	8.31	47.9	9.79	45.0	0.92
58 43 _07	**58 83 _07**		6.75	290	0.67	41.3	1.03	43.5	1.48	46.5	2.35	50.9	4.69	50.9	5.90	47.9	6.97	45.0	0.91
58 43 _09	**58 83 _09**		9.25	200	0.43	35.4	0.67	37.6	0.94	39.8	1.48	42.8	3.42	51.6	4.76	51.6	5.50	47.9	0.89
58 43 _15	**58 83 _15**		14.50	250	0.35	42.0	0.54	35.4	0.76	47.9	1.19	51.6	2.44	55.3	3.35	55.3	4.22	55.3	0.83
58 43 _20	**58 83 _20**		19.50	180	0.21	33.2	0.34	35.4	0.46	36.9	0.74	40.6	1.61	47.9	2.21	47.9	2.82	47.9	0.81
58 43 _29	**58 83 _29**		29.00	220	0.19	35.4	0.27	38.4	0.39	40.6	0.59	44.3	1.25	51.6	1.65	51.6	1.89	47.9	0.75
58 43 _39	**58 83 _39**		39.00	140	0.16	39.1	0.23	41.3	0.32	44.3	0.50	47.9	1.03	55.3	1.34	55.3	1.68	55.3	0.70
58 43 _50	**58 83 _50**		50.00	110	0.11	31.0	0.16	32.5	0.21	34.7	0.34	36.9	0.68	44.3	0.97	44.3	1.21	44.3	0.64
58 44 _05	**58 84 _05**	63	4.75	730	2.82	125.4	4.43	132.8	5.90	132.8	8.19	125.4	13.81	107.0	17.70	99.6			0.92
58 44 _07	**58 84 _07**		6.75	550	2.01	125.4	3.15	132.8	4.16	132.8	5.70	125.4	9.66	107.0	12.47	99.6			0.91
58 44 _09	**58 84 _09**		9.25	360	0.99	84.8	1.58	92.2	2.19	95.9	3.38	99.6	6.61	99.6	8.52	92.9			0.90
58 44 _15	**58 84 _15**		14.50	440	0.99	121.7	1.60	132.8	2.07	132.8	3.29	132.8	5.61	125.4	7.04	118.0			0.84
58 44 _20	**58 84 _20**		19.50	360	0.52	84.8	0.82	92.2	1.14	95.9	1.72	99.6	4.00	121.7	5.14	114.3			0.83
58 44 _29	**58 84 _29**		29.00	480	0.64	129.1	1.01	140.1	1.39	151.2	2.08	162.3	3.45	143.8	4.32	136.5			0.77
58 44 _39	**58 84 _39**		39.00	330	0.40	103.3	0.59	110.6	0.82	118.0	1.30	129.1	2.52	140.1	3.42	140.1			0.73
58 44 _52	**58 84 _52**		52.00	220	0.21	70.1	0.34	77.4	0.47	84.8	0.74	92.2	1.61	110.6	2.19	118.0			0.68
58 45 _05	**58 85 _05**	80	4.75	1475	6.97	309.8	9.25	280.3	11.44	265.5	15.56	243.4	26.15	206.5					0.94
58 45 _07	**58 85 _07**		6.75	1030	4.83	309.8	6.52	280.3	8.23	265.5	11.32	243.4	18.79	206.5					0.91
58 45 _09	**58 85 _09**		9.25	810	3.19	272.9	4.73	272.9	6.07	265.5	8.34	243.4	13.81	206.5					0.90
58 45 _15	**58 85 _15**		14.50	950	2.66	331.9	3.89	331.9	4.79	309.8	6.17	272.9	9.39	217.6					0.87
58 45 _20	**58 85 _20**		19.50	730	1.66	272.9	2.68	295.0	3.49	295.0	4.83	280.3	7.68	236.0					0.86
58 45 _29	**58 85 _29**		29.00	880	1.85	383.6	2.74	405.7	3.38	390.9	4.45	361.4	7.27	309.8					0.80
58 45 _39	**58 85 _39**		39.00	627	1.17	317.2	1.81	339.3	2.48	361.4	3.37	354.6	5.40	302.4					0.77
58 45 _52	**58 85 _52**		52.00	440	0.51	177.0	0.76	191.8	1.07	202.8	1.64	221.3	3.30	243.4					0.74
58 46 _05	**58 86 _05**	100	4.75	2430	14.44	649.1	19.07	590.1	23.83	553.2	15.56	505.3	54.14	427.8					0.94
58 46 _07	**58 86 _07**		6.75	1690	9.70	612.2	12.87	553.2	16.23	531.1	22.39	486.8	38.89	427.8					0.92
58 46 _09	**58 86 _09**		9.25	1400	7.16	612.2	9.52	553.2	12.20	531.1	16.49	486.8	28.43	427.8					0.91
58 46 _15	**58 86 _15**		14.50	1510	5.63	686.0	7.78	649.1	9.12	597.5	12.07	531.1	19.18	457.3					0.87
58 46 _20	**58 86 _20**		19.50	1320	4.05	663.8	5.73	641.7	6.97	597.5	8.94	531.1	14.89	457.3					0.87
58 46 _29	**58 86 _29**		29.00	1700	3.97	848.2	5.39	789.2	6.26	745.0	8.01	627.0	13.83	590.1					0.77
58 46 _39	**58 86 _39**		39.00	1210	2.78	796.6	3.86	759.7	4.87	737.6	6.07	663.8	10.03	575.3					0.80
58 46 _52	**58 86 _52**		52.00	810	1.56	560.6	2.44	604.8	3.23	627.0	4.13	579.0	6.71	501.6					0.77
58 47 _05	**58 87 _05**	125	4.75	5150	28.43	1290	38.15	1180	47.18	1106	63.01	996	78.85	885 [1)]					0.91
58 47 _07	**58 87 _07**		6.75	4760	20.20	1217	26.59	1106	33.10	1033	45.58	959	73.67	848 [2)]					0.89
58 47 _09	**58 87 _09**		9.25	3250	14.46	1180	19.19	1070	23.31	996	32.05	885	53.13	775					0.87
58 47 _15	**58 87 _15**		14.50	4320	11.02	1328	14.62	1217	20.42	1291	25.64	1106	43.41	959					0.79
58 47 _20	**58 87 _20**		19.50	2880	8.07	1290	10.94	1180	13.01	1106	18.00	1033	30.15	885					0.78
58 47 _29	**58 87 _29**		29.00	4200	7.95	1623	10.78	1512	12.58	1438	17.21	1328	28.03	1143					0.67
58 47 _39	**58 87 _39**		39.00	2800	5.82	1549	7.86	1438	9.12	1365	12.24	1254	20.50	1106					0.65
58 47 _52	**58 87 _52**		52.00	1850	3.74	1328	5.07	1254	6.26	1180	8.10	1106	13.33	959					0.65

1) For 125 mm, 4.75 ratio, stated power and torque correspond to a maximum input speed of 2,200 rpm
2) For 125 mm, 6.75 ratio, stated power and torque correspond to a maximum input speed of 2,800 rpm

The values given in the ratings table on page 19 are based on uniform, smooth servo-operation. Since, in practice, applications are very diverse, it is essential to consider the given conditions by using the appropriate factors (see below). A maximum unit temperature of 176° F should not be exceeded. Formulas for determining power and torque with a rack & pinion drive on output:

$a = \frac{v}{t_b}$ [in/s²]

$m = \frac{W}{g}$ [lb.s²/in]

$F_T = m \cdot g + m \cdot a$ (for lifting axis) [lb]

$F_T = m \cdot g \cdot \mu + m \cdot a$ (for driving axis) [lb]

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24}$ [lb.ft]

$n_2 = \frac{60 \cdot v}{(d/25.4)\,\pi}$ [rpm]

$i_{gear} = \frac{n_1}{n_2}$

$T_{2perm} = \frac{T_{2table}}{K_A \cdot S \cdot b_B}$ [lb.ft.]

The unit should be selected that $T_{2perm.} > T_{2req}$

$P_{1req.} = \frac{T_{2req} \cdot n_2}{5250 \cdot \eta}$ [hp]

Symbols

a	=	acceleration or deceleration rate	[in/s²]
b_B	=	operating time factor	
d	=	pitch diameter of pinion	[mm]
F_T	=	tangential acceleration force	[lb.]
g	=	acceleration due to gravity	[386 in/s²]
i	=	gearbox ratio	
K_A	=	load factor	
m	=	mass being moved	[lb.s²/in]
n_1	=	input speed of gearbox	[rpm]
n_2	=	output speed of gearbox	[rpm]
P_1	=	input power	[hp]
S	=	safety factor	
t_b	=	acceleration time	[s]
T_{2perm}	=	corrected acceleration torque	[lb.ft.]
T_{2req}	=	acceleration torque	[lb.ft.]
T_{2table}	=	rated output torque of reducer	[lb.ft.]
v	=	maximum linear speed	[in/s]
W	=	weight being moved	[lb]
η	=	gearbox efficiency at input speed	
μ	=	coefficient of friction of axis	
π	=	3.1415	

Load Factor K_A

Drive	Type of load from the machines to be driven		
	uniform	medium shocks	heavy shocks
uniform	1.00	1.25	1.75
light shocks	1.25	1.50	2.00
medium shocks	1.50	1.75	2.25

Operating Time Factor b_B

Operating time	4–8 h	8–12 h	>12 h
Operating time factor	1.00	1.20	1.35

Safety Coefficient S

The safety factor should be selected based on experience, typically S = 1.1 to 1.4.

Calculating Example

Values Given

○ Driving Axis ⊗ Lifting Axis

Weight to be moved: W = 660 lb

Linear speed: v = 42.5 in/s

Acceleration time: t_b = 0.27 s

Acceleration due to gravity: g = 386 in/s²

Coefficient of friction: μ =

Pinion pitch diameter: d = 63.66 mm

Load factor: K_A = 1.25

Operation time factor: b_B = 1.2

Safety factor: S = 1.2

Input speed from motor: n_1 = 3000 rpm

Motor type:

Motor manufacturer:

Calculations

$a = \frac{v}{t_b} = \frac{42.5}{0.27} = 157.4$ in/s²

$m = \frac{W}{g} = \frac{660}{386} = 1.71$ lb.s²/in

$F_T = m \cdot g + m \cdot a = 1.71 \cdot 386 + 1.71 \cdot 157.4 = 929.4$ lb

$F_T = m \cdot g \cdot \mu + m \cdot a$ (for driving axis only)

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24} = \frac{929.4 \cdot (63.66/25.4)}{24} = 97.0$ lb.ft.

$n_2 = \frac{60 \cdot v}{(d/25.4)\,\pi} = \frac{60 \cdot 42.5}{(63.66/25.4) \cdot \pi} = 323.9$ rpm

$i_{gear} = \frac{n_1}{n_2} = \frac{3{,}000}{323.9} \cong 9{,}25$

Assuming 58_5_09 reducer with $T_{2table} = 206.5$ lb.ft.

$T_{2perm} = \frac{T_{2table}}{K_A \cdot S \cdot b_B} = \frac{206.5}{1.25 \cdot 1.2 \cdot 1.2} = 114.7$ lb.ft.

The unit should be selected such that $T_{2perm.} > T_{2req}$

$T_{2perm} > T_{2req} = 114.7$ lb.ft. > 97.0 lb.ft.

$P_{1req} = \frac{T_{2req} \cdot n_2}{5250 \cdot \eta} = \frac{97.0 \cdot 323.9}{5250 \cdot 0.65} = 9.21$ hp

Your Calculations

Values Given

○ Driving Axis ○ Lifting Axis

Weight to be moved: W = _____ [lb]

Linear speed: v = _____ [in/s]

Acceleration time: t_b = _____ [s]

Acceleration due to gravity: g = 386 [in/s²]

Coefficient of friction: μ = _____

Pinion pitch diameter: d = _____ [mm]

Load factor: K_A = _____

Operation time factor: b_B = _____

Safety factor: S = _____

Input speed from motor: n_1 = _____ [rpm]

Motor type: _____

Motor manufacturer: _____

Calculations

$a = \frac{v}{t_b} =$ _____ [in/s²]

$m = \frac{W}{g} =$ _____ [lb.s²/in]

$F_T = m \cdot g + m \cdot a =$ _____ [lb]

$F_T = m \cdot g \cdot \mu + m \cdot a =$ _____ [lb]

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24} =$ _____ [lb.ft.]

$n_2 = \frac{60 \cdot v}{(d/25.4)\,\pi} =$ _____ [rpm]

$i_{gear} = \frac{n_1}{n_2} =$ _____ ≅ _____

Permissible torque T_{2table}, see page 19

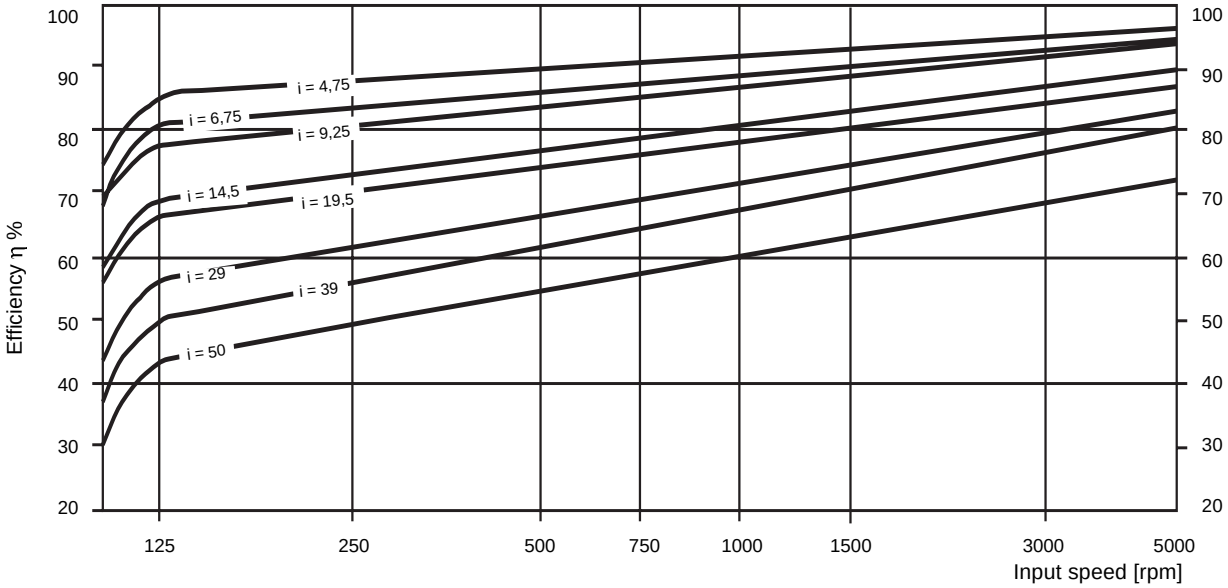
$T_{2perm} = \frac{T_{2table}}{K_A \cdot S \cdot b_B} =$ _____ = [lb.ft.]

$T_{2perm} > T_{2req} =$ [lb.ft.]

$P_{1req} = \frac{T_{2req} \cdot n_2}{5250 \cdot \eta} =$ _____ = [hp]

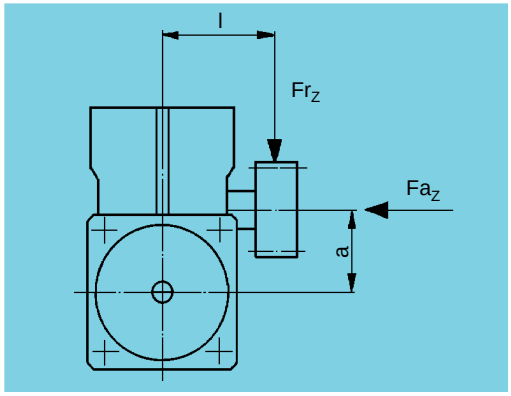
Selection: 58_5_09 Servo-Worm Reducer, page 12, 20 29 ___ pinion shaft, page 25

Efficiency of Servo-Worm Reducers with driving worm and under full load.



Additional forces on output

The distances given are reference values. You should consider the values produced from the type of rack & pinion connected to the output (see bottom of page 67). It is assumed that the point of action of the force is the center of the shaft. In cases where additional axial and radial forces occur, over and above the values in the table, please consult the factory.



Center distance a_0 (mm)		50		63		80		100		125	
Overhung distance:											
l (mm)		90	140	110	160	125	175	140	190	175	220
Max. additional force:											
Radial Fr_z	[lb]	810	520	1125	790	1890	1350	2250	1690	4720	3600
Axial Fa_z	[lb]	405	405	560	560	900	900	1125	1125	2250	2250

Mounting Instructions

Servo-Worm Reducers
Five mounting faces with tapped holes are provided for mounting in any position. In order to accommodate all external forces (see page 22), we recommend mounting the unit on the largest contact face, i.e. one of the two cover sides. Mounting the unit so the input worm shaft is vertical or under the output shaft is ideal for lubrication; mounting the unit so the input worm shaft is above the output shaft will reduce the driving capacity of the unit by about 10 %.

Input Motor Coupling
The input motor coupling is delivered pre-assembled. Before attaching it to the motor shaft, all contact surfaces must be cleaned and protected by applying a thin oil film. An internal snap ring inside the coupling positions it on the motor shaft, preventing any axial movement of the coupling. To assemble the coupling onto the motor shaft, following these recommendations:

1. Slide the coupling onto the motor shaft until it bottoms out on the snap ring.
2. Tighten the clamping screws slightly and check the coupling for runout.
3. Tighten the screws alternating crosswise using the torque value shown in the table opposite, ensuring that the gap between the coupling and contact face remains even.
4. A final check of the runout is recommended at the end of the coupling.

Order Code	Torque
65 43 ..	5.2 lb.ft.
65 44 ..	7.4 lb.ft.
65 46 ..	7.4 lb.ft.
65 47 ..	18.5 lb.ft.

Servo-Motor
Insert the motor with the mounted coupling into the pilot diameter of the motor mounting flange and bolt it to the gearbox. This should be done with the gearbox input shaft vertically up and the motor shaft vertically down.

Output Pinion Shafts
Clean the pinion shaft and hollow shaft extension and then grease or oil them lightly.
For output shafts with the key connection, the internal snap ring, washer and screw provided serve to lock the output shaft axially. Insert the internal snap ring in the groove of the hollow shaft and slide the output drive shaft into the desired side of the hollow shaft until it bottoms out. The washer and screw are attached to the output shaft from the other side of the gearbox. The internal snap ring must be clamped between the washer and the end of the output shaft.

Compression Coupling
Slide the compression coupling onto the hollow shaft extension of the gearbox (do not tighten the screws beforehand!). Insert the output shaft into the desired side of the hollow shaft until it bottoms out. Tighten the screws one after the other (not alternating crosswise) in several passes to the torque indicated in the table.

Order Code	Torque
80 83 030	3 lb.ft.
80 84 036	9 lb.ft.
80 85 050	9 lb.ft.
80 86 062	9 lb.ft.
80 87 080	22 lb.ft.

Maintenance

Adjustment of Angular Backlash of Gearbox

The units are assembled at the factory with the minimum amount of backlash. After prolonged use, the backlash level may increase due to wear. It can be reset to the factory setting by moving the eccentrically supported output shaft (the worm wheel). To achieve this, we recommend the following:

1. Unscrew the hexagon socket head screws of the two end covers, without removing the screws, in order to avoid oil leakage.
2. Turn both end covers towards the next higher number marked on the housing, ensuring that both covers are moved by the same amount.
3. Check the backlash by turning the worm shaft until the worm wheel has made at least one complete revolution. If necessary, adjust the end covers further by one step.
4. Evenly retighten the hexagon socket head screws alternately crosswise. A slight change in the gear center distance (in relation to the rest of the unit) must be compensated by adjusting the mounting of the gearbox.

Lubricant Change

At the factory, the units are filled with a synthetic lubricant and test run. They are delivered ready for use. A check of the lubricant level once a month – more frequently during the first weeks of operation – is recommended. Under normal load conditions and with single shift working, it is recommended that the lubricant be changed every four years; with 2 or 3 shift working, the lubricant should be changed annually. To do this, the unit must be emptied, flushed through and then refilled to the oil-level hole approximately in the middle of the gearbox, using one of the lubricants listed below. Important: Synthetic lubricants must not be mixed with mineral oils. For oil quantities, see table below.

We recommend the following synthetic lubricants:
Shell Tivela WB, BP Energol SG-XP 220,
ARAL Degol GS 220, Klüber Synth GH 6 – 220.

Shell Tivela WB, 1 liter – Order Code: 65 90 000.

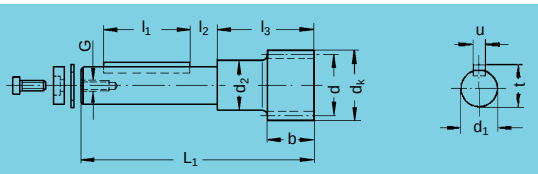
Center distance	Oil quantity
a_o = 50 mm	0.3 liter
a_o = 63 mm	0.5 liter
a_o = 80 mm	1.2 liters
a_o = 100 mm	2.0 liters
a_o = 125 mm	4.0 liters

Spare Parts

Description	Input Radial seal	Output Radial seal	Special angular contact ball bearing	Deep groove ball bearing	Tapered roller bearing
Pieces per unit	1	2	2	1	2
a = 50	A20x47x7	A40x62x7	7204 B	6303	32008
Order code	921 33 069	921 33 122	911 92 001	911 04 030	911 41 040
a = 63	A25x62x10	A45x72x8	7305 B	6205	33109
Order code	921 33 086	921 03 133	911 92 002	911 03 050	911 39 001
a = 80	A50x90x10	A50x80x8	7308 B	6307	33210
Order code	921 33 144	921 03 143	911 92 003	911 04 070	911 40 090
a = 100	A50x90x10	A70x100x10	7308 B	6307	33014
Order code	921 33 144	921 03 186	911 92 003	911 04 070	911 38 005
a = 125	A45x65x10	A85x130x10	7311 B	6310	33217
Order code	921 33 132	921 00 202	911 92 011	911 04 100	911 43 085

Straight Pinion Shaft,

20° pressure angle, hardened & ground teeth, crowned, 16MnCr5 (AISI 51L17)

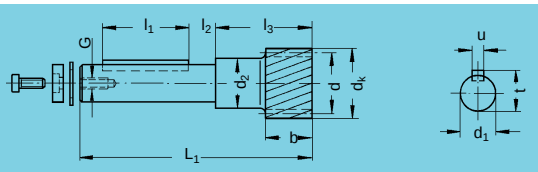


Quality
6 e 25
(~AGMA 12)

Order code	Gearbox size	Module	No. of teeth	x	d	d_k	b	d_{h6}	d_2	L_1	l_1	l_2	l_3	u	t	G	Wt. (lb)
20 28 332	50	2	32	–	64	68	25	25	38	140	63	13.0	53	8	28	M 8	2.75
20 28 321	50	3	21	–	63	69	30	25	38	142	63	13.0	55	8	28	M 8	2.93
20 28 432	63	2	32	–	64	68	25	28	42	164.5	80	14.5	57.5	8	31	M 8	3.30
20 28 421	63	3	21	–	63	69	30	28	42	167	80	14.5	60	8	31	M 8	3.52
20 28 417	63	4	17	–	68	76	40	28	42	172	80	14.5	65	8	31	M 8	4.40
20 28 521	80	3	21	–	63	69	30	36	48	185	100	12.5	62	10	39	M 12	5.50
20 28 517	80	4	17	–	68	76	40	36	48	190	100	12.5	67	10	39	M 12	5.83
20 28 617	100	4	17	–	68	76	40	48	57	215	125	9.0	72	14	51.5	M 12	8.91
20 28 630	100	4	30	–	120	128	40	48	57	215	125	9.0	72	14	51.5	M 12	14.08
20 28 613	100	5	13	0.500	65	80	50	48	57	225	125	9.0	82	14	51.5	M 12	9.24
20 28 715	125	5	15	0.500	75	90	50	60	68	272	150	10.0	90	18	64	M 16	15.27
20 28 713	125	6	13	0.500	78	96	60	60	68	282	150	10.0	100	18	64	M 16	16.39

Helical Pinion Shaft,

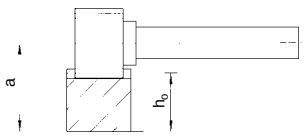
19° 31’ 42” left-hand, 20° pressure angle, hardened & ground teeth, crowned, 16MnCr5 (AISI 51L17)



Quality
6 e 25
(~AGMA 12)

Order code	Gearbox size	Module	No. of teeth	x	d	d_k	b	d_{h6}	d_2	L_1	l_1	l_2	l_3	u	t	G	Wt. (lb)
20 29 330	50	2	30	–	63.66	67.7	25	25	38	140	63	13	53	8	28	M 8	2.75
20 29 320	50	3	20	–	63 66	69 7	30	25	38	142	63	13	55	8	28	M 8	2.93
20 29 430	63	2	30	–	63.66	67.7	25	28	42	164.5	80	14.5	57.5	8	31	M 8	3.30
20 29 420	63	3	20	–	63.66	69.7	30	28	42	167	80	14.5	60	8	31	M 8	3.52
20 29 415	63	4	15	–	63.66	71.7	40	28	42	172	80	14.5	65	8	31	M 8	4.07
20 29 520	80	3	20	–	63.66	69.7	30	36	48	185	100	12.5	62	10	39	M 12	5.28
20 29 515	80	4	15	–	63.66	71.7	40	36	48	190	100	12.5	67	10	39	M 12	5.50
20 29 615	100	4	15	–	63.66	71.7	40	48	57	215	125	9.0	72	14	51.5	M 12	8.58
20 29 630	100	4	30	–	127.32	135.3	40	48	57	215	125	9.0	72	14	51.5	M 12	15.18
20 29 612	100	5	12	0.434	63.66	78.0	50	48	57	225	125	9.0	82	14	51.5	M 12	9.24
20 29 715	125	5	15	0.500	79.58	94.5	50	60	68	272	150	10.0	90	18	64	M 16	15.93
20 29 713	125	6	13	0.500	82.76	100.7	60	60	70	282	150	10.0	100	18	64	M 16	17.36

Calculation of center distance ‘a’ between rack & pinion.

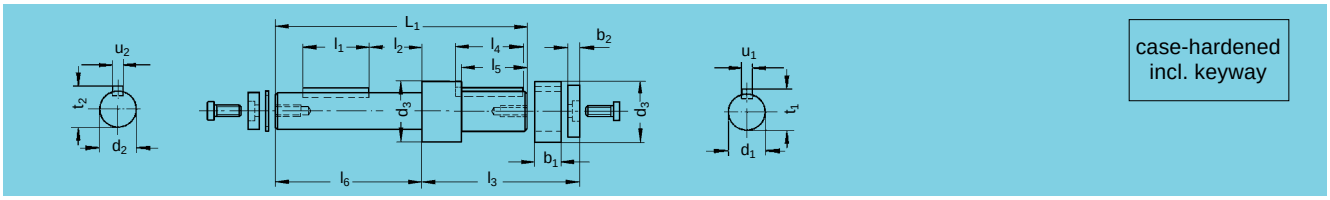


$$a = \frac{z \cdot m}{2 \cdot \cos ß} + x \cdot m + h_o$$

z = number of teeth
m = module
ß = helix angle
h_o = distance from pitch line to back face of rack
x = profile modification factor

Output Shaft,

short barrel. material: 16Mn Cr5 (AISI 51L17)

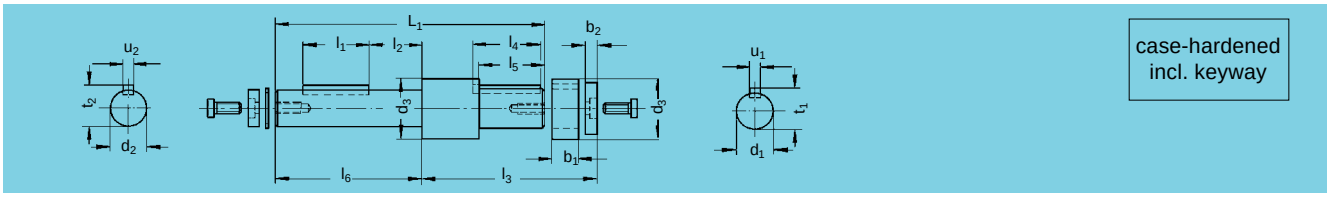


case-hardened incl. keyway

Order code	Center distance	d_{1j6}	d_{h6}	d_3	L_1	l_1	l_2	l_3	l_4	l_5	l_6	u_1	u_2	t_1	t_2	b_1	b_2	Wt. (lb)
65 03 040	50 mm	25	25	40	160	63	13		50	48	87	8	8	28	28	20	8	1.98
65 04 040	63 mm	28	30	45	185	80	14.5	Dep.	50	48	107	8	8	31	33	20	8	2.42
65 05 040	80 mm	36	35	48	203.5	100	12.5	on	50	48	123	10	10	39	38	20	11.5	4.40
65 06 040	100 mm	48	45	60	248.5	125	9	pairing	70	68	143	14	14	51.5	48.5	40	11.5	8.80
65 07 040	125 mm	60	55	74	316	150	10		100	99	182	16	18	59	64	20	16	18.92

Output Shaft,

long barrel, material: 16Mn Cr5 (AISI 51L17)



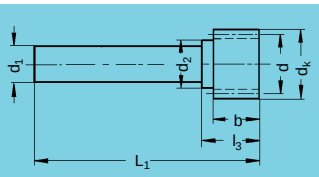
case-hardened incl. keyway

Order code	Center distance	d_{1j6}	d_{h6}	d_3	L_1	l_1	l_2	l_3	l_4	l_5	l_6	u_1	u_2	t_1	t_2	b_1	b_2	Wt. (lb)
65 03 140	50 mm	25	25	40	210	63	13		50	48	87	8	8	28	28	20	8	2.86
65 04 140	63 mm	28	30	45	235	80	14.5	Dep.	50	48	107	8	8	31	33	20	8	3.74
65 05 140	80 mm	36	35	48	253.5	100	12.5	on	50	48	123	10	10	39	38	20	115	5.94
65 06 140	100 mm	48	45	60	298.5	125	9	pairing	70	68	143	14	14	51.5	48.5	40	115	11.00

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Straight Pinion Shaft,

20° pressure angle, hardened & ground teeth, crowned, 16MnCr5 (AISI 51L17)

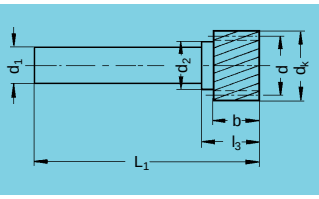


Quality
6 e 25
(~AGMA 12)

Order code	Gearbox size	Module	No.of teeth	x	d	d_k	b	d_{h6}	d_2	L_1	l_3	Wt. (lb)
20 88 332	50	2	32	–	64	68	25	25	38	140	34	2.75
20 88 321	50	3	21	–	63	69	30	25	38	142	36.5	2.93
20 88 432	63	2	32	–	64	68	25	28	42	164.5	38.5	3.30
20 88 421	63	3	21	–	63	69	30	28	42	167	41	3.52
20 88 417	63	4	17	–	68	76	40	28	42	172	46	4.40
20 88 521	80	3	21	–	63	69	30	36	48	185	37.5	5.50
20 88 517	80	4	17	–	68	76	40	36	48	190	42.5	5.83
20 88 617	100	4	17	–	68	76	40	48	57	215	43.5	8.91
20 88 630	100	4	30	–	120	128	40	48	57	215	43.5	14.08
20 88 613	100	5	13	0.500	65	80	50	48	57	225	53.5	9.02
20 88 715	125	5	15	0.500	75	90	50	60	68	255	55	13.86
20 88 713	125	6	13	0.500	78	96	60	60	68	265	65	15.05

Helical Pinion Shaft,

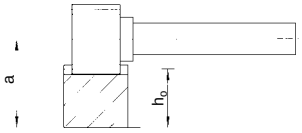
19° 31’ 42” left-hand, 20° pressure angle, hardened & ground teeth, crowned, 16MnCr5 (AISI 51L17)



Quality
6 e 25
(~AGMA 12)

Order code	Gearbox size	Module	No.of teeth	x	d	d_k	b	d_{h6}	d_2	L_1	l_3	Wt. (lb)
20 89 330	50	2	30	–	63.66	67.7	25	25	38	140	34	2.75
20 89 320	50	3	20	–	63.66	69.7	30	25	38	142	36.5	2.93
20 89 430	63	2	30	–	63.66	67.7	25	28	42	164.5	38.5	3.30
20 89 420	63	3	20	–	63.66	69.7	30	28	42	167	41	3.52
20 89 415	63	4	15	–	63.66	71.7	40	28	42	172	46	4.07
20 89 520	80	3	20	–	63.66	69.7	30	36	48	185	37.5	5.28
20 89 515	80	4	15	–	63.66	71.7	40	36	48	190	42.5	5.50
20 89 615	100	4	15	–	63.66	71.7	40	48	57	215	43.5	8.58
20 89 630	100	4	30	–	127.32	135.3	40	48	57	215	43.5	15.18
20 89 612	100	5	12	0.434	63.66	78.0	50	48	57	225	53.5	9.04
20 89 715	125	5	15	0.500	79.58	94.5	50	60	70	255	55	14.45
20 89 713	125	6	13	0.500	82.76	100.7	60	60	70	265	65	15.69

Calculation of center distance ‘a’ between rack & pinion.

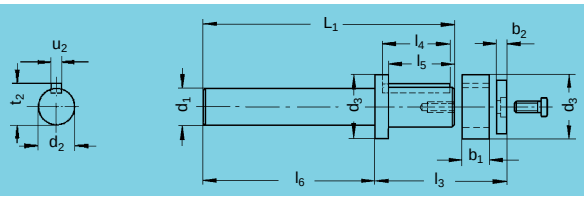


$$a = \frac{z \cdot m}{2 \cdot \cos ß} + x \cdot m + h_o$$

z = number of teeth
m = module
ß = helix angle
h_o = distance from pitch line to back face of rack
x = profile modification factor

Output Shaft,

short barrel, material: 16Mn Cr5 (AISI 51L17)

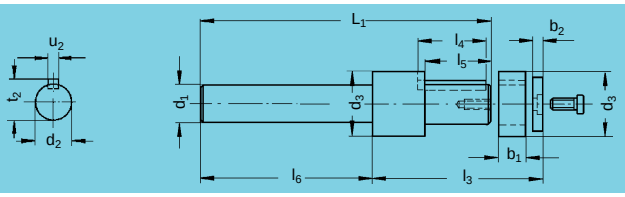


case-hardened incl. keyway

Order code	Center distance	d_{1j6}	d_{h6}	d_3	L_1	l_3	l_4	l_5	l_6	u_2	t_2	b_1	b_2	Wt. (lb)
65 03 080	50 mm	25	25	40	160		50	48	105.5	8	28	20	8	1.76
65 04 080	63 mm	28	30	45	189	Dep.	50	48	130	8	33	20	8	2.20
65 05 080	80 mm	36	35	48	216	on	50	48	160.5	10	38	20	11.5	3.96
65 06 080	100 mm	48	45	60	251.5	pairing	70	68	175	14	48.5	40	11.5	8.36
65 07 080	125 mm	60	55	74	309		100	99	200	16	64	20	16	17.60

Output Shaft,

long barrel, material: 16Mn Cr5 (AISI 51L17)



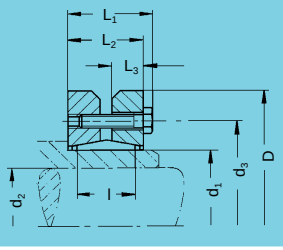
case-hardened incl. keyway

Order code	Center distance	d_{1j6}	d_{h6}	d_3	L_1	l_3	l_4	l_5	l_6	u_2	t_2	b_1	b_2	Wt. (lb)
65 03 180	50 mm	25	25	40	210		50	48	105.5	8	28	20	8	2.64
65 04 180	63 mm	28	30	45	239	Dep.	50	48	130	8	33	20	8	3.52
65 05 180	80 mm	36	35	48	266	on	50	48	160.5	10	38	20	11.5	5.50
65 06 180	100 mm	48	45	60	301.5	pairing	70	68	175	14	48.5	40	11.5	10.56

Output Compression Couplings,

for connecting Output Pinion Shafts and Pinions with Hubs

Supplied as complete set



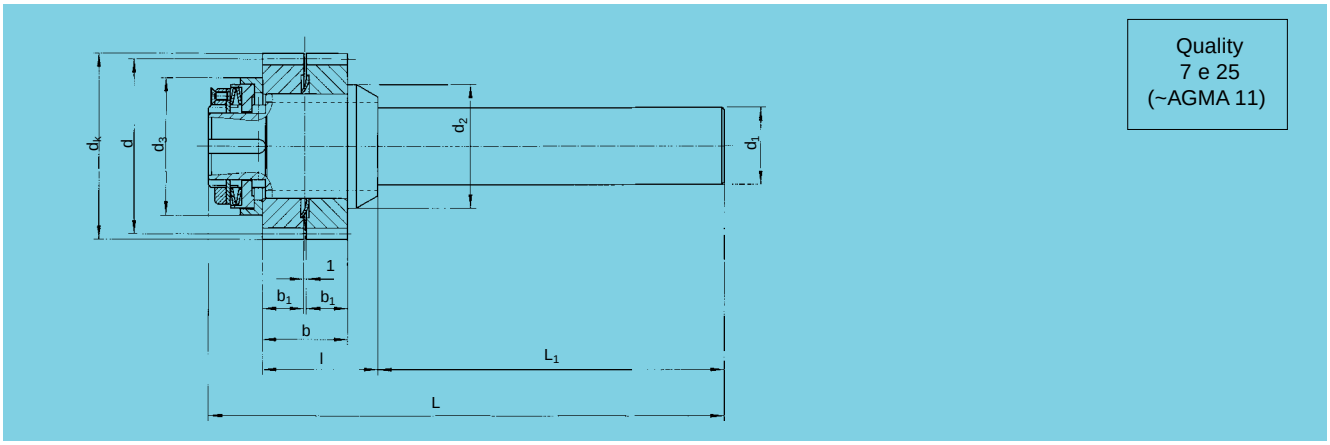
$$J_{red} = \frac{J}{i^2}$$

Order code	$T_{2\,max}$ lb.ft.	d_1	d_2	d_3	D	L_1	L_2	L_3	l	G	Torque lb.ft.	J in.lb.s² x 10^{-3}	Wt. (lb)
80 83 030	74	30	16	44	60	25	21.5	9	16	7 x M5	3.0	1.545	0.66
80 84 036	273	36	22	52	72	27.5	23.5	10	18	5 x M6	8.9	3.566	0.88
80 80 044	384	44	25	61	80	29.5	25.5	11	20	7 x M6	8.9	5.774	1.32
80 85 050	568	50	30	70	90	31.5	27.5	12	22	8 x M6	8.9	10.020	1.76
80 80 055	494	55	32	75	100	34.5	30.5	13	23	8 x M6	8.9	16.575	2.42
80 86 062	974	62	40	86	110	34.5	30.5	13	23	10 x M6	8.9	24.016	2.86
80 80 068	1158	68	45	86	115	34.5	30.5	13	23	10 x M6	8.9	28.008	3.08
80 87 080	1807	80	55	100	145	38.0	32.5	14	25	7 x M8	22.1	78.650	4.18
80 80 110	5163	110	75	136	185	57.0	50.0	22	39	9 x M10	43.5	311.08	12.98

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Helical Split-Pinion Shaft,

19° 31’ 42” left-hand, 20° pressure angle, ground teeth, 16MnCr5 (AISI 51L17)



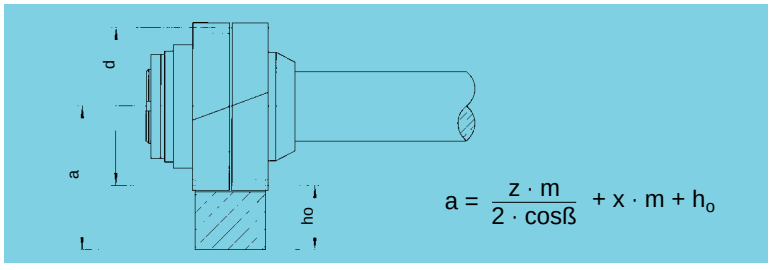
Order code	Reducer Size	Output Coupling	T_2 (lb.ft.) without preload	$T_{2\,max}$ (lb.ft.) with max preload	z No. of teeth	d	d_k	b	b_1	d_{1h6}	d_2	d_3	l	L_1	L	Wt. (lb)
Module 2.0																
74 92 330	58 83 ...	80 83 030	99.6	49.8	30	63.66	67.7	31	15	25	45	50	37.5	106.0	163.5	1.41
74 92 430	58 84 ...	80 84 036	99.6	49.8	30	63.66	67.7	31	15	28	45	50	42.0	126.0	188.0	3.85
Module 3.0																
74 93 320	58 83 ...	80 83 030	99.6	92.2	20	63.66	69.7	31	15	25	45	50	37.5	106.0	163.5	3.19
74 93 420	58 84 ...	80 84 036	184.4	92.2	20	63.66	69.7	31	15	28	45	50	42.0	126.0	188.0	3.74
74 93 520	58 85 ...	80 85 050	184.4	92.2	20	63.66	69.7	31	15	36	50	50	38.5	147.5	212.0	5.39
Module 4.0																
74 94 515	58 85 ...	80 85 050	284.0	142.0	15	63.66	71.7	41	20	36	50	50	43.5	147.5	212.0	5.50

Maximum Preload Torque $T_{v\,max}$

Module	$T_{v\,max}$ (lb.ft.)	Disc spring layers	Tightening of adjusting nut
2.0	49.8	Single	14 graduation marks
3.0	92.2	Double	6 graduation marks
4.0	142.0	Triple	10 graduation marks

Note: Higher preload values are possible by means of multiple spring layers, but the transmittable torque T_{2max} will be reduced. Disc springs can also be ordered separately.

Calculation of center distance ‘a’ between rack & pinion.



m	a	h_o
2.0	53.83	22.0
3.0	57.83	26.0
4.0	66.83	35.0

z = number of teeth
m = module
ß = helix angle
h_o = distance from pitch line to back face of rack
x = profile modification factor

Description of Operation

Preloaded split-pinions are typically used to eliminate axis backlash for high accuracy positioning applications. The pinions effectively eliminate the backlash between the rack & pinion by using two pinions – one to drive the axis and one to preload the axis to eliminate the backlash. Eliminating the system backlash preserves accurate axis positioning during the transition period between acceleration/steady state and deceleration, when the rack & pinion flank contact and load reverses direction. To insure no backlash develops, the preload torque must be set higher than the deceleration torque.

Split-pinion shafts consist of an output shaft, a helical split-pinion and a preload section. The split pinion is manufactured as a set with an axial gap of 1.0 mm. By reducing this distance between the pinion halves (by axial movement of the outer pinion), the backlash is reduced and the preload is initiated when the teeth are in mesh with the rack. A specific preload torque between the rack and split-pinion can be produced with the preload section.

Adjusting Instructions

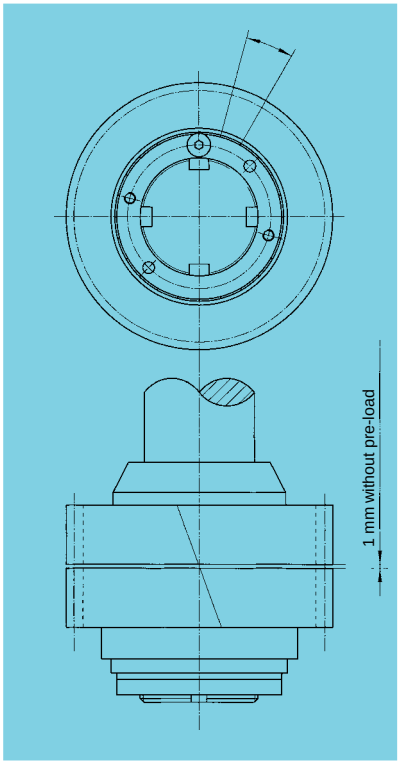
The preload section consists of:

- An adjusting nut, which is locked to prevent turning by means of a safety washer and set screw.
- A disc spring assembly
- A thrust plate

The outside of the thrust plate is provided with 24 marks and the adjusting nut with 4 marks (graduations).

Before tightening the adjusting nut, the center distance between the rack and split-pinion should be set so that the backlash is less than 0.1 mm (0.004”). A good tooth contact pattern must be obtained as with ordinary rack and pinion drives. Then, after loosening the set screw, the adjusting nut can be tightened until no backlash remains, i.e. until both tooth flanks of the split-pinion are in contact with the rack. This can be checked with a dial indicator on the tooth flanks.

The next step is to begin to turn the adjusting nut by a certain number of graduation marks (TS) to produce the desired preload torque value. It is not always necessary to set the maximum preload torque value as shown in the table on the previous page. These values can be used as a starting point if the preload torque required (for the desired positioning accuracy) is not known. The preload torque value may have to be changed to obtain the desired performance. If, for example, a preload torque value of 50% T_{2max} is sufficient in the application, the transmittable torque T_{2max} value in the table can be exceeded by 50%.



For more information, please consult the factory.

Lubrication Recommendations

It is recommended that an automatic lubrication system, such as the ones shown on pages 69 – 72, be used to lubricate the split-pinion and rack. The felt gear applicator can mesh directly with the split-pinion, since the elasticity of the felt teeth can handle the maximum backlash compensation.

Straight Pinions,

20° pressure angle, hardened & ground teeth, with bore ØH6 and keyway, 16MnCr5 (AISI 51L17)

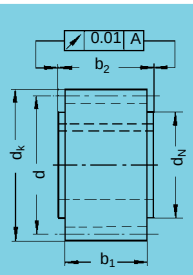


Fig. 1

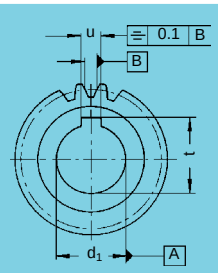


Fig. 1 + 3
Keyway middle of tooth gap

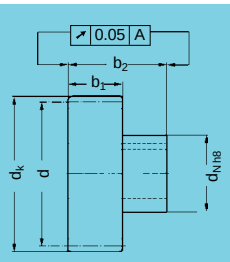


Fig. 3

Quality
7 e 25
(~AGMA 11)

Order code	Fig.	No of teeth z	d	d_k	d_1 H6	d_N	b_1	b_2	u	t	Wt. (lb)	Compression Coupling On page 28
Module 2												
24 21 216	1	16	32	36	15	25	28	30.0	5	17.3	0.22	
24 22 218	1	18	36	40	20	25	28	30.0	6	22.8	0.44	
24 22 220	1	20	40	44	20	30	28	30.0	6	22.8	0.44	
24 21 222	1	22	44	48	15	25	28	30.0	5	17.3	0.66	
24 22 222	1	22	44	48	20	30	28	30.0	6	22.8	0.66	
24 23 222	1	22	44	48	25	36	28	30.0	8	28.3	0.44	
24 26 225	3	25	50	54	16	30	28	54.0	5	18.3	0.66	80 83 030
24 22 225	1	25	50	54	20	30	28	30.0	6	22.8	0.88	
24 20 425	3	25	50	54	22	36	28	56.0	6	24.8	0.88	80 84 036
24 23 225	1	25	50	54	25	36	28	30.0	8	28.3	0.66	
24 24 225	1	25	50	54	30	45	28	30.0	8	33.3	0.66	
24 22 228	1	28	56	60	20	30	28	30.0	6	22.8	1.10	
24 23 228	1	28	56	60	25	36	28	30.0	8	28.3	0.88	
24 22 428	3	28	56	60	30	50	28	60.0	8	33.3	0.88	80 85 050
24 24 228	1	28	56	60	30	45	28	30.0	8	33.3	0.88	
24 25 228	1	28	56	60	35	48	28	30.0	10	38.3	1.32	
24 26 232	3	32	64	68	16	30	28	54.0	5	18.3	1.32	80 83 030
24 22 232	1	32	64	68	20	30	28	30.0	6	22.8	1.32	
24 20 432	3	32	64	68	22	36	28	56.0	6	24.8	1.32	80 84 036
24 23 232	1	32	64	68	25	36	28	30.0	8	28.3	1.32	
24 22 432	3	32	64	68	30	50	28	60.0	8	33.3	1.32	80 85 050
24 24 232	1	32	64	68	30	45	28	30.0	8	33.3	1.32	
24 23 432	3	32	64	68	32	55	28	65.0	10	35.3	1.10	80 80 055
24 25 232	1	32	64	68	35	48	28	30.0	10	38.3	1.10	
24 23 236	1	36	72	76	25	36	28	30.0	8	28.3	1.76	
24 24 236	1	36	72	76	30	45	28	30.0	8	33.3	1.54	
24 25 236	1	36	72	76	35	48	28	30.0	10	38.3	1.54	
24 25 436	3	36	72	76	40	62	28	65.0	12	43.3	1.10	80 86 062
24 27 236	1	36	72	76	45	58	28	30.0	14	48.8	1.32	
24 23 240	1	40	80	84	25	36	28	30.0	8	28.3	2.20	
24 24 240	1	40	80	84	30	45	28	30.0	8	33.3	2.20	
24 23 440	3	40	80	84	32	55	28	65.0	10	35.3	1.98	80 80 055
24 25 240	1	40	80	84	35	48	28	30.0	10	38.3	1.98	
24 25 440	3	40	80	84	40	62	28	65.0	12	43.3	1.54	80 86 062
24 26 440	3	40	80	84	45	68	28	65.0	14	48.8	2.86	80 80 068
24 27 240	1	40	80	84	45	58	28	30.0	14	48.8	1.76	
24 25 245	1	45	90	94	35	48	28	30.0	10	38.3	2.64	
24 27 245	1	45	90	94	45	58	28	30.0	14	48.8	2.42	
24 25 250	1	50	100	104	35	48	28	30.0	10	38.3	3.30	
24 27 250	1	50	100	104	45	58	28	30.0	14	48.8	3.08	
24 26 450	3	50	100	104	45	68	28	65.0	14	48.8	4.40	80 80 068

Straight Pinions,

20° pressure angle, hardened & ground teeth, with bore ØH6 with keyway, 16MnCr5 (AISI 51L17)

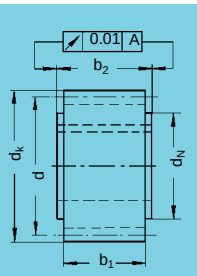


Fig. 1

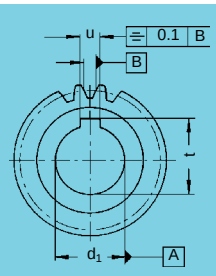


Fig. 1 + 3
Keyway middle of tooth gap

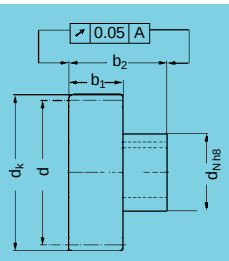


Fig. 3

Quality
7 e 25
(~AGMA 11)

Order code	Fig.	No of teeth z	d	d_k	d_1 H6	d_N	b_1	b_2	u	t	Wt. (lb)	Compression Coupling On page 28
Module 3												
24 33 218	1	18	54	60	25	36	28	30.0	8	28.3	0.88	
24 33 220	1	20	60	66	25	36	28	30.0	8	28.3	1.10	
24 34 220	1	20	60	66	30	45	28	30.0	8	33.3	1.10	
24 35 220	1	20	60	66	35	48	28	30.0	10	38.3	0.88	
24 30 422	3	22	66	72	22	36	28	56.0	6	24.8	1.76	80 84 036
24 31 422	3	22	66	72	25	44	28	60.0	8	28.3	1.98	80 80 044
24 33 222	1	22	66	72	25	36	28	30.0	8	28.3	1.32	
24 32 422	3	22	66	72	30	50	28	60.0	8	33.3	1.98	80 85 050
24 34 222	1	22	66	72	30	45	28	30.0	8	33.3	1.32	
24 33 422	3	22	66	72	32	55	28	65.0	10	38.3	2.20	80 80 055
24 34 422	3	22	66	72	35	55	28	65.0	10	38.3	1.98	80 80 055
24 35 222	1	22	66	72	35	48	28	30.0	10	38.3	1.32	
24 33 225	1	25	75	81	25	36	28	30.0	8	28.3	1.98	
24 34 225	1	25	75	81	30	45	28	30.0	8	33.3	1.76	
24 35 225	1	25	75	81	35	48	28	30.0	10	38.3	1.76	
24 35 425	3	25	75	81	40	62	28	65.0	12	43.3	2.64	80 86 062
24 37 225	1	25	75	81	45	58	28	30.0	14	48.8	1.32	
24 30 428	3	28	84	90	22	36	28	56.0	6	24.8	2.86	80 84 036
24 31 428	3	28	84	90	25	44	28	60.0	8	28.3	3.08	80 80 044
24 33 228	1	28	84	90	25	36	28	30.0	8	28.3	2.42	
24 32 428	3	28	84	90	30	50	28	60.0	8	33.3	3.08	80 85 050
24 34 228	1	28	84	90	30	45	28	30.0	8	33.3	2.42	
24 33 428	3	28	84	90	32	55	28	65.0	10	38.3	3.30	80 80 055
24 34 428	3	28	84	90	35	55	28	65.0	10	38.3	3.08	80 80 055
24 35 228	1	28	84	90	35	48	28	30.0	10	38.3	2.20	
24 36 428	3	28	84	90	45	68	28	65.0	14	48.8	3.30	80 80 068
24 37 228	1	28	84	90	45	58	28	30.0	14	48.8	1.98	
24 33 232	1	32	96	102	25	36	28	30.0	8	28.3	3.30	
24 34 232	1	32	96	102	30	45	28	30.0	8	33.3	3.08	
24 35 232	1	32	96	102	35	48	28	30.0	10	38.3	3.08	
24 35 432	3	32	96	102	40	62	28	65.0	12	43.3	3.96	80 86 062
24 37 232	1	32	96	102	45	58	28	30.0	14	48.8	2.86	
24 35 236	1	36	108	114	35	48	28	30.0	10	38.5	3.96	
24 36 436	3	36	108	114	45	68	28	65.0	14	48.8	4.84	80 80 068
24 37 236	1	36	108	114	45	58	28	30.0	14	48.8	3.74	
24 35 240	1	40	120	126	35	48	28	30.0	10	38.5	5.06	
24 37 240	1	40	120	126	45	58	28	30.0	14	48.8	4.62	

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Straight Pinions,

20° pressure angle, hardened & ground teeth, with bore ØH6 with keyway, 16MnCr5 (AISI 51L17)

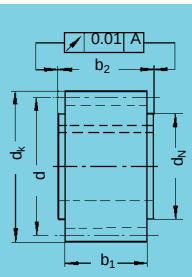


Fig. 1

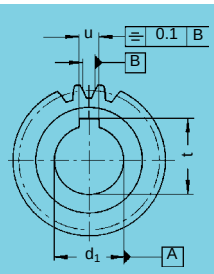


Fig. 1 + 3
Keyway middle of tooth gap

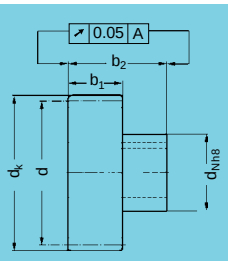


Fig. 3

Quality
7 e 25
(~AGMA 11)

Order code	Fig.	No of teeth z	d	d_k	d_1 H6	d_N	b_1	b_2	u	t	Wt. (lb)	Compression Coupling On page 28
Module 4												
24 43 420	3	20	80	88	32	55	40	75.0	10	35.3	3.74	80 80 055
24 45 220	1	20	80	88	35	52	40	50.0	10	38.3	2.86	
24 44 420	3	20	80	88	35	55	40	75.0	10	38.3	3.74	80 80 055
24 45 420	3	20	80	88	40	62	40	75.0	12	43.3	3.74	80 86 062
24 47 220	1	20	80	88	45	65	40	50.0	14	48.8	2.64	
24 45 222	1	22	88	96	35	52	40	50.0	10	38.3	3.74	
24 47 222	1	22	88	96	45	65	40	50.0	14	48.8	3.30	
24 46 422	3	22	88	96	45	68	40	75.0	14	48.8	4.40	80 80 068
24 43 425	3	25	100	108	32	55	40	75.0	10	35.3	5.72	80 80 055
24 45 225	1	25	100	108	35	52	40	50.0	10	38.3	4.84	
24 44 425	3	25	100	108	35	55	40	75.0	10	38.3	5.50	80 80 055
24 45 425	3	25	100	108	40	62	40	75.0	12	43.3	5.50	80 86 062
24 47 225	1	25	100	108	45	65	40	50.0	14	48.8	4.40	
24 47 425	3	25	100	108	55	80	40	80.0	16	59.3	5.50	80 87 080
24 45 228	1	28	112	120	35	52	40	50.0	10	38.3	6.38	
24 47 228	1	28	112	120	45	65	40	50.0	14	48.8	5.94	
24 46 428	3	28	112	120	45	68	40	75.0	14	48.8	6.82	80 80 068
24 45 232	1	32	128	136	35	52	40	50.0	10	38.3	8.36	
24 47 232	1	32	128	136	45	65	40	50.0	14	48.8	8.14	
24 47 432	3	32	128	136	55	80	40	80.0	16	59.3	9.02	80 87 080
24 48 432	3	32	128	136	75	110	40	100.0	20	80.4	11.0	80 80 110
24 47 240	1	40	160	168	45	65	40	50.0	14	48.8	12.98	
24 49 240	1	40	160	168	60	80	40	50.0	18	64.3	12.32	
24 48 440	3	40	160	168	75	110	40	100.0	20	80.4	16.06	80 80 110
Module 5												
24 56 421	3	21	105	115	45	68	50	85.0	14	48.8	8.14	80 80 068
24 57 421	3	21	105	115	55	80	50	90.0	16	59.3	8.14	80 87 080
24 56 425	3	25	125	135	45	68	50	85.0	14	48.8	11.44	80 80 068
24 57 425	3	25	125	135	55	80	50	90.0	16	59.3	11.22	80 87 080
24 58 425	3	25	125	135	75	110	50	110.0	20	80.4	10.34	80 80 110
Module 6												
24 67 421	3	21	126	138	55	80	60	100.0	16	59.3	12.32	80 87 080
24 68 421	3	21	126	138	75	110	60	120.0	20	80.4	10.34	80 80 110
24 67 425	3	25	150	162	55	80	60	100.0	16	59.3	17.60	80 87 080
24 68 425	3	25	150	162	75	110	60	120.0	20	80.4	15.62	80 80 110

Helical Pinions,

19° 31’ 42” left-hand, hardened & ground teeth, with bore ØH6 with keyway, 16MnCr5 (AISI 51L17)

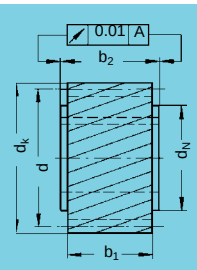


Fig. 1

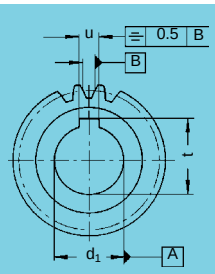


Fig. 1 + 3
Keyway middle of tooth gap

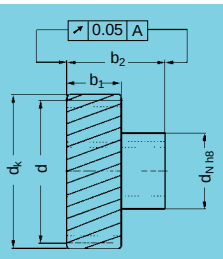


Fig. 3

Quality
7 e 25
(~AGMA 11)

Order code	Fig.	No of teeth z	d	d*π	d_k	d_1^{H6}	d_N	b_1	b_2	u	t	Wt. (lb)	Compression Coupling On page 28
Module 2													
24 22 520	1	20	42.44	133.33	46.4	20	30	28	30	6	22.8	0.66	
24 23 520	1	20	42.44	133.33	46.4	22	30	28	30	6	24.8	0.66	
24 26 521	1	21	44.56	140.00	48.6	16	25	28	30	5	18.3	0.66	
24 20 321	3	21	44.56	140.00	48.6	22	36	28	56	6	24.8	0.44	80 84 036
24 22 525	1	25	53.05	166.67	57.1	20	30	28	30	6	22.8	0.88	
24 23 525	1	25	53.05	166.67	57.1	25	36	28	30	8	28.3	0.88	
24 25 528	1	28	59.42	186.67	63.4	35	48	28	30	10	38.3	0.88	
24 26 530	1	30	63.66	200.00	67.7	16	25	28	30	5	18.3	1.54	
24 22 530	1	30	63.66	200.00	67.7	20	30	28	30	6	22.8	1.32	
24 20 330	3	30	63.66	200.00	67.7	22	36	28	56	6	24.8	1.32	80 84 036
24 23 530	1	30	63.66	200.00	67.7	25	36	28	30	8	28.3	1.76	
24 22 330	3	30	63.66	200.00	67.7	30	50	28	60	8	33.3	1.76	80 85 050
24 23 330	3	30	63.66	200.00	67.7	32	55	28	65	10	35.3	1.76	80 80 055
24 22 532	1	32	67.91	213.33	71.9	20	30	28	30	6	22.8	1.76	
24 23 532	1	32	67.91	213.33	71.9	25	36	28	30	8	28.3	1.54	
24 25 532	1	32	67.91	213.33	71.9	35	48	28	30	10	38.3	1.32	
24 25 536	1	36	76.39	240.00	80.4	35	48	28	30	10	38.3	1.76	
24 23 339	3	39	82.76	260.00	86.8	32	55	28	65	10	35.3	2.86	80 80 055
24 25 540	1	40	84.88	266.67	88.9	35	48	28	30	10	38.3	2.42	
Module 3													
24 30 320	3	20	63.66	200.00	69.7	22	36	28	56	6	24.8	1.32	80 84 036
24 31 320	3	20	63.66	200.00	69.7	25	44	28	60	8	28.3	1.54	80 80 044
24 34 520	1	20	63.66	200.00	69.7	30	45	28	30	8	33.3	1.76	
24 32 320	3	20	63.66	200.00	69.7	30	50	28	60	8	33.3	1.76	80 85 050
24 33 320	3	20	63.66	200.00	69.7	32	55	28	65	10	35.3	1.76	80 80 055
24 35 520	1	20	63.66	200.00	69.7	35	48	28	30	10	38.3	1.54	
24 33 522	1	22	70.03	220.00	76.0	25	36	28	30	8	28.3	1.76	
24 34 522	1	22	70.03	220.00	76.0	30	45	28	30	8	33.3	1.54	
24 35 522	1	22	70.03	220.00	76.0	35	48	28	30	10	38.3	1.54	
24 30 325	3	25	79.58	250.00	85.6	22	36	28	56	6	24.8	2.20	80 84 036
24 33 525	1	25	79.58	250.00	85.6	25	36	28	30	8	28.3	2.20	
24 31 325	3	25	79.58	250.00	85.6	25	44	28	60	8	28.3	2.42	80 80 044
24 34 525	1	25	79.58	250.00	85.6	30	45	28	30	8	33.3	2.20	
24 32 325	3	25	79.58	250.00	85.6	30	50	28	60	8	33.3	2.62	80 85 050
24 33 325	3	25	79.58	250.00	85.6	32	55	28	65	10	35.3	2.62	80 80 055
24 35 525	1	25	79.58	250.00	85.6	35	48	28	30	10	38.3	1.98	
24 34 325	3	25	79.58	250.00	85.6	35	55	28	65	10	38.3	2.42	80 80 055
24 36 525	1	25	79.58	250.00	85.6	40	70	28	50	12	43.3	2.42	

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Helical Pinions,

19° 31’ 42” left-hand, hardened & ground teeth, with bore Ø^{H6} with keyway, 16MnCr5 (AISI 51L17)

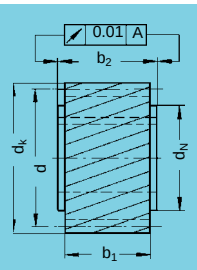


Fig. 1

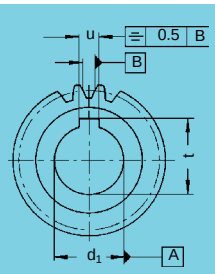


Fig. 1 + 3
Keyway middle of tooth gap

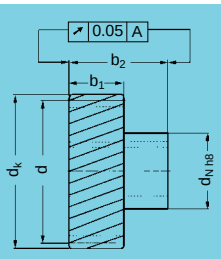


Fig. 3

Quality
7 e 25
(~AGMA 11)

Order code	Fig.	No of teeth z	d	d*π	d_k	d_1^{H6}	d_N	b_1	b_2	u	t	Wt. (lb)	Compression Coupling On page 28
Module 4													
24 45 515	1	15	63.66	200.00	71.7	35	52	40	50	10	38.3	3.08	
24 43 318	3	18	76.39	240.00	84.4	32	55	40	75	10	35.3	3.30	80 80 055
24 45 520	1	20	84.88	266.67	92.9	35	52	40	50	10	38.3	4.18	
24 47 520	1	20	84.88	266.67	92.9	45	65	40	50	14	48.8	3.52	
24 43 321	3	21	89.13	280.00	97.1	32	55	40	75	10	35.3	4.40	80 80 055
24 44 321	3	21	89.13	280.00	97.1	35	55	40	75	10	38.3	4.18	80 80 055
24 45 321	3	21	89.13	280.00	97.1	40	62	40	75	12	43.3	4.18	80 86 062
24 46 321	3	21	89.13	280.00	97.1	45	68	40	75	14	48.8	3.74	80 80 068
24 45 522	1	22	93.37	293.33	101.4	35	52	40	50	10	38.3	5.06	
24 47 522	1	22	93.37	293.33	101.4	45	65	40	50	14	48.8	4.40	
24 43 324	3	24	101.86	320.00	109.9	32	55	40	75	10	35.3	5.72	80 80 055
24 44 324	3	24	101.86	320.00	109.9	35	55	40	75	10	38.3	5.50	80 80 055
24 45 324	3	24	101.86	320.00	109.9	40	62	40	75	12	43.3	5.50	80 86 062
24 46 324	3	24	101.86	320.00	109.9	45	68	40	75	14	48.8	5.06	80 80 068
24 47 324	3	24	101.86	320.00	109.9	55	80	40	80	16	59.3	5.28	80 87 080
24 45 525	1	25	106.10	333.33	114.1	35	52	40	50	10	38.3	6.82	
24 47 525	1	25	106.10	333.33	114.1	45	65	40	50	14	48.8	6.16	
Module 5													
24 56 318	3	18	95.49	300.00	105.5	45	68	50	85	14	48.8	5.94	80 80 068
24 56 324	3	24	127.32	400.00	137.3	45	68	50	85	14	48.8	10.78	80 80 068
24 57 324	3	24	127.32	400.00	137.3	55	80	50	90	16	59.3	10.78	80 87 080
24 58 324	3	24	127.32	400.00	137.3	75	110	50	110	20	79.9	12.32	80 80 110
Module 6													
24 67 320	3	20	127.32	400.00	139.3	55	80	60	100	16	59.3	12.54	80 87 080
24 68 320	3	20	127.32	400.00	139.3	75	110	60	120	20	79.9	13.86	80 80 110
24 67 325	3	25	159.16	500.00	171.2	55	80	60	100	16	59.3	19.80	80 87 080
24 68 325	3	25	159.16	500.00	171.2	75	110	60	120	20	79.9	21.12	80 80 110
Module 8													
24 88 318	3	18	152.79	480	168.8	75	110	80	140	20	79.9	23.76	80 80 110

Straight Pinions,

milled teeth, 20° pressure angle

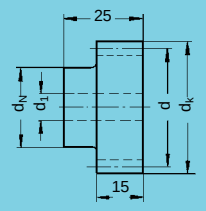


Fig. 1

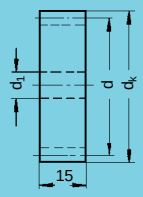


Fig. 2

Steel Quality 8 e 25 (~AGMA 10)	Plastic Quality 9 bc 26 (~AGMA 9)

Order code Steel	Order code Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Plastic
21 10 012	**22 10 012**	1	12	12.0	14.0	6	9	–	–	0.02	0.004
21 10 013	**22 10 013**	1	13	13.0	15.0	6	9	–	–	0.02	0.006
21 10 014	**22 10 014**	1	14	14.0	16.0	6	11	–	–	0.04	0.007
21 10 015	**22 10 015**	1	15	15.0	17.0	6	12	–	–	0.04	0.009
21 10 016	**22 10 016**	1	16	16.0	18.0	6	12	–	–	0.07	0.010
21 10 017	**22 10 017**	1	17	17.0	19.0	6	14	–	–	0.07	0.011
21 10 018	**22 10 018**	1	18	18.0	20.0	6	15	–	–	0.09	0.013
21 10 019	**22 10 019**	1	19	19.0	21.0	6	15	–	–	0.09	0.018
21 10 020	**22 10 020**	1	20	20.0	22.0	6	16	–	–	0.11	0.022
21 10 021	**22 10 021**	1	21	21.0	23.0	6	16	–	–	0.11	0.026
21 10 022	**22 10 022**	1	22	22.0	24.0	6	18	–	–	0.13	0.031
21 10 023	**22 10 023**	1	23	23.0	25.0	6	18	–	–	0.13	0.033
21 10 024	**22 10 024**	1	24	24.0	26.0	9	20	–	–	0.15	0.037
21 10 025	**22 10 025**	1	25	25.0	27.0	9	20	–	–	0.15	0.044
21 10 030	**22 10 030**	1	30	30.0	32.0	9	20	–	–	0.22	0.055
21 10 035	**22 10 035**	1	35	35.0	37.0	9	25	–	–	0.31	0.062
21 10 038	**22 10 038**	1	38	38.0	40.0	9	25	–	–	0.37	0.070
21 10 040	**22 10 040**	1	40	40.0	42.0	9	25	–	–	0.40	0.077
21 10 045	**22 10 045**	1	45	45.0	47.0	9	30	–	–	0.55	0.099
21 10 048	**22 10 048**	1	48	48.0	50.0	9	30	–	–	0.57	0.106
21 10 050	**22 10 050**	1	50	50.0	52.0	9	30	–	–	0.62	0.110
21 10 057	**22 10 057**	1	57	57.0	59.0	9	40	–	–	0.81	0.150
21 10 060	**22 10 060**	1	60	60.0	62.0	9	40	–	–	0.88	0.165
23 10 076	**–**	2	76	76.0	78.0	10	–	–	–	1.21	–
23 10 080	**–**	2	80	80.0	82.0	10	–	–	–	1.32	–
23 10 095	**–**	2	95	95.0	97.0	10	–	–	–	1.87	–
23 10 100	**–**	2	100	100.0	102.0	10	–	–	–	2.09	–
23 10 114	**–**	2	114	114.0	116.0	10	–	–	–	2.64	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Straight Pinions,

milled teeth, 20° pressure angle

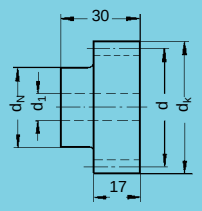


Fig. 1

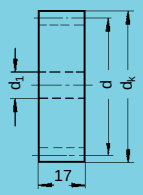


Fig. 2

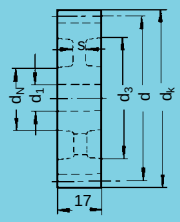


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)	Plastic Quality 9 bc 26 (~AGMA 9)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 15 012	**–**	**22 15 012**	1	12	18.0	21.0	6	14	–	–	0.07	–	0.012
21 15 013	**–**	**22 15 013**	1	13	19.5	22.5	6	14	–	–	0.07	–	0.012
21 15 014	**–**	**22 15 014**	1	14	21.0	24.0	6	16	–	–	0.09	–	0.015
21 15 015	**–**	**22 15 015**	1	15	22.5	25.5	6	18	–	–	0.11	–	0.020
21 15 016	**–**	**22 15 016**	1	16	24.0	27.0	6	18	–	–	0.15	–	0.028
21 15 017	**–**	**22 15 017**	1	17	25.5	28.5	9	20	–	–	0.18	–	0.032
21 15 018	**–**	**22 15 018**	1	18	27.0	30.0	9	20	–	–	0.20	–	0.035
21 15 019	**–**	**22 15 019**	1	19	28.5	31.5	9	20	–	–	0.22	–	0.040
21 15 020	**–**	**22 15 020**	1	20	30.0	33.0	9	25	–	–	0.29	–	0.052
21 15 021	**–**	**22 15 021**	1	21	31.5	34.5	9	25	–	–	0.31	–	0.056
21 15 022	**–**	**22 15 022**	1	22	33.0	36.0	9	25	–	–	0.33	–	0.059
21 15 023	**–**	**22 15 023**	1	23	34.5	37.5	9	25	–	–	0.35	–	0.064
21 15 024	**–**	**22 15 024**	1	24	36.0	39.0	9	25	–	–	0.37	–	0.068
21 15 025	**–**	**22 15 025**	1	25	37.5	40.5	9	25	–	–	0.40	–	0.072
21 15 030	**–**	**22 15 030**	1	30	45.0	48.0	9	30	–	–	0.51	–	0.092
21 15 035	**–**	**22 15 035**	1	35	52.5	55.5	9	40	–	–	0.88	–	0.108
21 15 038	**–**	**22 15 038**	1	38	57.0	60.0	9	40	–	–	0.88	–	0.161
21 15 040	**–**	**22 15 040**	1	40	60.0	63.0	9	40	–	–	1.01	–	0.184
21 15 045	**–**	**22 15 045**	1	45	67.5	70.5	12	50	–	–	1.34	–	0.244
21 15 048	**–**	**22 15 048**	1	48	72.0	75.0	12	50	–	–	1.54	–	0.279
21 15 050	**–**	**22 15 050**	1	50	75.0	78.0	12	50	–	–	1.65	–	0.299
21 15 057	**–**	**22 15 057**	1	57	85.5	88.5	12	60	–	–	2.20	–	0.400
21 15 060	**–**	**22 15 060**	1	60	90.0	93.0	12	60	–	–	2.55	–	0.464
23 15 076	**–**	**–**	2	76	114.0	117.0	16	–	–	–	3.08	–	–
23 15 080	**–**	**–**	2	80	120.0	123.0	16	–	–	–	3.30	–	–
23 15 595	**–**	**–**	2	95	142.5	145.5	20	–	–	–	4.62	–	–
–	**23 15 095**	**–**	3	95	142.5	145.5	16	70	114	6.0	–	4.40	–
–	**23 15 100**	**–**	3	100	150.0	153.0	16	70	122	6.0	–	5.06	–
–	**23 15 114**	**–**	3	114	171.0	174.0	16	70	146	6.5	–	5.50	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle

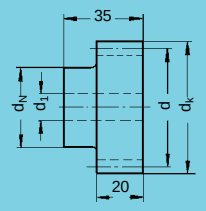


Fig. 1

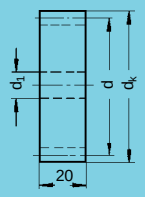


Fig. 2

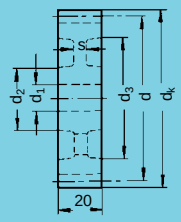


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)	Plastic Quality 9 bc 26 (~AGMA 9)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 20 012	**–**	**22 20 012**	1	12	24.0	28.0	9	18.0	–	–	0.15	–	0.033
21 20 013	**–**	**22 20 013**	1	13	26.0	30.0	9	19.0	–	–	0.26	–	0.040
21 20 014	**–**	**22 20 014**	1	14	28.0	32.0	9	19.0	–	–	0.31	–	0.044
21 20 015	**–**	**22 20 015**	1	15	30.0	34.0	9	24.5	–	–	0.33	–	0.046
21 20 016	**–**	**22 20 016**	1	16	32.0	36.0	9	25.0	–	–	0.37	–	0.051
21 20 017	**–**	**22 20 017**	1	17	34.0	38.0	9	25.0	–	–	0.40	–	0.070
21 20 018	**–**	**22 20 018**	1	18	36.0	40.0	9	25.0	–	–	0.42	–	0.079
21 20 019	**–**	**22 20 019**	1	19	38.0	42.0	9	25.0	–	–	0.44	–	0.086
21 20 020	**–**	**22 20 020**	1	20	40.0	44.0	9	30.0	–	–	0.48	–	0.103
21 20 021	**–**	**22 20 021**	1	21	42.0	46.0	9	30.0	–	–	0.57	–	0.112
21 20 022	**–**	**22 20 022**	1	22	44.0	48.0	9	30.0	–	–	0.59	–	0.121
21 20 023	**–**	**22 20 023**	1	23	46.0	50.0	9	30.0	–	–	0.62	–	0.130
21 20 024	**–**	**22 20 024**	1	24	48.0	52.0	12	35.0	–	–	0.79	–	0.143
21 20 025	**–**	**22 20 025**	1	25	50.0	54.0	12	35.0	–	–	0.86	–	0.154
21 20 030	**–**	**22 20 030**	1	30	60.0	64.0	12	40.0	–	–	1.10	–	0.231
21 20 035	**–**	**–**	1	35	70.0	74.0	12	50.0	–	–	1.47	–	–
21 20 038	**–**	**–**	1	38	76.0	80.0	12	50.0	–	–	1.98	–	–
21 20 040	**–**	**–**	1	40	80.0	84.0	12	50.0	–	–	2.09	–	–
21 20 045	**–**	**–**	1	45	90.0	94.0	12	60.0	–	–	2.75	–	–
21 20 048	**–**	**–**	1	48	96.0	100.0	15	70.0	–	–	3.30	–	–
21 20 050	**–**	**–**	1	50	100.0	104.0	15	70.0	–	–	3.52	–	–
21 20 057	**–**	**–**	1	57	114.0	118.0	15	70.0	–	–	4.40	–	–
21 20 060	**–**	**–**	1	60	120.0	124.0	15	70.0	–	–	5.28	–	–
23 20 576	**–**	**–**	2	76	152.0	156.0	20	–	–	–	6.16	–	–
23 20 580	**–**	**–**	2	80	160.0	164.0	20	–	–	–	6.82	–	–
23 20 595	**–**	**–**	2	95	190.0	194.0	20	–	–	–	9.68	–	–
–	**23 20 076**	**–**	3	76	152.0	156.0	16	70.0	126	7.5	–	3.96	–
–	**23 20 080**	**–**	3	80	160.0	164.0	16	70.0	134	7.5	–	4.18	–
–	**23 20 095**	**–**	3	95	190.0	194.0	16	80.0	164	7.5	–	4.84	–
–	**23 20 100**	**–**	3	100	200.0	204.0	16	80.0	174	7.5	–	5.50	–
–	**23 20 114**	**–**	3	114	228.0	232.0	16	80.0	200	7.5	–	5.94	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Straight Pinions,

milled teeth, 20° pressure angle

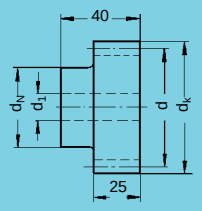


Fig. 1

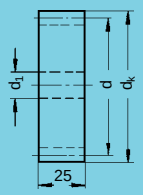


Fig. 2

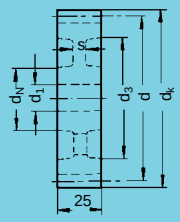


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)	Plastic Quality 9 bc 26 (~AGMA 9)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 25 012	**–**	**22 25 012**	1	12	30.0	35.0	9	20.0	–	–	0.35	–	0.064
21 25 013	**–**	**22 25 013**	1	13	32.5	37.5	9	20.0	–	–	0.40	–	0.070
21 25 014	**–**	**22 25 014**	1	14	35.0	40.0	9	25.0	–	–	0.48	–	0.088
21 25 015	**–**	**22 25 015**	1	15	37.5	42.5	9	25.0	–	–	0.55	–	0.099
21 25 016	**–**	**22 25 016**	1	16	40.0	45.0	9	30.0	–	–	0.68	–	0.123
21 25 017	**–**	**22 25 017**	1	17	42.5	47.5	9	30.0	–	–	0.77	–	0.139
21 25 018	**–**	**22 25 018**	1	18	45.0	50.0	9	35.0	–	–	0.90	–	0.163
21 25 019	**–**	**22 25 019**	1	19	47.5	52.5	12	35.0	–	–	0.95	–	0.172
21 25 020	**–**	**22 25 020**	1	20	50.5	55.5	12	35.0	–	–	1.03	–	0.187
21 25 021	**–**	**22 25 021**	1	21	52.5	57.5	12	35.0	–	–	1.10	–	0.198
21 25 022	**–**	**22 25 022**	1	22	55.0	60.0	12	40.0	–	–	1.17	–	0.211
21 25 023	**–**	**22 25 023**	1	23	57.5	62.5	12	40.0	–	–	1.36	–	0.246
21 25 024	**–**	**22 25 024**	1	24	60.0	65.0	12	40.0	–	–	1.45	–	0.264
21 25 025	**–**	**22 25 025**	1	25	62.5	67.5	12	45.0	–	–	1.65	–	0.299
21 25 030	**–**	**22 25 030**	1	30	75.0	80.0	12	50.0	–	–	2.13	–	0.387
21 25 035	**–**	**–**	1	35	87.5	92.5	12	60.0	–	–	3.28	–	–
21 25 038	**–**	**–**	1	38	95.0	100.0	12	60.0	–	–	3.78	–	–
21 25 040	**–**	**–**	1	40	100.0	105.0	12	70.0	–	–	4.05	–	–
21 25 045	**–**	**–**	1	45	112.5	117.5	15	70.0	–	–	5.19	–	–
21 25 048	**–**	**–**	1	48	120.0	125.0	15	80.0	–	–	6.05	–	–
21 25 050	**–**	**–**	1	50	125.0	130.0	15	80.0	–	–	6.47	–	–
21 25 057	**–**	**–**	1	57	142.5	147.5	15	90.0	–	–	8.07	–	–
21 25 060	**–**	**–**	1	60	150.0	155.0	15	90.0	–	–	8.80	–	–
23 25 576	**–**	**–**	2	76	190.0	195.0	20	–	–	–	12.10	–	–
23 25 580	**–**	**–**	2	80	200.0	205.0	25	–	–	–	13.42	–	–
23 25 595	**–**	**–**	2	95	237.5	242.5	25	–	–	–	18.92	–	–
–	**23 25 076**	**–**	3	76	190.0	195.0	20	80.0	160	8.0	–	5.50	–
–	**23 25 080**	**–**	3	80	200.0	205.0	20	80.0	166	8.0	–	5.94	–
–	**23 25 095**	**–**	3	95	237.5	242.5	20	90.0	198	8.0	–	8.14	–
–	**23 25 100**	**–**	3	100	250.0	255.0	20	90.0	210	8.0	–	9.68	–
–	**23 25 114**	**–**	3	114	285.0	290.0	20	90.0	240	8.0	–	11.22	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle

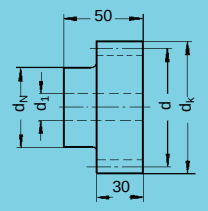


Fig. 1

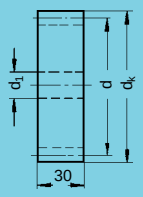


Fig. 2

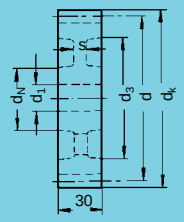


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)	Plastic Quality 9 bc 26 (~AGMA 9)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 30 012	**–**	**22 30 012**	1	12	36	42	14	25	–	–	0.55	–	0.099
21 30 013	**–**	**22 30 013**	1	13	39	45	14	25	–	–	0.66	–	0.119
21 30 014	**–**	**22 30 014**	1	14	42	48	14	25	–	–	0.75	–	0.134
21 30 015	**–**	**22 30 015**	1	15	45	51	14	35	–	–	0.90	–	0.163
21 30 016	**–**	**22 30 016**	1	16	48	54	14	35	–	–	1.12	–	0.202
21 30 017	**–**	**22 30 017**	1	17	51	57	14	42	–	–	1.47	–	0.266
21 30 018	**–**	**22 30 018**	1	18	54	60	14	45	–	–	1.54	–	0.279
21 30 019	**–**	**22 30 019**	1	19	57	63	14	45	–	–	1.65	–	0.299
21 30 020	**–**	**22 30 020**	1	20	60	66	14	45	–	–	1.80	–	0.328
21 30 021	**–**	**22 30 021**	1	21	63	69	14	45	–	–	1.96	–	0.354
21 30 022	**–**	**22 30 022**	1	22	66	72	14	50	–	–	2.31	–	0.418
21 30 023	**–**	**22 30 023**	1	23	69	75	14	50	–	–	2.42	–	0.440
21 30 024	**–**	**22 30 024**	1	24	72	78	14	50	–	–	2.64	–	0.480
21 30 025	**–**	**22 30 025**	1	25	75	81	14	60	–	–	2.97	–	0.539
21 30 027	**–**	**–**	1	27	81	87	14	60	–	–	3.52	–	–
21 30 030	**–**	**–**	1	30	90	96	14	60	–	–	3.96	–	–
21 30 035	**–**	**–**	1	35	105	111	14	80	–	–	5.94	–	–
21 30 038	**–**	**–**	1	38	114	120	14	80	–	–	6.60	–	–
21 30 040	**–**	**–**	1	40	120	126	14	80	–	–	7.26	–	
23 30 545	**–**	**–**	2	45	135	141	20	–	–	–	7.26	–	–
23 30 548	**–**	**–**	2	48	144	150	20	–	–	–	8.36	–	–
23 30 550	**–**	**–**	2	50	150	156	25	–	–	–	9.02	–	–
23 30 552	**–**	**–**	2	52	156	162	25	–	–	–	9.90	–	–
23 30 556	**–**	**–**	2	56	168	174	25	–	–	–	11.44	–	–
23 30 560	**–**	**–**	2	60	180	186	25	–	–	–	13.20	–	–
23 30 576	**–**	**–**	2	76	228	234	25	–	–	–	21.10	–	–
23 30 580	**–**	**–**	2	80	240	246	25	–	–	–	23.30	–	–
23 30 595	**–**	**–**	2	95	285	291	25	–	–	–	33.00	–	–
–	**23 30 050**	**–**	3	50	150	156	25	80	122	9.5	–	5.50	–
–	**23 30 060**	**–**	3	60	180	186	25	80	152	9.5	–	7.04	–
–	**23 30 076**	**–**	3	76	228	234	25	90	200	9.5	–	9.24	–
–	**23 30 080**	**–**	3	80	240	246	25	90	212	9.5	–	9.90	–
–	**23 30 095**	**–**	3	95	285	291	25	100	254	10.5	–	14.08	–
–	**23 30 100**	**–**	3	100	300	306	25	100	268	12.5	–	16.72	–
–	**23 30 114**	**–**	3	114	342	348	25	100	310	12.5	–	19.80	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle

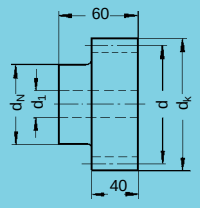


Fig. 1

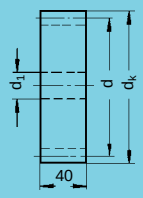


Fig. 2

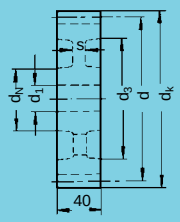


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 40 012	–	–	1	12	48	56	16	35	–	–	1.28	–	–
21 40 013	–	–	1	13	52	60	16	35	–	–	1.58	–	–
21 40 014	–	–	1	14	56	64	16	45	–	–	1.98	–	–
21 40 015	–	–	1	15	60	68	16	45	–	–	2.20	–	–
21 40 016	–	–	1	16	64	72	16	45	–	–	2.42	–	–
21 40 017	–	–	1	17	68	76	16	50	–	–	2.86	–	–
21 40 018	–	–	1	18	72	80	16	50	–	–	3.08	–	–
21 40 019	–	–	1	19	76	84	16	60	–	–	3.74	–	–
21 40 020	–	–	1	20	80	88	16	60	–	–	3.96	–	–
21 40 021	–	–	1	21	84	92	16	70	–	–	4.84	–	–
21 40 022	–	–	1	22	88	96	16	70	–	–	5.50	–	–
21 40 023	–	–	1	23	92	100	16	75	–	–	5.72	–	–
21 40 024	–	–	1	24	96	104	16	75	–	–	6.05	–	–
21 40 025	–	–	1	25	100	108	16	75	–	–	6.38	–	–
21 40 030	–	–	1	30	120	128	16	75	–	–	8.80	–	–
23 40 538	–	–	2	38	152	160	25	–	–	–	12.54	–	–
23 40 540	–	–	2	40	160	168	25	–	–	–	13.86	–	–
23 40 545	–	–	2	45	180	188	25	–	–	–	17.60	–	–
23 40 548	–	–	2	48	192	200	25	–	–	–	19.80	–	–
23 40 550	–	–	2	50	200	208	25	–	–	–	21.60	–	–
23 40 552	–	–	2	52	208	216	25	–	–	–	23.30	–	–
23 40 556	–	–	2	56	224	232	25	–	–	–	27.10	–	–
23 40 560	–	–	2	60	240	248	25	–	–	–	31.20	–	–
23 40 576	–	–	2	76	304	312	25	–	–	–	49.90	–	–
23 40 580	–	–	2	80	320	328	25	–	–	–	55.40	–	–
23 40 595	–	–	2	95	380	388	25	–	–	–	78.30	–	–
–	**23 40 038**	–	3	38	152	160	25	80	116	12.5	–	8.58	–
–	**23 40 040**	–	3	40	160	168	25	80	124	12.5	–	9.24	–
–	**23 40 050**	–	3	50	200	208	25	90	164	12.5	–	12.32	–
–	**23 40 060**	–	3	60	240	248	25	90	200	12.5	–	16.06	–
–	**23 40 076**	–	3	76	304	312	25	100	264	12.5	–	20.90	–
–	**23 40 080**	–	3	80	320	328	25	100	280	13.5	–	23.50	–
–	**23 40 095**	–	3	95	380	388	25	110	340	13.5	–	31.50	–
–	**23 40 100**	–	3	100	400	408	25	110	360	13.5	–	34.10	–
–	**23 40 114**	–	3	114	456	464	25	110	415	13.5	–	43.30	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle

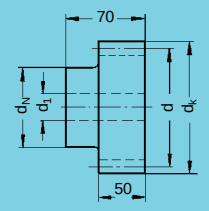


Fig. 1

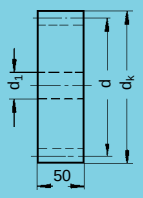


Fig. 2

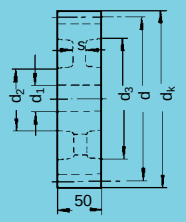


Fig. 3

Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 50 012	–	–	1	12	60	70	20	45	–	–	2.64	–	–
21 50 013	–	–	1	13	65	75	20	45	–	–	3.04	–	–
21 50 014	–	–	1	14	70	80	20	55	–	–	3.92	–	–
21 50 015	–	–	1	15	75	85	20	60	–	–	4.40	–	–
21 50 016	–	–	1	16	80	90	20	60	–	–	4.62	–	–
21 50 017	–	–	1	17	85	95	20	70	–	–	4.84	–	–
21 50 018	–	–	1	18	90	100	20	70	–	–	5.68	–	–
21 50 019	–	–	1	19	95	105	20	70	–	–	6.16	–	–
21 50 020	–	–	1	20	100	110	20	70	–	–	6.82	–	–
21 50 021	–	–	1	21	105	115	20	70	–	–	8.36	–	–
21 50 022	–	–	1	22	110	120	20	80	–	–	9.46	–	–
21 50 023	–	–	1	23	115	125	20	80	–	–	10.34	–	–
21 50 024	–	–	1	24	120	130	20	80	–	–	11.00	–	–
21 50 025	–	–	1	25	125	135	20	80	–	–	11.88	–	–
21 50 030	–	–	1	30	150	160	20	90	–	–	16.94	–	–
23 50 536	–	–	2	36	180	190	30	–	–	–	21.80	–	–
23 50 538	–	–	2	38	190	200	30	–	–	–	24.40	–	–
23 50 540	–	–	2	40	200	210	30	–	–	–	27.10	–	–
23 50 545	–	–	2	45	225	235	30	–	–	–	34.30	–	–
23 50 548	–	–	2	48	240	250	30	–	–	–	38.90	–	–
23 50 550	–	–	2	50	250	260	30	–	–	–	42.20	–	–
23 50 552	–	–	2	52	260	270	30	–	–	–	45.80	–	–
23 50 556	–	–	2	56	280	290	30	–	–	–	53.00	–	–
23 50 560	–	–	2	60	300	310	30	–	–	–	60.90	–	–
23 50 576	–	–	2	76	380	390	30	–	–	–	97.70	–	–
23 50 580	–	–	2	80	400	410	30	–	–	–	108.20	–	–
23 50 595	–	–	2	95	475	485	30	–	–	–	152.90	–	–
–	**23 50 038**	–	3	38	190	200	40	100	160	14	–	14.96	–
–	**23 50 040**	–	3	40	200	210	40	100	165	14	–	16.28	–
–	**23 50 050**	–	3	50	250	260	40	100	215	16	–	21.10	–
–	**23 50 060**	–	3	60	300	310	40	100	260	16	–	27.70	–
–	**23 50 076**	–	3	76	380	390	40	120	340	16	–	40.00	–
–	**23 50 080**	–	3	80	400	410	40	130	360	16	–	41.80	–
–	**23 50 095**	–	3	95	475	485	40	130	430	16	–	57.20	–
–	**23 50 100**	–	3	100	500	510	40	180	450	22	–	67.50	–
–	**23 50 114**	–	3	114	570	580	40	180	510	22	–	85.10	–
–	**23 50 150**	–	3	150	750	760	40	180	700	22	–	127.60	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

All dimensions are in millimeters and are subject to change. For ISO tolerance values, see page 44.

Module 6.0 Straight Pinions,

milled teeth, 20° pressure angle

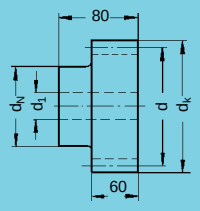


Fig. 1

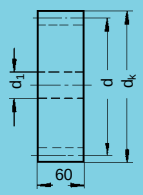


Fig. 2

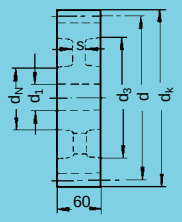


Fig. 3

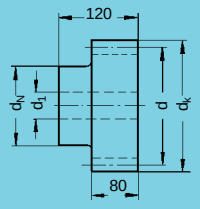
Steel Quality 8 e 25 (~AGMA 10)	Cast Iron Quality 8 e 26 (~AGMA 10)

Steel	Order code Grey cast iron	Plastic	Fig.	No of teeth z	d	d_k	d_1	d_N	d_3	s	Wt. (lb) Steel	Wt. (lb) Grey cast iron	Wt. (lb) Plastic
21 60 015	–	–	1	15	90	102	20	60	–	–	7.04	–	–
21 60 019	–	–	1	19	114	126	20	80	–	–	11.88	–	–
21 60 021	–	–	1	21	126	138	20	90	–	–	14.74	–	–
21 60 025	–	–	1	25	150	162	20	110	–	–	21.10	–	–
23 60 530	–	–	2	30	180	192	30	–	–	–	26.20	–	–
23 60 536	–	–	2	36	216	228	30	–	–	–	37.80	–	–
23 60 538	–	–	2	38	228	240	30	–	–	–	42.20	–	–
23 60 540	–	–	2	40	240	252	30	–	–	–	46.60	–	–
–	**23 60 030**	–	3	30	180	192	40	100	132	20	–	19.36	–
–	**23 60 038**	–	3	38	228	240	40	100	180	20	–	26.60	–
–	**23 60 050**	–	3	50	300	312	40	120	252	20	–	41.80	–
–	**23 60 076**	–	3	76	456	468	40	130	408	20	–	80.10	–

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Module 8.0 Straight Pinions,

milled teeth, 20° pressure angle, quality 8 e 25 (~AGMA 10)

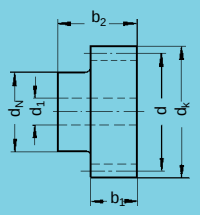


Order code Steel	No of teeth	d	d_k	d_1	d_N	d_3	s	Wt. (lb)
21 80 012	12	96	112	40	75	–	–	10.12
21 80 015	15	120	136	40	90	–	–	16.94
21 80 020	20	160	176	40	120	–	–	26.80
21 80 025	25	200	216	40	150	–	–	52.40

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle, material X 8 CrNi S 18-9 (AISI 303)



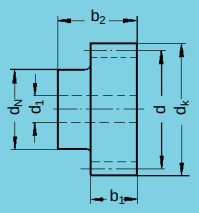
Quality
8 e 25
(~AGMA 10)

Order code	No of teeth z	d	d_k	d_1	d_N	b_1	b_2	Wt. (lb)
Module 1								
06 10 012	12	12.0	14.0	4	10	10	16	0.022
06 10 015	15	15.0	17.0	5	12	10	16	0.044
06 10 018	18	18.0	20.0	6	15	10	16	0.066
06 10 020	20	20.0	22.0	6	15	10	16	0.088
06 10 025	25	25.0	27.0	8	20	10	16	0.110
06 10 030	30	30.0	32.0	8	25	10	18	0.176
06 10 040	40	40.0	42.0	8	25	10	18	0.264
06 10 050	50	50.0	52.0	10	30	10	20	0.440
06 10 060	60	60.0	62.0	10	40	10	22	0.660
06 10 070	70	70.0	72.0	10	40	10	22	0.880
06 10 080	80	80.0	82.0	10	50	10	22	1.210
06 10 100	100	100.0	102.0	12	60	10	22	1.870
Module 1.5								
06 15 012	12	18.0	21.0	8	15	15	25	0.066
06 15 015	15	22.5	25.5	10	18	15	25	0.110
06 15 018	18	27.0	30.0	10	22	15	25	0.176
06 15 020	20	30.0	33.0	10	25	15	25	0.220
06 15 025	25	37.5	40.5	10	25	15	30	0.374
06 15 030	30	45.0	48.0	10	30	15	30	0.572
06 15 040	40	60.0	63.0	10	40	15	30	1.100
06 15 050	50	75.0	78.0	10	50	15	30	1.606
06 15 060	60	90.0	93.0	12	60	15	30	2.420
Module 2								
06 20 212	12	24.0	28.0	10	20	20	31	0.154
06 20 215	15	30.0	34.0	12	25	20	31	0.264
06 20 218	18	36.0	40.0	12	30	20	31	0.396
06 20 220	20	40.0	44.0	12	30	20	31	0.484
06 20 225	25	50.0	54.0	12	30	20	31	0.550
06 20 230	30	60.0	64.0	12	40	20	31	1.056
06 20 240	40	80.0	84.0	12	50	20	31	1.870
06 20 250	50	100.0	104.0	12	50	20	31	2.640
06 20 260	60	120.0	124.0	12	70	20	31	4.070
Module 3								
06 30 212	12	36.0	42.0	12	25	30	40	0.462
06 30 215	15	45.0	51.0	12	35	30	40	0.836
06 30 218	18	54.0	60.0	12	45	30	40	1.320
06 30 220	20	60.0	66.0	15	45	30	40	1.496
06 30 225	25	75.0	81.0	15	50	30	40	2.310
06 30 230	30	90.0	96.0	20	50	30	40	5.940
06 30 240	40	120.0	126.0	20	70	30	45	7.700
06 30 250	50	150.0	156.0	20	80	30	45	9.240

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

Straight Pinions,

milled teeth, 20° pressure angle, C45 (AISI 10L45)



Quality
8 e 25
(~AGMA 10)

Order code	Module m	No of teeth z	d	d_k	d_1	d_N	b_1	b_2	Wt. (lb)
5 mm Circular Pitch									
07 06 012	1.591	12	19.1	22.3	6	14	12	25	0.066
07 06 015	1.591	15	23.9	27.0	6	18	12	25	0.132
07 06 018	1.591	18	28.6	31.8	8	20	12	25	0.154
07 06 020	1.591	20	31.8	35.0	8	20	12	25	0.220
07 06 025	1.591	25	39.8	43.0	8	25	12	25	0.308
07 06 030	1.591	30	47.7	50.9	10	30	12	25	0.440
07 06 040	1.591	40	63.6	66.8	10	40	12	25	0.792
07 06 050	1.591	50	79.6	82.7	12	50	12	25	1.232
07 06 060	1.591	60	95.5	98.6	12	60	12	25	1.804
10 mm Circular Pitch									
07 08 012	3.183	12	38.2	44.6	10	25	25	40	0.484
07 08 015	3.183	15	47.7	54.1	12	30	25	40	0.836
07 08 018	3.183	18	57.3	63.7	15	40	25	40	1.100
07 08 020	3.183	20	63.7	70.0	15	40	25	40	1.320
07 08 025	3.183	25	79.6	85.9	15	50	25	40	2.110
07 08 030	3.183	30	95.5	101.9	20	60	25	40	3.210
07 08 040	3.183	40	127.3	133.7	20	80	25	40	5.900

Additional machining (boring, adding keyway, threading, etc.) is possible with quick turn around time.

The following table lists the corresponding values to the ISO tolerances shown through out the catalog. These tolerances should be taken into consideration when designing mating parts.

Dimension	>6 to 10	>10 to 18	>18 to 30	>30 to 50	>50 to 80	>80 to 120	>120 to 180
h6	-0.000 to –0.009	-0.000 to –0.011	-0.000 to –0.013	-0.000 to –0.016	–	–	–
H6	–	+0.000 to +0.011	+0.000 to +0.013	+0.000 to +0.016	+0.000 to +0.019	+0.000 to +0.022	+0.000 to +0.025
h8	–	-0.000 to –0.027	-0.000 to –0.033	-0.000 to –0.039	-0.000 to –0.046	-0.000 to –0.054	–
H8	–	–	–	–	+0.000 to +0.046	+0.000 to +0.054	+0.000 to +0.063
h9	-0.000 to -0.036	-0.000 to –0.043	-0.000 to –0.052				
h11	–	-0.000 to –0.110	-0.000 to –0.130	-0.000 to –0.160	–	–	–
j6	–	–	-0.004 to +0.009	-0.005 to +0.011	-0.007 to +0.012	–	–
G7	+0.005 to +0.020	+0.006 to +0.024	+0.007 to +0.028	+0.009 to +0.034	+0.010 to +0.040	+0.012 to +0.047	+0.014 to +0.054
P8	-0.015 to -0.037	-0.018 to –0.045	–	–	–	–	–
r6	–	+0.023 to +0.034	+0.028 to +0.041	+0.034 to +0.050	+0.043 to +0.060		

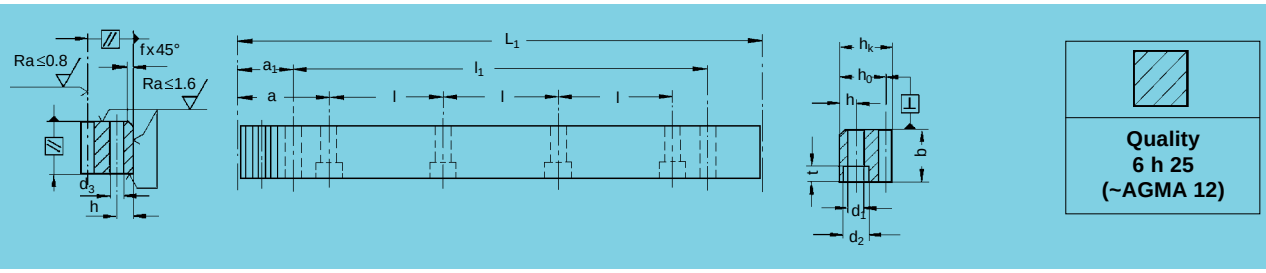
All dimensions are in millimeters and are subject to change.

	Series	Style	Module	Heat Treatment	Quality Level*	Page
	28	Straight	2, 3, 4, 5, 6	Hardened & Ground	6 h 25 (~AGMA 12)	46
	33	Straight	2, 3, 4, 5	Quenched & Tempered	8 e 27 (~AGMA 10)	47
	25	Straight	1, 1.5, 2, 2.5, 3, 4, 5, 6, 8	Soft	9 e 27 (~AGMA 9)	48
	34	Straight	2, 3, 4, 5, 6	Induction Hardened	10 e 27 (~AGMA 8)	49
	27	Straight	1, 1.5, 2, 2.5, 3, 4, 5, 6, 8	Induction Hardened	10 e 27 (~AGMA 8)	50
	36	Straight	1, 1.5, 2, 3	Soft, Stainless	8 e 27 (~AGMA 10)	51
	37 0. ...	Straight	5, 10 mm circular pitch	Soft	9 e 27 (~AGMA 9)	52
	26	Straight	1, 1.5, 2, 2.5, 3	Plastic	10 e 27 (~AGMA 8)	53
	29	Helical	2, 3, 4, 5, 6	Hardened & Ground	6 h 25 (~AGMA 12)	54
	38	Helical	2, 3, 4, 5	Quenched & Tempered	8 e 27 (~AGMA 10)	55
	39	Helical	2, 3, 4, 5, 6	Induction Hardened	10 e 27 (~AGMA 8)	56
	36 9. ..	Straight	1, 1.5, 2, 3	Soft, Stainless	8 e 27 (~AGMA 10)	57
	35 .1 ...	Straight	1, 1.5, 2, 3, 4	Quenched & Tempered	8 e 27 (~AGMA 10)	58
	35 .0 ...	Straight	1, 1.5, 2, 2.5, 3, 4, 5	Soft	9 e 27 (~AGMA 9)	59
	37 9. ...	Straight	5, 10 mm circular pitch	Soft	9 e 27 (~AGMA 9)	60
	80		Guide Bushings			60

* Approximate AGMA quality level is given in parenthesis.

Straight Racks,

20° pressure angle, hardened & ground teeth



Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
28 20 025	2.0	251.3	40	24	24	22.0	2	62.8	125.66	2	8	7	11	7	31.3	188.7	5.7	0.022	2.20
28 21 025	2.0	251.3	40	24	24	22.0	2			Without mounting holes							–	0.022	2.20
28 20 050	2.0	502.7	80	24	24	22.0	2	62.8	125.66	4	8	7	11	7	31.3	440.1	5.7	0.022	4.62
28 21 050	2.0	502.7	80	24	24	22.0	2			Without mounting holes							–	0.022	4.62
28 20 100	2.0	1005.3	160	24	24	22.0	2	62.8	125.66	8	8	7	11	7	31.3	942.7	5.7	0.022	9.24
28 21 100	2.0	1005.3	160	24	24	22.0	2			Without mounting holes							–	0.022	9.24
28 30 025	3.0	254.5	27	29	29	26.0	2	63.6	127.23	2	9	10	15	9	34.4	185.7	7.7	0.024	3.30
28 31 025	3.0	254.5	27	29	29	26.0	2			Without mounting holes							7.7	0.024	3.30
28 30 050	3.0	508.9	54	29	29	26.0	2	63.6	127.23	4	9	10	15	9	34.4	440.1	7.7	0.024	6.60
28 31 050	3.0	508.9	54	29	29	26.0	2			Without mounting holes							7.7	0.024	6.60
28 30 100	3.0	1017.9	108	29	29	26.0	2	63.6	127.23	8	9	10	15	9	34.4	949.1	7.7	0.024	13.20
28 31 100	3.0	1017.9	108	29	29	26.0	2			Without mounting holes							7.7	0.024	13.20
28 40 025	4.0	251.3	20	39	39	35.0	3	62.8	125.66	2	12	10	15	9	37.5	176.3	7.7	0.025	5.72
28 41 025	4.0	251.3	20	39	39	35.0	3			Without mounting holes							–	0.025	5.72
28 40 050	4.0	502.7	40	39	39	35.0	3	62.8	125.66	4	12	10	15	9	37.5	427.7	7.7	0.025	11.70
28 41 050	4.0	502.7	40	39	39	35.0	3			Without mounting holes							–	0.025	11.70
28 40 100	4.0	1005.3	80	39	39	35.0	3	62.8	125.66	8	12	10	15	9	37.5	930.3	7.7	0.025	23.10
28 41 100	4.0	1005.3	80	39	39	35.0	3			Without mounting holes							–	0.025	23.10

Material 16Mn Cr5 (AISI 51L17), case-hardened teeth induction hardened to ~60 Rc; ground on all sides after hardening. Since only the teeth are induction-hardened, subsequent drilling and pinning is possible.

Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
28 50 055	5.0	502.6	32	49	39	34	3	62.8	125.66	4	12	14	20	13	30.1	442.4	11.7	0.025	14.74
28 51 055	5.0	502.6	32	49	39	34	3			Without mounting holes								0.025	14.74
28 50 105	5.0	1005.3	64	49	39	34	3	62.8	125.66	8	12	14	20	13	30.1	945.0	11.7	0.025	29.50
28 51 105	5.0	1005.3	64	49	39	34	3			Without mounting holes								0.025	29.50
28 60 055	6.0	508.9	27	59	49	43	3	63.6	127.23	4	16	18	26	17	31.4	446.1	15.7	0.026	22.90
28 61 055	6.0	508.9	27	59	49	43	3			Without mounting holes								0.026	22.90
28 60 105	6.0	1017.8	54	59	49	43	3	63.6	127.23	8	16	18	26	17	31.4	955.0	15.7	0.026	44.40
28 61 105	6.0	1017.8	54	59	49	43	3			Without mounting holes								0.026	44.40

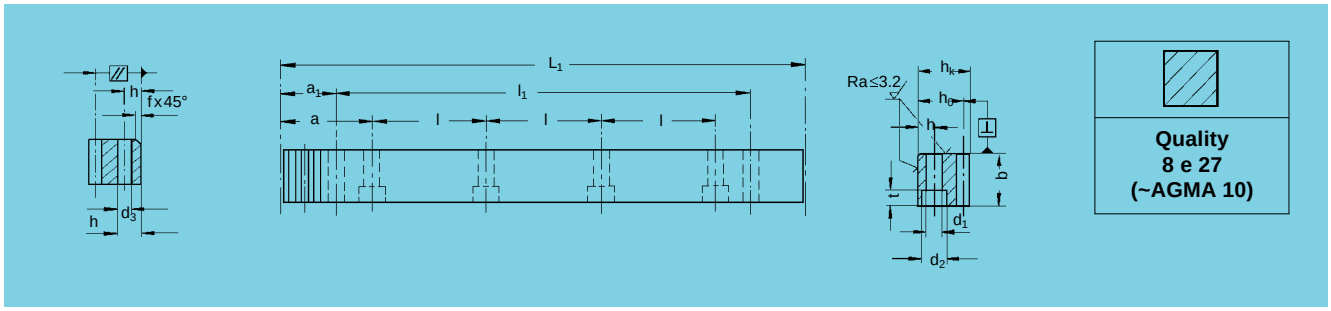
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi). Teeth induction-hardened to 50 – 55 Rc; ground on all sides after hardening. Since only teeth are induction-hardened, subsequent drilling and pinning is possible.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$). To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle



Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
33 21 050	2	502.65	80	25	24	22	2	62.83	125.66	4	8	7	11	7	31.3	440.1	5.7	0.044	4.84
33 20 050	2	502.65	80	25	24	22	2			Without mounting holes								0.044	4.84
33 21 100	2	1005.31	160	25	24	22	2	62.83	125.66	8	8	7	11	7	31.3	942.7	5.7	0.044	9.46
33 20 100	2	1005.31	160	25	24	22	2			Without mounting holes								0.044	9.46
33 31 050	3	508.94	54	30	29	26	2	63.62	127.23	4	9	10	15	9	34.4	440.1	7.7	0.046	6.82
33 30 050	3	508.94	54	30	29	26	2			Without mounting holes								0.046	6.82
33 31 100	3	1017.88	108	30	29	26	2	63.62	127.23	8	9	10	15	9	34.4	949.1	7.7	0.046	13.64
33 30 100	3	1017.88	108	30	29	26	2			Without mounting holes								0.046	13.64
33 41 050	4	502.65	40	40	39	35	2	62.83	125.66	4	12	10	15	9	37.5	427.7	7.7	0.048	12.10
33 40 050	4	502.65	40	40	39	35	3			Without mounting holes								0.048	12.10
33 41 100	4	1005.31	80	40	39	35	3	62.83	125.66	8	12	10	15	9	37.5	930.3	7.7	0.048	24.20
33 40 100	4	1005.31	80	40	39	35	3			Without mounting holes								0.048	24.20
33 51 050	5	502.65	32	49	39	34	3	62.83	125.66	4	12	14	20	13	30.2	442.3	11.7	0.050	15.00
33 50 050	5	502.65	32	49	39	34	3			Without mounting holes								0.050	15.00
33 51 100	5	1005.31	64	49	39	34	3	62.83	125.66	8	12	14	20	13	30.2	945.0	11.7	0.050	44.90
33 50 100	5	1005.31	64	49	39	34	3			Without mounting holes								0.050	44.90

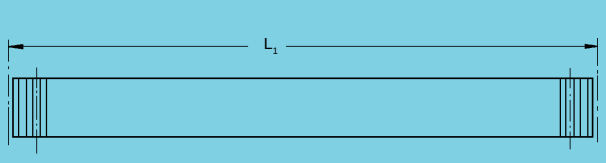
Material is high-quality, specially treated steel with a tensile strength of ~900 N/mm² (~130.6 kpsi). Back and contact faces of rack are ground.

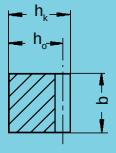
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

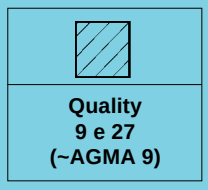
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$). To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
25 10 025	1	251.33	80	15	15	14												0.055	0.90
25 10 050	1	499.51	159	15	15	14												0.055	1.80
25 10 100	1	999.03	318	15	15	14												0.055	3.61
25 15 025	1.5	249.76	53	17	17	15.5												0.059	1.12
25 15 050	1.5	499.51	106	17	17	15.5												0.059	2.27
25 15 100	1.5	999.03	212	17	17	15.5												0.059	4.53
25 15 200	1.5	1998.05	424	17	17	15.5												0.059	9.04
25 20 025	2	251.33	40	20	20	18												0.059	1.56
25 20 050	2	502.65	80	20	20	18												0.059	3.10
25 20 100	2	999.03	159	20	20	18												0.061	6.18
25 20 150	2	1507.96	240	20	20	18												0.061	9.35
25 20 200	2	1998.05	318	20	20	18												0.061	12.36
25 20 300	2	3015.93	480	20	20	18												0.061	18.68
25 25 025	2.5	251.33	32	25	25	22.5												0.063	2.42
25 25 050	2.5	502.65	64	25	25	22.5												0.063	4.86
25 25 100	2.5	997.46	127	25	25	22.5												0.063	9.64
25 25 200	2.5	2002.77	255	25	25	22.5												0.063	19.36
25 30 025	3	254.47	27	30	30	27												0.065	3.54
25 30 051	3	508.94	54	30	30	27												0.065	7.08
25 30 101	3	1017.88	108	30	30	27												0.065	14.17
25 30 150	3	1526.81	162	30	30	27												0.065	21.30
25 30 201	3	2035.75	216	30	30	27												0.065	28.30
25 30 300	3	3053.63	324	30	30	27												0.065	42.50
25 40 025	4	251.33	20	40	40	36												0.068	6.23
25 40 050	4	502.65	40	40	40	36												0.068	12.43
25 40 100	4	1005.31	80	40	40	36												0.068	24.90
25 40 150	4	1507.96	120	40	40	36												0.068	43.90
25 40 201	4	2010.62	160	40	40	36												0.068	49.70
25 40 300	4	3015.93	240	40	40	36												0.068	74.70
25 50 025	5	251.33	16	50	40	35												0.070	7.57
25 50 050	5	502.65	32	50	40	35												0.070	15.11
25 50 100	5	1005.31	64	50	40	35												0.070	30.20
25 50 200	5	2010.62	128	50	40	35												0.070	60.50
25 60 051	6	508.94	27	60	50	44												0.072	23.10
25 60 101	6	1017.88	54	60	50	44												0.072	46.20
25 60 201	6	2035.75	108	60	50	44												0.072	92.30
25 80 100	8	1005.31	40	79.5	79.5	71.5												0.075	98.20
25 80 200	8	2010.62	80	79.5	79.5	71.5												0.075	196.40

Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
25 30 050	3	499.51	53	30	30	27												0.065	6.95
25 30 100	3	999.03	106	30	30	27												0.065	13.90
25 30 200	3	1998.05	212	30	30	27												0.065	27.80
25 40 200	4	1998.05	159	40	40	36												0.068	49.40
25 60 050	6	490.09	26	60	50	44												0.072	22.20
25 60 100	6	999.03	53	60	50	44												0.072	45.30
25 60 200	6	1998.05	106	60	50	44												0.072	90.60

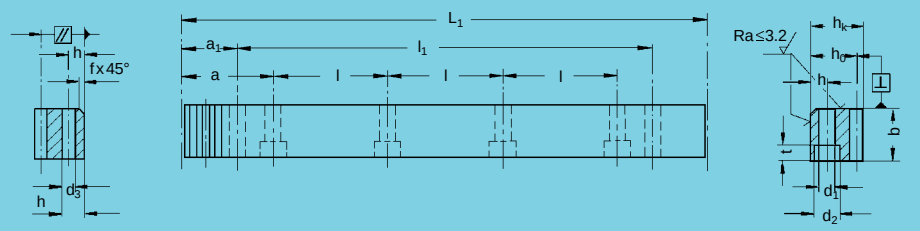
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi).

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth. 20° pressure angle



Quality 10 e 27 (~AGMA 8)

Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
34 20 050	2	502.65	80	24	24	22	2	62.83	125.66	4	8	7	11	7	31.3	440.1	5.7	0.086	4.62
34 21 050	2	502.65	80	24	24	22	2			Without mounting holes								0.086	4.62
34 20 100	2	1005.31	160	24	24	22	2	62.83	125.66	8	8	7	11	7	31.3	942.7	5.7	0.086	9.24
34 21 100	2	1005.31	160	24	24	22	2			Without mounting holes								0.086	9.24
34 20 200	2	2010.62	320	24	24	22	2	62.83	125.66	16	8	7	11	7	31.3	1948.0	5.7	0.086	18.48
34 21 200	2	2010.62	320	24	24	22	2			Without mounting holes								0.086	18.48
34 30 050	3	508.94	54	29	29	26	2	63.62	127.23	4	9	10	15	9	34.4	440.1	7.7	0.091	6.60
34 31 050	3	508.94	54	29	29	26	2			Without mounting holes								0.091	6.60
34 30 100	3	1017.88	108	29	29	26	2	63.62	127.23	8	9	10	15	9	34.4	949.1	7.7	0.091	13.20
34 31 100	3	1017.88	108	29	29	26	2			Without mounting holes								0.091	13.20
34 30 200	3	2035.75	216	29	29	26	2	63.62	127.23	16	9	10	15	9	34.4	1967	7.7	0.091	26.40
34 31 200	3	2035.75	216	29	29	26	2			Without mounting holes								0.091	26.40
34 40 050	4	502.65	40	39	39	35	3	62.83	125.66	4	12	10	15	9	37.5	427.7	7.7	0.095	11.66
34 41 050	4	502.65	40	39	39	35	3			Without mounting holes								0.095	11.66
34 40 100	4	1005.31	80	39	39	35	3	62.83	125.66	8	12	10	15	9	37.5	930.3	7.7	0.095	22.40
34 41 100	4	1005.31	80	39	39	35	3			Without mounting holes								0.095	22.40
34 40 200	4	2010.62	160	39	39	35	3	62.83	125.66	16	12	10	15	9	37.5	1935.6	7.7	0.095	45.10
34 41 200	4	2010.62	160	39	39	35	3			Without mounting holes								0.095	45.10
34 50 050	5	502.65	32	49	39	34	3	62.83	125.66	4	12	14	20	13	30.2	442.3	11.7	0.098	15.20
34 51 050	5	502.65	32	49	39	34	3			Without mounting holes								0.098	15.20
34 50 100	5	1005.31	64	49	39	34	3	62.83	125.66	8	12	14	20	13	30.2	945.0	11.7	0.098	30.40
34 51 100	5	1005.31	64	49	39	34	3			Without mounting holes								0.098	30.40
34 50 200	5	2010.62	128	49	39	34	3	62.83	125.66	16	12	14	20	13	30.2	1950.3	11.7	0.098	60.50
34 51 200	5	2010.62	128	49	39	34	3			Without mounting holes								0.098	60.50
34 60 050	6	508.94	27	59	49	43	3	63.62	127.23	4	16	18	26	17	31.4	446.1	15.7	0.100	23.10
34 61 050	6	508.94	27	59	49	43	3			Without mounting holes								0.100	23.10
34 60 100	6	1017.88	54	59	49	43	3	63.62	127.23	8	16	18	26	17	31.4	955.0	15.7	0.100	46.20
34 61 100	6	1017.88	54	59	49	43	3			Without mounting holes								0.100	46.20
34 60 200	6	2035.75	108	59	49	43	3	63.62	127.23	16	16	18	26	17	31.4	1972.9	15.7	0.100	92.40
34 61 200	6	2035.75	108	59	49	43	3			Without mounting holes								0.100	92.40

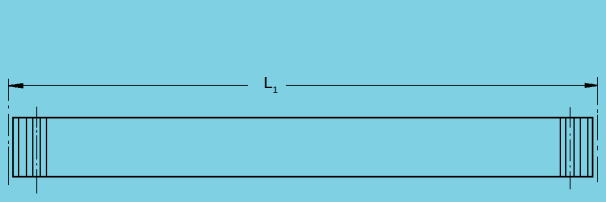
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi). Teeth induction-hardened to 50 – 55 Rc; Back and contact faces of rack are ground after hardening. Since only teeth are induction-hardened, subsequent drilling and pinning is possible.

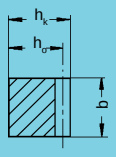
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

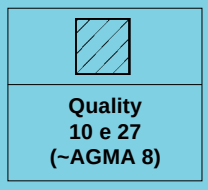
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$). To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth. 20° pressure angle







Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 1)	Wt. (lb)
27 10 025	1	251.33	80	15	15	14												0.078	0.90
27 10 050	1	499.51	159	15	15	14												0.078	1.80
27 10 100	1	999.03	318	15	15	14												0.078	3.61
27 15 025	1.5	249.76	53	17	17	15.5												0.082	1.12
27 15 050	1.5	499.51	106	17	17	15.5												0.082	2.27
27 15 100	1.5	999.03	212	17	17	15.5												0.082	4.53
27 15 200	1.5	1998.05	424	17	17	15.5												0.082	9.04
27 20 025	2	251.33	40	20	20	18												0.082	1.56
27 20 050	2	502.65	80	20	20	18												0.082	3.10
27 20 100	2	999.03	159	20	20	18												0.086	6.18
27 20 150	2	1507.96	240	20	20	18												0.086	9.35
27 20 200	2	1998.05	318	20	20	18												0.086	12.36
27 20 300	2	3015.93	480	20	20	18												0.086	18.68
27 25 025	2.5	251.33	32	25	25	22.5												0.063	2.42
27 25 050	2.5	502.65	64	25	25	22.5												0.063	4.86
27 25 100	2.5	997.46	127	25	25	22.5												0.063	9.64
27 25 200	2.5	2002.77	255	25	25	22.5												0.063	19.36
27 30 025	3	254.47	27	30	30	27												0.091	3.54
27 30 051	3	508.94	54	30	30	27												0.091	7.08
27 30 101	3	1017.88	108	30	30	27												0.091	14.17
27 30 150	3	1526.81	162	30	30	27												0.091	21.30
27 30 201	3	2035.75	216	30	30	27												0.091	28.30
27 30 300	3	3053.63	324	30	30	27												0.091	42.50
27 40 025	4	251.33	20	40	40	36												0.095	6.23
27 40 050	4	502.65	40	40	40	36												0.095	12.43
27 40 100	4	1005.31	80	40	40	36												0.095	24.90
27 40 150	4	1507.96	120	40	40	36												0.095	43.90
27 40 201	4	2010.62	160	40	40	36												0.095	49.70
27 40 300	4	3015.93	240	40	40	36												0.095	74.70
27 50 025	5	251.33	16	50	40	35												0.098	7.57
27 50 050	5	502.65	32	50	40	35												0.098	15.11
27 50 100	5	1005.31	64	50	40	35												0.098	30.20
27 50 200	5	2010.62	128	50	40	35												0.098	60.50
27 60 051	6	508.94	27	60	50	44												0.100	23.10
27 60 101	6	1017.88	54	60	50	44												0.100	46.20
27 60 201	6	2035.75	108	60	50	44												0.100	92.30
27 80 100	8	1005.31	40	79.5	79.5	71.5												0.100	98.20
27 80 200	8	2010.62	80	79.5	79.5	71.5												0.100	196.40

Order code	Module	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300	Wt. (lb)
27 30 050	3	499.51	53	30	30	27												0.091	6.95
27 30 100	3	999.03	106	30	30	27												0.091	13.90
27 30 200	3	1998.05	212	30	30	27												0.091	27.80
27 40 200	4	1998.05	159	40	40	36												0.095	49.40
27 60 050	6	490.09	26	60	50	44												0.100	22.20
27 60 100	6	999.03	53	60	50	44												0.100	45.30
27 60 200	6	1998.05	106	60	50	44												0.100	90.60

Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm^2 (~94.3 kpsi). Teeth induction-hardened to 50 – 55 Rc.

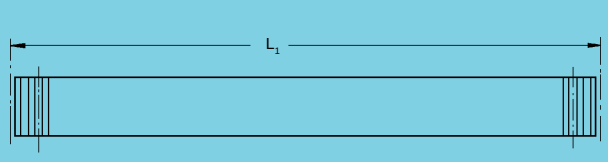
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

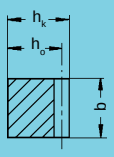
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle

EDELSTAHL Rost frei





Quality
8 e 27
(~AGMA 10)

Order code	L_1	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
Modul / Module **1**																		
36 00 050	499.5	159	10	10	9.0	–	–	–	–	–	–	–	–	–	–	–	0.040	0.88
36 00 100	999.0	318	10	10	9.0	–	–	–	–	–	–	–	–	–	–	–	0.040	1.54
Modul / Module **1.5**																		
36 01 050	499.5	106	15	15	13.5	–	–	–	–	–	–	–	–	–	–	–	0.042	1.716
36 01 100	999.0	212	15	15	13.5	–	–	–	–	–	–	–	–	–	–	–	0.042	3.41
Modul / Module **2**																		
36 02 050	502.6	80	20	20	18.0	–	–	–	–	–	–	–	–	–	–	–	0.044	3.08
36 02 100	999.0	159	20	20	18.0	–	–	–	–	–	–	–	–	–	–	–	0.044	6.16
36 02 200	1998.0	318	20	20	18.0	–	–	–	–	–	–	–	–	–	–	–	0.044	12.32
Modul / Module **3**																		
36 04 050	499.5	53	30	30	27.0	–	–	–	–	–	–	–	–	–	–	–	0.046	6.82
36 04 100	999.0	106	30	30	27.0	–	–	–	–	–	–	–	–	–	–	–	0.046	13.64
36 04 200	1998.0	212	30	30	27.0	–	–	–	–	–	–	–	–	–	–	–	0.046	27.50

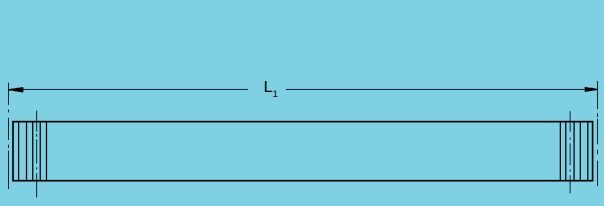
Material X 8 CrNi S 18-9 (AISI 303 Stainless).

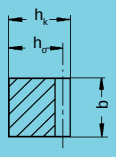
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

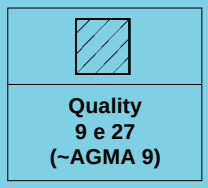
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







Order code	Module m	L_1	No. of teeth z	b	h_K	h_0	a	l	h	d_1	d_2	$GT_f/300$ [1]	Wt. (lb)
5 mm Circular Pitch													
37 06 025	1.591	250	50	15	14.8	13.2	–	–	–	–	–	0.059	0.858
37 06 050	1.591	500	100	15	14.8	13.2	–	–	–	–	–	0.059	1.716
37 06 100	1.591	1000	200	15	14.8	13.2	–	–	–	–	–	0.059	3.41
10 mm Circular Pitch													
37 08 025	3.183	250	25	30	29.7	26.5	–	–	–	–	–	0.065	3.41
37 08 050	3.183	500	50	30	29.7	26.5	–	–	–	–	–	0.065	6.82
37 08 100	3.183	1000	100	30	29.7	26.5	–	–	–	–	–	0.065	13.64
37 08 200	3.183	2000	200	30	29.7	26.5	–	–	–	–	–	0.065	27.30

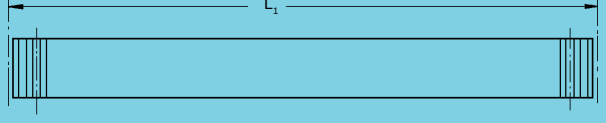
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi).

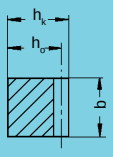
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

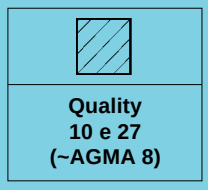
1) $GT_f/300$ = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







Order code	L_1	No. of teeth z	b	h_K	h_0	a	l	h	d_1	d_2	$GT_f/300$ [1]	Wt. (lb)
Module 1 mm												
26 10 025	251.3	80	15	15	14.0	–	–	–	–	–	0.078	0.176
26 10 050	499.5	159	15	15	14.0	–	–	–	–	–	0.078	0.33
26 10 100	999.0	318	15	15	14.0	–	–	–	–	–	0.078	0.66
Module 1.5 mm												
26 15 025	249.8	53	17	17	15.5	–	–	–	–	–	0.082	0.198
26 15 050	499.5	106	17	17	15.5	–	–	–	–	–	0.082	0.40
26 15 100	999.0	212	17	17	15.5	–	–	–	–	–	0.082	0.79
Module 2 mm												
26 20 025	251.3	40	20	20	18.0	–	–	–	–	–	0.086	0.286
26 20 050	502.7	80	20	20	18.0	–	–	–	–	–	0.086	0.55
26 20 100	999.0	159	20	20	18.0	–	–	–	–	–	0.086	1.10
Module 2.5 mm												
26 25 025	251.3	32	25	25	22.5	–	–	–	–	–	0.088	0.33
26 25 050	502.7	64	25	25	22.5	–	–	–	–	–	0.088	0.66
26 25 100	997.5	127	25	25	22.5	–	–	–	–	–	0.088	1.32
Module 3 mm												
26 30 025	254.5	27	30	30	27.0	–	–	–	–	–	0.091	0.44
26 30 050	499.5	53	30	30	27.0	–	–	–	–	–	0.091	0.88
26 30 100	999.0	106	30	30	27.0	–	–	–	–	–	0.091	1.76

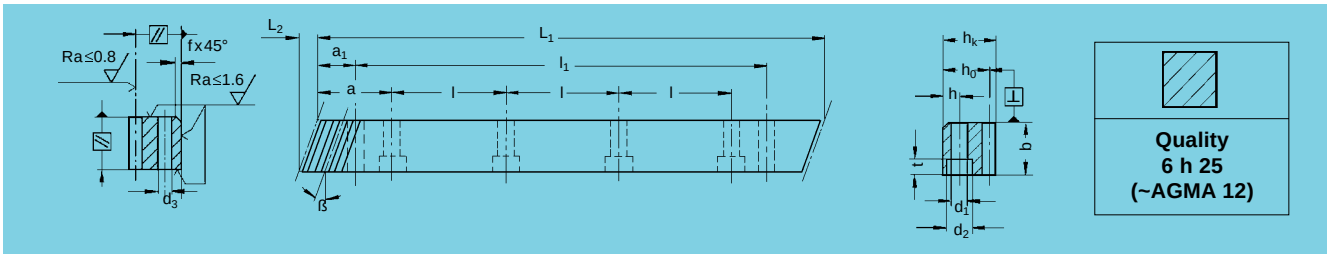
Material plastic POM. This material is particularly suitable for racks because deformations due to temperature fluctuations and/or moisture absorption are minimal and its surface hardness and tensile strength are very high. Chemical resistance data are located in our main catalog.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

1) $GT_f/300$ = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \bullet \pi \bullet z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Helical Racks,

19° 31’ 42” right-hand, hardened & ground teeth, 20° pressure angle



Order code	Module	L_1	L_2	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
29 20 050	2	500.00	8.5	75	24	24	22	2	62.50	125	4	8	7	11	7	31.7	436.6	5.7	0.022	4.62
29 21 050	2	500.00	8.5	75	24	24	22	2			Without mounting holes								0.022	4.62
29 20 100	2	1000.00	8.5	150	24	24	22	2	62.50	125	8	8	7	11	7	31.7	936.6	5.7	0.022	9.02
29 21 100	2	1000.00	8.5	150	24	24	22	2			Without mounting holes								0.022	9.02
29 20 999	2	200.00	8.5	30	24	24	22				Assembly Companion Rack									1.87
29 30 050	3	500.00	10.3	50	29	29	26	2	62.50	125	4	9	10	15	9	35	430.0	7.7	0.024	6.38
29 31 050	3	500.00	10.3	50	29	29	26	2			Without mounting holes								0.024	6.38
29 30 100	3	1000.00	10.3	100	29	29	26	2	62.50	125	8	9	10	15	9	35	930.0	7.7	0.024	12.98
29 31 100	3	1000.00	10.3	100	29	29	26	2			Without mounting holes								0.024	12.98
29 30 999	3	200.00	10.3	20	29	29	26				Assembly Companion Rack									2.64
29 40 050	4	506.67	13.8	38	39	39	35	3	62.50	125	4	12	10	15	9	33.3	433.0	7.7	0.024	11.88
29 41 050	4	506.67	13.8	38	39	39	35	3			Without mounting holes								0.024	11.88
29 40 100	4	1000.00	13.8	75	39	39	35	3	62.50	125	8	12	10	15	9	33.3	933.4	7.7	0.024	23.50
29 41 100	4	1000.00	13.8	75	39	39	35	3			Without mounting holes								0.024	23.50
29 40 999	4	200.00	13.8	15	39	39	35				Assembly Companion Rack									5.94

Material 16Mn Cr5 (AISI 51L17), case-hardened teeth induction hardened to ~60 Rc; ground on all sides after hardening. Since only the teeth are induction-hardened, subsequent drilling and pinning is possible.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length. Assembly companion rack (29 .. 999) has matching left-hand helix angle to aid assembly of racks end-to-end.

Order code	Module	L_1	L_2	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
29 50 055	5	500.00	17.4	30	49	39	34	3	62.50	125	4	12	14	20	13	37.5	425.0	11.7	0.025	14.30
29 51 055	5	500.00	17.4	30	49	39	34	3			Without mounting holes								0.025	14.30
29 50 105	5	1000.00	17.4	60	49	39	34	3	62.50	125	8	12	14	20	13	37.5	925.0	11.7	0.025	28.60
29 51 105	5	1000.00	17.4	60	49	39	34	3			Without mounting holes								0.025	28.60
29 50 999	5	200.00	17.4	12	49	39	34				Assembly Companion Rack									6.60
29 60 055	6	500.00	20.9	25	59	49	43	3	62.50	125	4	16	18	26	17	37.5	425.0	15.7	0.026	21.80
29 61 055	6	500.00	20.9	25	59	49	43	3			Without mounting holes								0.026	21.80
29 60 105	6	1000.00	20.9	50	59	49	43	3	62.50	125	8	16	18	26	17	37.5	925.0	15.7	0.026	43.60
29 61 105	6	1000.00	20.9	50	59	49	43	3			Without mounting holes								0.026	43.60
29 60 999	6	200.00	20.9	10	59	49	43				Assembly Companion Rack									9.68
29 80 055	8	480.00	28.0	18	79	79	71	3	60.00	120	4	25	22	33	21	120.0	240.0	19.7	0.027	46.20
29 81 055	8	480.00	28.0	18	79	79	71	3			Without mounting holes								0.027	46.20
29 80 105	8	960.00	28.0	36	79	79	71	3	60.00	120	8	25	22	33	21	120.0	720.0	19.7	0.027	93.50
29 81 105	8	960.00	28.0	36	79	79	71	3			Without mounting holes								0.027	93.50
29 80 999	8	213.33	28.0	8	79	79	71				Assembly Companion Rack									20.90

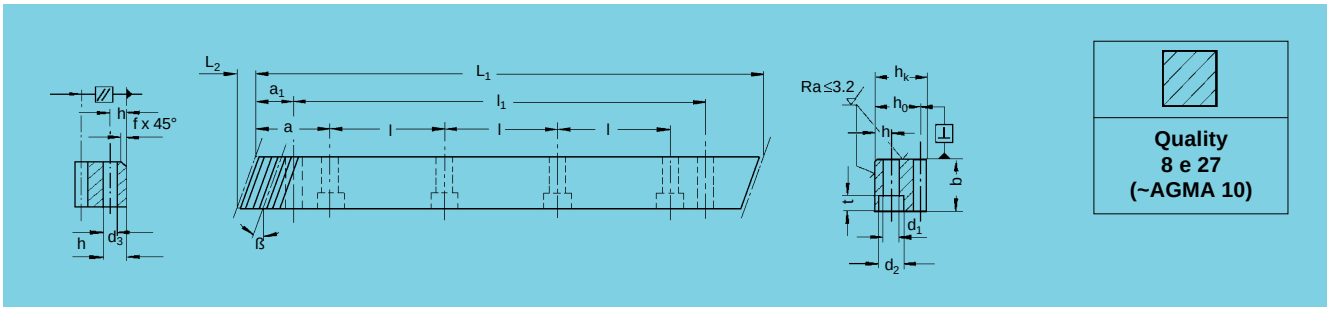
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi). Teeth induction-hardened to 50 – 55 Rc; ground on all sides after hardening. Since only the teeth are induction-hardened, subsequent drilling and pinning is possible.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length. Assembly companion rack (29 .. 999) has matching left-hand helix angle to aid assembly of racks end-to-end.

1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$). To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Helical Racks,

19° 31’ 42” right-hand, milled teeth, 20° pressure angle



Order code	Module	L_1	L_2	No. of teeth	b	h_k	h_o	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
38 21 050	2	500.00	8.9	75	25	24	22	2	62.50	125	4	8	7	11	7	31.7	436.6	5.7	0.044	4.62
38 20 050	2	500.00	8.9	75	25	24	22	2			Without mounting holes								0.044	4.62
38 21 100	2	1000.00	8.9	150	25	24	22	2	62.50	125	8	8	7	11	7	31.7	936.6	5.7	0.044	9.46
38 20 100	2	1000.00	8.9	150	25	24	22	2			Without mounting holes								0.044	9.46
29 20 999	2	200.00	8.8	30	25	24	22				Assembly Companion Rack									1.87
38 31 050	3	500.00	10.6	50	30	29	26	2	62.50	125	4	9	10	15	9	35.0	430.0	7.7	0.046	6.60
38 30 050	3	500.00	10.6	50	30	29	26	2			Without mounting holes								0.046	6.60
38 31 100	3	1000.00	10.6	100	30	29	26	2	62.50	125	8	9	10	15	9	35.0	930.0	7.7	0.046	13.42
38 30 100	3	1000.00	10.6	100	30	29	26	2			Without mounting holes								0.046	13.42
29 30 999	3	200.00	10.6	20	30	29	26				Assembly Companion Rack									2.64
38 41 050	4	506.67	14.2	38	40	39	35	2	62.50	125	4	12	10	15	9	33.3	433.0	7.7	0.048	12.10
38 40 050	4	506.67	14.2	38	40	39	35	2			Without mounting holes								0.048	12.10
38 41 100	4	1000.00	14.2	75	40	39	35	2	62.50	125	8	12	10	15	9	33.3	933.4	7.7	0.048	24.00
38 40 100	4	1000.00	14.2	75	40	39	35	2			Without mounting holes								0.048	24.00
29 40 999	4	200.00	14.2	15	40	39	35				Assembly Companion Rack									5.94
38 51 050	5	500.00	17.4	30	50	39	34	3	62.50	125	4	12	14	20	13	37.5	425.0	11.7	0.050	14.30
38 50 050	5	500.00	17.4	30	50	39	34	3			Without mounting holes								0.050	14.30
38 51 100	5	1000.00	17.4	60	50	39	34	3	62.50	125	8	12	14	20	13	37.5	925.0	11.7	0.050	28.60
38 50 100	5	1000.00	17.4	60	50	39	34	3			Without mounting holes								0.050	28.60
29 50 999	5	200.00	17.4	12	49	39	34				Assembly Companion Rack									6.60

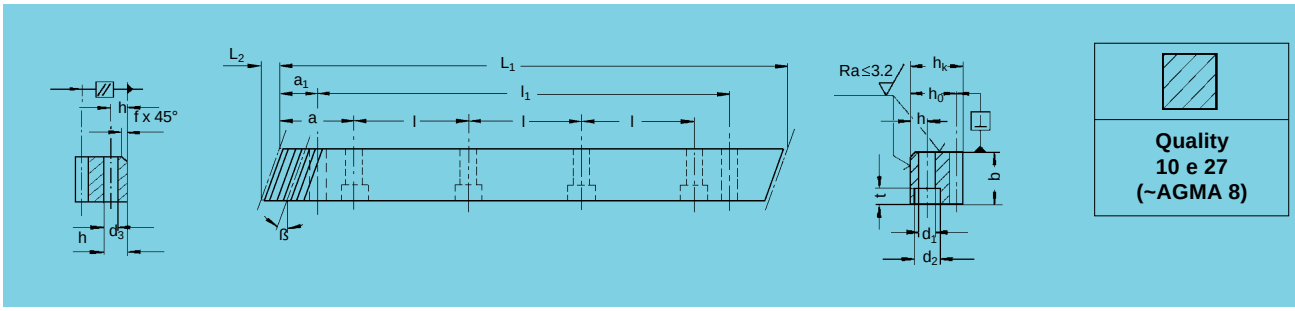
Material is high-quality, specially treated steel with a tensile strength of ~900 N/mm² (~130.6 kpsi). Back and contact faces of rack are ground.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length. Assembly companion rack (29 .. 999) has matching left-hand helix angle to aid assembly of racks end-to-end.

1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Helical Racks,

19° 31’ 42” right-hand, milled teeth, 20° pressure angle



Order code	Module	L_1	L_2	No. of teeth	b	h_k	h_0	f	a	l	No. of holes	h	d_1	d_2	t	a_1	l_1	d_3	GT_f /300 [1]	Wt. (lb)
39 20 050	2	500.00	8.5	75	24	24	22	2	62.50	125	4	8	7	11	7	31.7	436.6	5.7	0.086	4.62
39 21 050	2	500.00	8.5	75	24	24	22	2			Without mounting holes								0.086	4.62
39 20 100	2	1000.00	8.5	150	24	24	22	2	62.50	125	8	8	7	11	7	31.7	936.6	5.7	0.086	9.24
39 21 100	2	1000.00	8.5	150	24	24	22	2			Without mounting holes								0.086	9.24
29 20 999	2	200.00	8.5	30	24	24	22				Assembly Companion Rack									1.87
39 30 050	3	500.00	10.3	50	29	29	26	2	62.50	125	4	9	10	15	9	35.0	430.0	7.7	0.091	6.60
39 31 050	3	500.00	10.3	50	29	29	26	2			Without mounting holes								0.091	6.60
39 30 100	3	1000.00	10.3	100	29	29	26	2	62.50	125	8	9	10	15	9	35.0	930.0	7.7	0.091	13.20
39 31 100	3	1000.00	10.3	100	29	29	26	2			Without mounting holes								0.091	13.20
29 30 999	3	200.00	10.3	20	29	29	26				Assembly Companion Rack									2.64
39 40 050	4	506.67	13.8	38	39	39	35	3	62.50	125	4	12	10	15	9	33.3	433.0	7.7	0.095	11.66
39 41 050	4	506.67	13.8	38	39	39	35	3			Without mounting holes								0.095	11.66
39 40 100	4	1000.00	13.8	75	39	39	35	3	62.50	125	8	12	10	15	9	33.3	933.4	7.7	0.095	23.10
39 41 100	4	1000.00	13.8	75	39	39	35	3			Without mounting holes								0.095	23.10
29 40 999	4	200.00	13.8	15	39	39	35				Assembly Companion Rack									5.94
39 50 050	5	500.00	17.4	30	49	39	34	3	62.50	125	4	12	14	20	13	37.5	425.0	11.7	0.098	14.30
39 51 050	5	500.00	17.4	30	49	39	34	2			Without mounting holes								0.098	14.30
39 50 100	5	1000.00	17.4	60	49	39	34	3	62.50	125	8	12	14	20	13	37.5	925.0	11.7	0.098	28.60
39 51 100	5	1000.00	17.4	60	49	39	34	2			Without mounting holes								0.098	28.60
29 50 999	5	200.00	17.4	12	49	39	34				Assembly Companion Rack									6.60
39 60 050	6	500.00	20.9	25	59	49	43	3	62.50	125	4	16	18	26	17	37.5	425.0	15.7	0.100	21.80
39 61 050	6	500.00	20.9	25	59	49	43	2			Without mounting holes								0.100	21.80
39 60 100	6	1000.00	20.9	50	59	49	43	3	62.50	125	8	16	18	26	17	37.5	925.0	15.7	0.100	43.60
39 61 100	6	1000.00	20.9	50	59	49	43	2			Without mounting holes								0.100	43.60
29 60 999	6	200.00	20.9	10	59	49	43				Assembly Companion Rack									9.68

Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi). Teeth induction-hardened to 50 – 55 Rc; Back and contact faces of rack are ground after hardening. Since only the teeth are induction-hardened, subsequent drilling and pinning is possible.

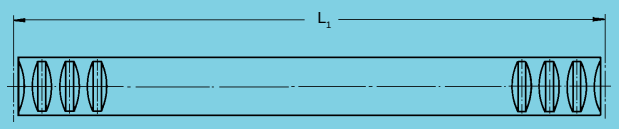
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length. Assembly companion rack (29 .. 999) has matching left-hand helix angle to aid assembly of racks end-to-end.

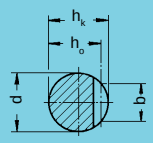
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

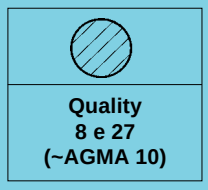
Straight Racks,

milled teeth, 20° pressure angle

EDELSTAHL Rost frei







Order code	L_1	No. of teeth z	Ø d_{h9}	b	h_K	h_0	GT_f /300 [1]	Wt. (lb)
Module 1								
36 90 050	499.5	159	10	6.0	9.9	8.9	0.040	1.45
36 90 100	999.0	318	10	6.0	9.9	8.9	0.040	2.97
Module 1.5								
36 91 050	499.5	106	15	9.0	14.9	13.4	0.042	1.85
36 91 100	999.0	212	15	9.0	14.9	13.4	0.042	3.74
Module 2								
36 92 050	502.6	80	20	12.0	19.8	17.8	0.044	2.42
36 92 100	999.0	159	20	12.0	19.8	17.8	0.044	4.84
Module 3								
36 94 050	499.5	53	30	18.0	29.8	26.8	0.046	5.50
36 94 100	999.0	106	30	18.0	29.8	26.8	0.046	11.22

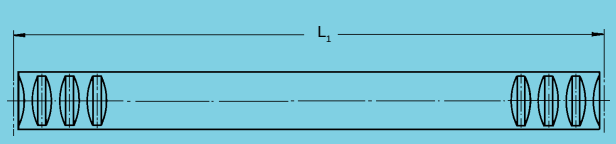
Material X 8 CrNi S 18-9 (AISI 303 Stainless), outside diameter $Ø_{h9}$. Also see our guide bushings on page 60.

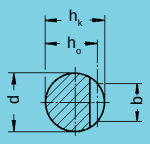
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

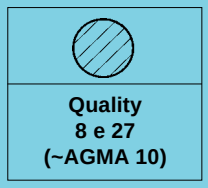
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







Order code	L_1	No. of teeth z	Ø d_{h9}	b	h_K	h_0	GT_f /300 [1]	Wt. (lb)
Module 1								
35 11 050	499.5	159	10	6.0	10	9.0	0.040	1.45
35 11 100	999.0	318	10	6.0	10	9.0	0.040	2.97
Module 1.5								
35 16 050	499.5	106	15	10.0	15	13.5	0.042	1.85
35 16 100	999.0	212	15	10.0	15	13.5	0.042	3.74
Module 2								
35 21 050	502.7	80	20	12.0	20	18.0	0.044	2.42
35 21 100	999.0	159	20	12.0	20	18.0	0.044	4.84
Module 3								
35 31 050	499.5	53	30	18.0	30	27.0	0.046	5.50
35 31 100	999.0	106	30	18.0	30	27.0	0.046	11.22
Module 4								
35 41 050	502.6	40	40	24.0	40	36.0	0.048	9.90
35 41 100	1005.3	80	40	24.0	40	36.0	0.048	20.00

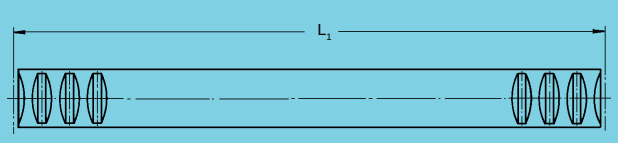
Material is high-quality, specially treated steel with a tensile strength of ~950 N/mm² (~137.8 kpsi), outside diameter $Ø_{h6}$. Also see our guide bushings on page 60.

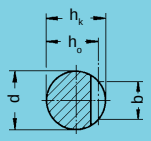
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

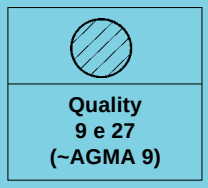
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







Order code	L_1	No. of teeth z	Ø d_{h9}	b	h_K	h_0	GT_f /300 [1]	Wt. (lb)
Module 1								
35 10 025	251.3	80	15	7.5	15	14.0	0.056	0.75
35 10 050	499.5	159	15	7.5	15	14.0	0.056	1.45
35 10 100	999.0	318	15	7.5	15	14.0	0.056	2.97
Module 1.5								
35 15 025	249.8	53	17	9.6	17	15.5	0.059	0.92
35 15 050	499.5	106	17	9.6	17	15.5	0.059	1.85
35 15 100	999.0	212	17	9.6	17	15.5	0.059	3.74
Module 2								
35 20 025	251.3	40	20	12.0	20	18.0	0.064	1.21
35 20 050	502.7	80	20	12.0	20	18.0	0.064	2.42
35 20 100	999.0	159	20	12.0	20	18.0	0.064	4.84
Module 2.5								
35 25 025	251.3	32	25	15.0	25	22.5	0.063	1.98
35 25 050	502.7	64	25	15.0	25	22.5	0.063	3.96
35 25 100	997.5	127	25	15.0	25	22.5	0.063	7.92
Module 3								
35 30 025	254.5	27	30	18.0	30	27.0	0.065	2.86
35 30 050	499.5	53	30	18.0	30	27.0	0.065	5.50
35 30 100	999.0	106	30	18.0	30	27.0	0.065	11.22
Module 4								
35 40 025	251.3	20	40	24.0	40	36.0	0.068	5.06
35 40 050	502.6	40	40	24.0	40	36.0	0.068	9.90
35 40 100	1005.3	80	40	24.0	40	36.0	0.068	20.00
Module 5								
35 50 025	251.3	16	50	30.0	50	45.0	0.070	8.36
35 50 050	502.6	32	50	30.0	50	45.0	0.070	15.62
35 50 100	1005.3	64	50	30.0	50	45.0	0.070	31.50

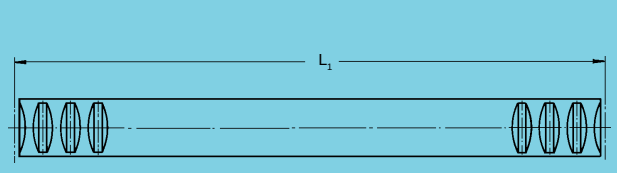
Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi), outside diameter $Ø_{h11}$. Also see our guide bushings on page 60.

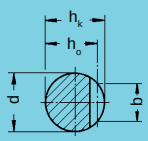
Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

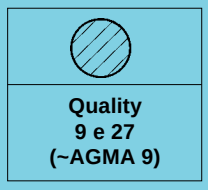
1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$). To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Straight Racks,

milled teeth, 20° pressure angle







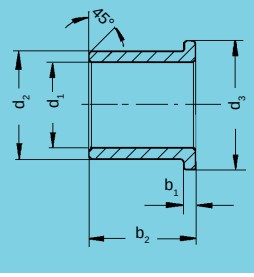
Order code	Module m	L_1	No. of teeth z	Ø d_{h11}	b	h_K	h_0	GT_f /300 [1]	Wt. (lb)
5 mm Circular Pitch									
37 96 050	1.591	500	100	15	9.6	14.8	13.2	0.059	1.87
37 96 100	1.591	1000	200	15	9.6	14.8	13.2	0.059	3.74
10 mm Circular Pitch									
37 98 050	3.183	500	50	30	18.0	29.7	26.5	0.074	5.50
37 98 100	3.183	1000	100	30	18.0	29.7	26.5	0.074	11.22

Material C45k (AISI 10L45) carbon steel with a tensile strength of ~650 N/mm² (~94.3 kpsi), outside diameter $Ø_{h11}$. Also see our guide bushings below.

Ends of racks are designed so that several racks can be mounted end-to-end to obtain any desired length.

Guide Bushings,

made of sintered bronze, filled with solid lubricant MoS_2 and therefore practically maintenance free.



Order code	d_1^{G7}	$d_{2\ r6}$	d_3	b_1	b_2	Wt. (lb)
80 35 010	10	16	22	3	16	0.037
80 35 015	15	21	26	3	16	0.055
80 35 020	20	26	32	3	25	0.092
80 35 030	30	38	46	4	30	0.253
80 35 040	40	50	60	5	50	0.594
80 35 050	50	60	70	5	63	1.276

1) GT_f /300 = total pitch deviation (per 300 mm) of measure length of the rack compared to the theoretical length L_{300}, with $L_{300} = (m / \cos ß) \cdot \pi \cdot z_{300}$).
To insure continuous lubrication of rack and pinion drives, we recommend to use automatic lubricators as described on page 69!

Maximum permissible torques in lb.ft. [1)]
based on pitting and bending strength of teeth with good grease lubrication (i.e. use of automatic lubricator described on page 69 or manual lubrication at least once a day), linear speed v = 60 inches per second, with rigid support of the pinion on one side and 1.0 safety factor.

[1)] for keyway connection of pinion, the maximum keyway torque must be checked, see page 65.

Module 1

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 10 ... / 36 00 ... 35 10 ... / 36 90 ...[2)]		35 11 ...[2)]		27 10 ...					26 10 ...
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 10 ... 06 10 ...	21 10 ...*	21 10 ...*		21 10 ...*					22 10 ...
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	15.0	0.33	1.33	1.99		2.21					0.07
17	17.0	0.48	1.84	2.95		4.57					0.11
18	18.0	0.66	2.07	3.39		5.97					0.13
20	20.0	0.96	2.73	4.43		9.59					0.15
22	22.0	1.40	3.91	6.12		12.54					0.22
25	25.0	2.43	4.94	8.11		16.23					0.37
28	28.0	3.69	5.61	10.33		17.70					0.59
32	32.0	5.90	9.59	14.75		20.65					0.96
36	36.0	8.11	11.06	18.44		23.60					1.25
40	40.0	11.80	16.23	23.60		28.03					1.84

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

Module 1.5

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 15 ... / 36 01 ... 35 15 ... / 36 91 ...[2)]		35 16 ...[2)]		27 15 ...					26 15 ...
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 15 ... 06 15 ...	21 15 ...*	21 15 ...*		21 15 ...*					22 15 ...
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	22.5	0.81	1.70	2.36		5.82					0.22
17	25.5	1.18	2.36	3.32		11.80					0.29
18	27.0	1.62	3.32	4.79		15.48					0.37
20	30.0	2.36	4.79	6.71		23.6					0.44
22	33.0	3.69	7.38	11.06		33.9					0.66
25	37.5	7.38	14.75	22.1		44.2					0.96
28	42.0	9.59	18.44	28.7		47.9					1.70
32	48.0	14.75	28.0	39.1		55.3					2.95
36	54.0	20.7	33.2	46.5		59.7					3.69
40	60.0	29.5	50.2	70.0		79.6					5.16

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

* Standard 21 series pinions, but induction hardened.

Maximum permissible torques in lb.ft. [1)]
based on pitting and bending strength of teeth with good grease lubrication (i.e. use of automatic lubricator described on page 69 or manual lubrication at least once a day), linear speed v = 60 inches per second, with rigid support of the pinion on one side and 1.0 safety factor.

[1)] for keyway connection of pinion, the maximum keyway torque must be checked, see page 65; for maximum torque of compression coupling connection, see page 28.

Module 2

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 20 ... / 36 02 ... 35 20 ... / 36 92 ...[2)]		33 20 ... 35 21...[2)]	38 20 ...	27 20... / 34 20 ... 34 21 ...		39 20 ... 39 21 ...	28 20 ... 28 21 ...	29 20 ... 29 21 ...	26 20...
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 20 ... 06 20 ...	21 20 ...* 24 2. 2.. 20 28/88 ...	21 20 ...* 24 2. 2.. 20 28/88 ...	24 2. 5.. 20 29 ... 20 89 ...	21 20 ...*	24 2. 2.. 20 28 ... 20 88 ...	24 2. 5.. 20 29 ... 20 89 ...	24 2. 2.. 20 28 ... 20 88 ...	24 2. 5.. 20 29 ... 20 89 ...	22 20 ...
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	30.0	3.32	10.32	16.21		22.1	66.3				0.44
17	34.0	5.75	14.75	21.4		31.0	84.8				0.66
18	36.0	7.38	16.95	24.3		36.9	88.4		99		0.81
20	42.44 40.0	10.33	20.6	31.7	33.9	55.3	102	106	118	134	0.88
22	44.0	14.01	24.3	38.3	43.5	66.3	107	114	131		1.33
25	53.05 50.0	19.90	35.4	50.1	53.8	94.3	125	133	148	168	2.21
28	59.41 56.0	24.3	47.2	60.4	64.9	103	136	145	166	184	3.69
30	63.66 60.0	32.4	54.5	73.8	77.4	112	146	157	176	199	
32	67.90 64.0	40.5	61.2	85.5	88.4	120	155	168	184	214	
36	76.39 72.0	55.3	87.7	103	111	128	170	184	210	236	
40	80.0	72.2	99.5	138	144	147	184	212	236	269	

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

Module 2.5

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 25 ... 35 25 ...[2)]				27 25 ...					26 25 ...
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 25 ...	21 25 ...*			21 25 ...*					22 25 ...
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	37.5	6.34	11.42			44.2					0.88
17	42.5	10.32	18.43			61.9					1.33
18	45.0	13.27	23.6			73.8					1.62
20	50.0	18.43	33.2			111					1.77
22	55.0	25.8	44.2			133					2.65
25	62.5	39.1	70.0			189					4.42
28	70.0	44.2	84.8			206					7.38
32	80.0	73.8	98.0			240					
36	90.0	99.5	158			258					
40	100.0	129	181			295					

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

* Standard 21 series pinions, but induction hardened.

Maximum permissible torques in lb.ft. [1)]
based on pitting and bending strength of teeth with good grease lubrication (i.e. use of automatic lubricator described on page 69 or manual lubrication at least once a day), linear speed v = 60 inches per second, with rigid support of the pinion on one side and 1.0 safety factor.

[1)] for keyway connection of pinion, the maximum keyway torque must be checked, see page 65; for maximum torque of compression coupling connection, see page 28.

Module 3

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 30... / 36 04.. / 37 08 35 30... / 36 94 ... / 37 98[2)]		33 30 ... 35 31...[2)]	38 30 ...	27 30 ... / 34 30 ... 34 31 ...		39 30 ... 39 31 ...	28 30 ... 28 31 ...	29 30 ... 29 31 ...	26 30 ...
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 30 ... 06 30 ...	21 30 ...* 24 3. 2.. 20 28/88 ...	21 30 ...* 24 3. 2.. 20 28/88 ...	24 3. 5.. 20 29 ... 20 89 ...	21 30...*	24 3. 2.. 20 28 ... 20 88 ...	24 3. 5.. 20 29 ... 20 89 ...	24 3. 2.. 20 28 ... 20 88 ...	24 3. 5.. 20 29 ... 20 89 ...	22 30 ...
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	45.0	9.59	30.2	46.4		64					1.33
17	51.0	15.48	51.6	73.8		109					1.92
18	54.0	25.8	59.7	89.2		129	273		295		3.32
20	63.66 60.0	33.9	67.8	102	107	158	287	302	310	372	4.57
22	70.03 66.0	48.6	84.8	125	134	225	302	317	346	391	8.11
25	79.57 75.0	71.5	124	173	181	324	346	361	391	446	11.06
28	84.0	95.8	151	210	217	357	380	409	442		
32	96.0	144	214	295	306	376	398	415	457		
36	108.0	200	271	377	387	473	494	516	568		
40	120.0	251	332	457	472	575	590	604	649		

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

Module 4

Rack Type		Soft		Quenched & Tempered		Induction Hardened			Hardened & Ground		Plastic
Rack Style		Straight		Straight	Helical	Straight		Helical	Straight	Helical	Straight
Rack Order code		25 40 ... 35 40 ... [2)]		33 40 ... 35 41...[2)]	38 40 ...	27 40 ... / 34 40 ... 34 41 ...		39 40 ... 39 41 ...	28 40 ... 28 41 ...	29 40 ... 29 41 ...	
Pinion Style		Soft	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Hardened	Plastic
Pinion Order code		21 40 ... 06 40 ...	21 40 ...* 24 4. 2.. 20 28/88 ...	21 40...* 24 4. 2.. 20 28/88 ...	24 4. 5.. 20 29 ... 20 89 ...	21 40...*	24 4. 2.. 20 28 ... 20 88 ...	24 4. 5.. 20 29 ... 20 89 ...	24 4. 2.. 20 28 ... 20 88 ...	24 4. 5.. 20 29 ... 20 89 ...	
No.of pinion teeth	Pitch Circle Diameter d Helical Straight										
15	63.66 40	29.5	95.8	140	151	162	479	494		568	
17	68	44.2	129	184	193	269	590	605	612		
18	84.88 72	62.6	147	214	225	332	642	664			
20	93.37 80	84.8	184	262	273	472	701	719	789	900	
22	106.10 88	122	221	317	328	656	774	811	885	988	
25	100	177	306	424	435	789	848	885	981	1129	
28	112	258	372	531	542	900	959	996	1106	1269	
32	128	361	516	709	726	1033	1099	1143	1254	1453	
36	144	501	663	884	944	1143	1210	1254			
40	160	627	811	1143	1217	1261	1401	1453	1475		

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

* Standard 21 series pinions, but induction hardened.

Maximum permissible torques in lb.ft. [1)]
based on pitting and bending strength of teeth with good grease lubrication (i.e. use of automatic lubricator described on page 69 or manual lubrication at least once a day), linear speed v = 60 inches per second, with rigid support of the pinion on one side and 1.0 safety factor.

[1)] for keyway connection of pinion, the maximum keyway torque must be checked, see page 65; for maximum torque of compression coupling connection, see page 28.

Module 5

Rack Type		**Soft**		**Quenched & Tempered**		**Induction Hardened**			**Hardened & Ground**	
Rack Style		**Straight**		**Straight**	**Helical**	**Straight**		**Helical**	**Straight**	**Helical**
Rack Order code		25 50 ... 35 50 ... [2)]		33 50 ... 35 51...[2)]	38 50 ... 38 51 ...	27 50 ... / 34 50 ... 34 51 ...		39 50 ... 39 51 ...	28 50 ... 28 51 ...	29 50 ... 29 51 ...
Pinion Style		**Soft**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**
Pinion Order code		21 50 ...	21 50 ...*	21 50 ...*	24 5. 5..	21 50...*	24 5. ... 20 28 ... 20 88 ...	24 5. ... 20 29 ... 20 89 ...	24 5. ... 20 28 ... 20 88 ...	24 5. ... 20 29 ... 20 89 ...
No.of pinion teeth	**Pitch Circle Diameter d** Helical	Straight								
12	63.66	60	36.9	111	140	221	207		664		774
13		65	44.3	133	170		243				
15	79.57	75	66.4	192	236		332	701	848	811	959
17		85	88.5	258	302		538				
18	95.49	90	118	295	339	479	668		1070		1217
19		95	140	332	384		789				
20		100	170	369	435		848				
21		105	207	413	472		1011	1070		1254	
22		110	243	450	524		1143				
24	127.32	120	317	546	620	885	1180	1239	1453		1623
25		125	361	590	679		1224	1291		1475	
30		150	590	885	996		1475				

[2)] For round 35 series rack, only 80 % of torque is transmittable due to reduced face width

Module 6

Rack Type		**Soft**		**Quenched & Tempered**		**Induction Hardened**			**Hardened & Ground**	
Rack Style		**Straight**		**Straight**	**Helical**	**Straight**		**Helical**	**Straight**	**Helical**
Rack Order code		25 60...				27 60... / 34 60 ... 34 61 ...		39 60 ... 39 61 ...	28 60 ... 28 61 ...	29 60 ... 29 61 ...
Pinion Style		**Soft**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**
Pinion Order code		21 60...	21 60...* .			21 60...*	24 6. ... 20 28 ... 20 88 ...	24 6. ... 20 29 ... 20 89 ...	24 6. ... 20 28 ... 20 88 ...	24 6. ... 20 29 ... 20 89 ...
No.of pinion teeth	**Pitch Circle Diameter d** Helical	Straight								
13	82.76	78						1070	1217	1254	1438
15		90	125	347			586				
19		114	266	483			1365				
20	127.32	120	317	597			1623		2065		2360
21		126	376	715			1807	2065		2213	
25	159.15	150	642	1033			2176	2287	2618	2655	3024

* Standard 21 series pinions, but induction hardened.

Maximum permissible torques in lb.ft. [1)]
based on pitting and bending strength of teeth with good grease lubrication (i.e. use of automatic lubricator described on page 69 or manual lubrication at least once a day), linear speed v = 60 inches per second, with rigid support of the pinion on one side and 1.0 safety factor.

[1)] for keyway connection of pinion, the maximum keyway torque must be checked, see below; for maximum torque of compression coupling connection, see page 28.

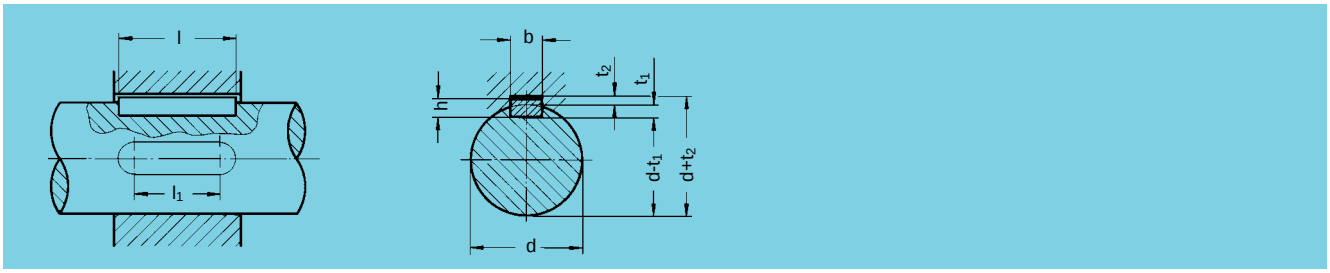
Module 8

Rack Type		**Soft**		**Quenched & Tempered**		**Induction Hardened**			**Hardened & Ground**		
Rack Style		**Straight**		**Straight**	**Helical**	**Straight**		**Helical**	**Straight**	**Helical**	
Rack Order code		25 80...				27 80...		39 80 ... 39 81 ...		29 80 ... 29 81 ...	
Pinion Style		**Soft**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	**Hardened**	
Pinion Order code		21 80...	21 80...* .			21 80...*		24 8. ...		24 8. ...	
No.of pinion teeth	**Pitch Circle Diameter d** Helical Straight										
12	96	170	516			774					
15	120	310	848			1401					
18	152.79							4426		5163	
20	160	774	1549			3319					
25	200	1549	2508			5532					

* Standard 21 series pinions, but induction hardened.

Torque Rating of Keyway Connections

The values in the table are based on a maximum permissible compressive stress of 100 N/mm² (14.5 kpsi) and a bearing length of l_1.



Key	**Shaft diameter**	**Shaft Keyway**	**Keyway**	**Maximum Transmittable Torque T_t in lb.ft., length of key l_1 in mm**								
b x h	d	b x t_1	b x t_2	10	16	20	28	40	50	70	100	140
3 x 3	8 ...10	3 x 1.8	3 x 1.4	3.7	6.6	8.9	11.1	16.2	19.2	28.0	39.8	55.3
4 x 4	10 ... 12	4 x 2.5	4 x 1.8	6.6	9.6	12.5	17.0	24.3	29.5	42.8	60.5	84.1
5 x 5	12 ...17	5 x 3.0	5 x 2.3	11.1	17.7	22.1	31.0	44.3	55.3	77.4	111	155
6 x 6	17 ... 22	6 x 3.5	6 x 2.8	18.4	29.5	36.9	51.6	73.8	92.2	129	184	258
8 x 7	22 ... 30	8 x 4.0	8 x 3.3	28.8	46.5	57.5	80.4	116	144	201	288	402
10 x 8	30 ... 38	10 x 5.0	10 x 3.3	36.9	60.5	75.2	105.5	150	188	263	376	526
12 x 8	38 ... 44	12 x 5.0	12 x 3.3	45.7	72.2	90.7	128	182	227	319	455	637
14 x 9	44 ... 50	14 x 5.5	14 x 3.8	60.5	97.4	121	170	243	304	424	607	850
16 x 10	50 ... 58	16 x 6.0	16 x 4.3	79.7	128	159	223	317	398	556	795	1112
18 x 11	58 ... 65	18 x 7.0	18 x 4.4	91.5	146	183	256	365	457	640	915	1280
20 x 12	65 ... 75	20 x 7.5	20 x 4.9	117	186	232	325	465	581	815	1165	1626
22 x 14	75 ... 85	22 x 9.0	22 x 5.4				413	590	738	1033	1475	2065

The values given in the ratings table are based on uniform, smooth servo-operation and reliable grease lubrication. Since, in practice, the applications are very diverse, it is essential to consider the given conditions by using the appropriate factors (see below).

Formulas for determining the acceleration torque of rack & pinion drive:

$a = \frac{v}{t_b}$ [in/s²]

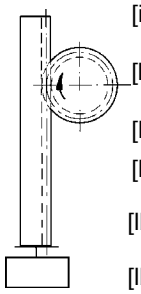
$m = \frac{W}{g}$ [lb.s²/in]

$F_T = m \cdot g + m \cdot a$ (for lifting axis) [lb]

$F_T = m \cdot g \cdot \mu + m \cdot a$ (for driving axis) [lb]

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24}$ [lb.ft]

$T_{2perm} = \frac{T_{2table}}{K_A \cdot S_B \cdot f_N}$ [lb.ft.]



The drive should be selected such that $T_{2perm.} > T_{2req}$

Load Factor K_A

Drive	Type of load from the machines to be driven		
	uniform	medium shocks	heavy shocks
uniform	1.00	1.25	1.75
light shocks	1.25	1.50	2.00
medium shocks	1.50	1.75	2.25

Safety Coefficient S

The safety factor should be selected based on experience, typically S_B = 1.1 to 1.4.

Symbols

a	=	acceleration or deceleration rate	[in/s²]
d	=	pitch diameter of pinion	[mm]
f_N	=	lifetime factor	
F_T	=	tangential acceleration force	[lb.]
g	=	acceleration due to gravity	[386 in/s²]
K_A	=	load factor	
m	=	mass being moved	[lb.s²/in]
S_B	=	safety factor	
t_b	=	acceleration time	[s]
T_{2perm}	=	corrected acceleration torque	[lb.ft.]
T_{2req}	=	acceleration torque	[lb.ft.]
T_{2table}	=	rated output torque of reducer	[lb.ft.]
v	=	maximum linear speed	[in/s]
W	=	weight being moved	[lb]
η	=	gearbox efficiency at input speed	
μ	=	coefficient of friction of axis	
π	=	3.1415	

Life-time factor f_n

Taking into consideration the linear speed at the rack, and the lubrication and support of the pinion.

Bearing distance*		1 x tooth width			2 x tooth width		
Lubrication		Contin.	Daily	Monthly	Contin.	Daily	Monthly
Linear speed of drive							
in/sec	ft/min						
20	100	0.85	0.95	From	1.05	1.15	From
40	200	0.95	1.10	3	1.15	1.301	3
59	295	1.00	1.20	to	1.20	1.45	to
79	395	1.05	1.30	10	1.25	1.60	10
118	590	1.10	1.50		1.40	1.90	
197	985	1.25	1.90		1.55	2.30	

* distance from center of pinion face width to center of adjacent bearing

The lifetime factors for daily and monthly lubrication cannot be determined by calculation and are only recommendations which underline the importance of good lubrication.

Lubrication

The ratings are based upon intermittent operating times with dwell times in-between, which is normal for servo systems, and continuous lubrication. A proven solution for continuous lubrication is our automatic lubricators and applicators, see page 69.

Calculating Example

Values Given

○ Driving Axis ⊗ Lifting Axis

Weight to be moved:	W	=	660 lb
Linear speed:	v	=	42.5 in/s
Acceleration time:	t_b	=	0.27 s
Acceleration due to gravity:	g	=	386 in/s²
Coefficient of friction:	μ	=	
Pinion pitch diameter:	d	=	67.90 mm
Load factor:	K_A	=	1.25
Lifetime factor:	f_N	=	1.1
Safety factor:	S_B	=	1.2

Calculations

$a = \frac{v}{t_b} = \frac{42.5}{0.27} = 157.4$ in/s²

$m = \frac{W}{g} = \frac{660}{386} = 1.71$ lb.s²/in

$F_T = m \cdot g + m \cdot a = 1.71 \cdot 386 + 1.71 \cdot 157.4 = 929.4$ lb

$F_T = m \cdot g \cdot \mu + m \cdot a$ (for driving axis only)

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24} = \frac{929.4 \cdot (67.90/25.4)}{24} = 103.5$ lb.ft.

Assuming 29.20.100 and 24.23.532 pinion with $T_{2table} = 214$ lb.ft.

$T_{2perm} = \frac{T_{2table}}{K_A \cdot S_B \cdot f_N} = \frac{214}{1.25 \cdot 1.2 \cdot 1.1} = 129.7$ lb.ft.

The drive should be selected such that $T_{2perm.} > T_{2req}$

$T_{2perm} > T_{2req} = 129.7$ lb.ft. > 103.5 lb.ft.

Selection: Rack: 29.20.100 Page 54
Pinion: 24.23.532 Page 32

Pinion Forces

Tangential Force $F_T = 929.4$ lb. (from above)

Separating Force $F_r = F_T \cdot \tan 20° = 929.4 \cdot 0.364 = 338.3$ lb.

Axial Force $F_A = F_T \cdot \tan 19.528° = 929.4 \cdot 0.355 = 329.6$ lb.
(Helical Only)

Radial Force $F_R = \sqrt{F_T^2 + F_r^2} = \sqrt{929.4^2 + 338.3^2} = 989$ lb.

Your Calculations

Values Given

○ Driving Axis ○ Lifting Axis

Weight to be moved:	W	=	_____ [lb]
Linear speed:	v	=	_____ [in/s]
Acceleration time:	t_b	=	_____ [s]
Acceleration due to gravity:	g	=	386 in/s²
Coefficient of friction:	μ	=	_____
Pinion pitch diameter:	d	=	_____ [mm]
Load factor:	K_A	=	_____
Lifetime factor:	f_N	=	_____
Safety factor:	S_B	=	_____

Calculations

$a = \frac{v}{t_b} =$ _____ [in/s²]

$m = \frac{W}{g} =$ _____ [lb.s²/in]

$F_T = m \cdot g + m \cdot a =$ _____ [lb]

$F_T = m \cdot g \cdot \mu + m \cdot a =$ _____ [lb]

$T_{2req} = \frac{F_T \cdot (d/25.4)}{24} =$ _____ [lb.ft.]

Permissible torque T_{2table}, see page 62

$T_{2perm} = \frac{T_{2table}}{K_A \cdot S_B \cdot f_N} =$ _____ = [lb.ft.]

$T_{2perm} > T_{2req} =$ _____ lb.ft. > _____ lb.ft. = fulfilled

Pinion Forces

$F_T =$

$F_r = F_T \cdot \tan 20° =$

$F_A = F_T \cdot \tan 19.528° =$
(Helical Only)

$F_R = \sqrt{F_T^2 + F_r^2} =$

When mounting a pinion directly onto a gearbox output shaft, the radial and axial forces should be taken into consideration when selecting the gearbox. The axial force is generated by helical gearing only and changes direction depending on the direction of travel of the rack & pinion.

Actual size of modular gearing according to DIN 867

Module 1.0

Module 1.25

Module 1.5

Module 2.0

Module 2.5

Module 3.0

Module 4.0

Module 5.0

Module 6.0

Module 8.0

Automatic Lubricators

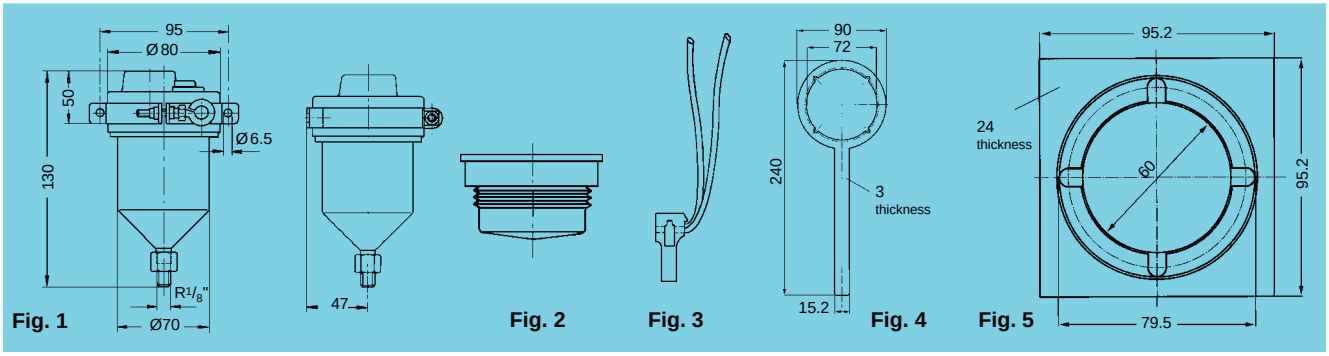


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

Order code	Fig.	Description	Wt. (lb)
65 91 000	1	Lubricator, filled with Klüber Microlube GB 0, well suited for lubricating racks, includes pipe clamp for mounting	1.10
65 91 004	1	Lubricator, filled with Klüber Structovis AHD, well suited for lubricating racks, includes pipe clamp for mounting	1.10
65 91 009	1	Lubricator, empty, includes pipe clamp for mounting	0.88
65 91 001	2	Spare nitrogen pressure chamber for refilling (includes batteries)	0.18
65 91 003	3	Contact cable for synchronization with machine operating time, ~150 mm long	0.02
65 91 030	4	Assembly wrench for opening lubricator	0.26
65 91 031	5	Mounting plate for opening lubricator	0.33

Proper lubrication of gearing is very important to insure long gear life and quality. With rack & pinion drives, it is extremely critical since there is no lubricant ”bath” that the gearing sits in. The following information is based on a series of tests carried out on a rack & pinion test stand and should be used only as basic guidelines to proper lubrication. Experimentation under specific application parameters will ultimately provide the best experience.

In order to apply the lubricant uniformly and consistently over time, an automatic lubricator is recommended (manual lubrication can be unreliable). The automatic lubricator shown was used throughout our entire testing period and has proved to be very practical. It can hold up to 125 cm^3 of grease and utilizes a sliding piston, actuated by an electro-chemical reaction (powered by 2 AA batteries) to gradually expand an internal gas chamber and uniformly release the grease. Depending on the flow rate desired, the lubricator can be set to discharge a specific quantity of lubricant by setting a combination of dip switches on the top of the lubricator:

Dip Switch Setting	1M	2M/3M	2M/6M	2M	3M/12M	3M	6M/12M	6M	12M/B	12M	B
Flow rate (cm^3/day)	4.00	3.33	2.67	2.00	1.70	1.33	1.00	0.67	0.50	0.33	0.17
Approximate Emptying time (days)	~31	~38	~47	~63	~74	~94	~125	~189	~250	~379	~735
Pressure build-up time (days)	~1	~1.25	~1.75	~2	~2.5	~3	~4	~6	~8	~12	~25

* The flow rates are based on an ambient temperature of 68°F; for higher temperatures, the flow rates will be higher.

The last dip switch, labeled ”LIGHT”, when set to ”ON” will produce a flashing light on the lubricator every 15 to 20 seconds to confirm that the lubricator is in working order.

Automatic Lubricators
When installing the hose connection set (page 72) between the automatic lubricator and applicator, it is recommended to fill the hose with grease, to minimize the start time of the grease. If necessary, it is possible to reduce the pressure build-up time of the lubricator; detailed operating instructions are provided with each lubricator.

The lubricators are available filled with Klüber Microlube GB 0 for use with the sliding brush applicator (page 72), or filled with Klüber Structovis AHD for use with the felt gear applicator (page 71). An empty lubricator is also available that can be filled with any grease. The lubricator can be mounted in any position and can easily be connected to any of the applicators with its R 1/8" male thread.

When the lubricator has fully discharged its contents, the internal gas chamber will need to be replaced by unscrewing the red lid and removing the batteries, circuit board & lid from the chamber assembly. The empty lubricator can then be refilled with the proper lubricant, being careful not to trap air bubbles inside the reservoir. The new chamber assembly should then be placed into the lubricator and the red lid tightened.

The lubricator can also be synchronized with a machine's operating time through a contact cable, which will shut the lubricator off when the machine is not running. The cable has two leads that, when shorted together, complete the circuit; the only additional component required is a potential-free switch or contactor (no external power supply required).

When the automatic lubricators are use and the grease is supplied by means of a felt gear (page 71) or sliding brush applicator (page 72), the following reference values per 125 cm^3 of grease are considered sufficient under medium load conditions:

Module 1.0 to 3.0: 2,000 km total travel length or
16,000 meters travel per cm^3 of grease
Module 4.0 to 5.0: 1,500 km total travel length or
12,000 meters travel per cm^3 of grease
Module 6.0 to 8.0: 1,000 km total travel length or
8,000 meters travel per cm^3 of grease

Recommended Lubricants and Quantities
The following lubricants were used in endurance tests and performed well. We recommend using **Klüber Microlube GB 0** (order code 65 90 002 for 1 kg) with the sliding brush applicator, and **Klüber Structovis AHD** (order code 65 90 003 for 1 kg) with the felt gear applicator. The Structovis grease flows easier through the felt gear than the Microlube. These greases have also been tested with good results: Oest Langzeitfett LT 200, BP Energrease LS EP 00, DEA Glissando 6833 EP 00, Reiner Gearmaster ZSA, and Molykote G-Rapid plus 3694.

Before running a rack & pinion drive, a thin film of grease should be applied to the full length of the rack and applicator. To find the required grease replenishment flow rate while the machine is running, the data in the following table can be use as a guideline. The flow rates are based on a linear speed of 1.5 meters/sec (~60 in/sec) and a 1.0 meter (~40") stroke length; any deviation from these parameters, including environment, should be taken into account.

Rack & Pinion Size		**Module 1 to 2**	**Module 3 to 8**
Sliding Brush Applicator	Lubricant Flow Rate Lubricator Switch Setting	~0.35 to 0.70 cm^3/day 12M or 6M	~0.70 to 1.30 cm^3/day 6M or 3M
Felt Gear Applicator	Lubricant Flow Rate Lubricator Switch Setting	~0.18 to 0.35 cm^3/day B or 12M	~0.35 to 0.70 cm^3/day 12M or 6M

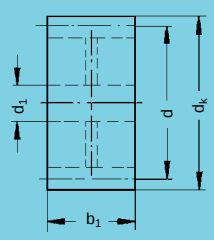
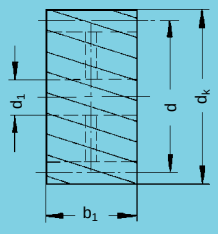
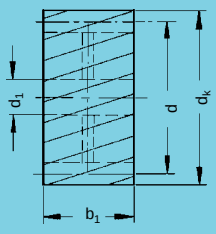


Fig. 1



for gears and pinions

Fig. 2



for racks

Fig. 3

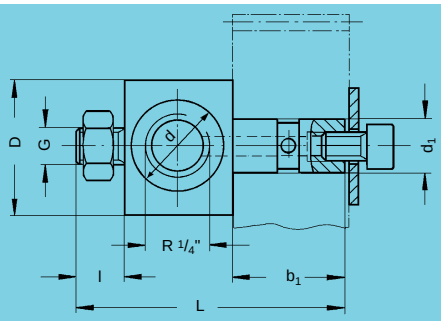


Fig. 4

Felt Gear Applicator

Order code	Fig.	Description	Module	z	d	d_k	d_1	D	b_1	L	l	G	Wt. (lb)
65 91 140	1	Felt gear. straight	1	40	40.0	42	12	–	15	–	–	–	0.02
65 91 100	4	Mounting shaft	1	–	–	–	12	30	15	50	10	M8	0.30
65 91 126	1	Felt gear. straight	1.5	26	39.0	42	12	–	15	–	–	–	0.02
65 91 100	4	Mounting shaft	1.5	–	–	–	12	30	15	50	10	M8	0.30
65 91 024	1	Felt gear. straight [1]	1.591	24	38.2	41.4	12	–	15	–	–	–	0.02
65 91 100	4	Mounting shaft [1]	1.591	–	–	–	12	30	15	50	10	M8	0.30
65 91 228	1	Felt gear. straight	2	19	38.0	42	12	–	25	–	–	–	0.02
65 91 229	2	Felt gear. helical RH	2	18	38.2	42	12	–	25	–	–	–	0.02
65 91 218	3	Felt gear. helical LH	2	18	38.2	42	12	–	25	–	–	–	0.02
65 91 200	4	Mounting shaft	2	–	–	–	12	30	25	60	10	M8	0.31
65 91 222	1	Felt gear. straight	2.5	22	55.0	60	12	–	25	–	–	–	0.06
65 91 200	4	Mounting shaft	2.5	–	–	–	12	30	25	60	10	M8	0.31
65 91 328	1	Felt gear. straight	3	19	57.0	63	12	–	30	–	–	–	0.08
65 91 329	2	Felt gear. helical RH	3	18	57.3	63	12	–	30	–	–	–	0.08
65 91 318	3	Felt gear. helical LH	3	18	57.3	63	12	–	30	–	–	–	0.08
65 91 300	4	Mounting shaft	3	–	–	–	12	30	30	65	10	M8	0.32
65 91 018	1	Felt gear. straight [2]	3.183	18	57.3	63.6	12	–	30	–	–	–	0.08
65 91 300	4	Mounting shaft [2]	3.183	–	–	–	12	30	30	65	10	M8	0.32
65 91 428	1	Felt gear. straight	4	19	76.0	84	12	–	40	–	–	–	0.22
65 91 429	2	Felt gear. helical RH	4	18	76.5	84	12	–	40	–	–	–	0.21
65 91 418	3	Felt gear. helical LH	4	18	76.5	84	12	–	40	–	–	–	0.21
65 91 400	4	Mounting shaft	4	–	–	–	12	30	40	75	10	M8	0.34
65 91 517	3	Felt gear. helical LH	5	17	90.2	100	20	–	50	–	–	–	0.29
65 91 518	1	Felt gear. straight	5	18	90.0	100	20	50	50	–	15	M12	0.29
65 91 529	2	Felt gear. helical RH	5	17	90.2	100	20	–	50	–	–	–	0.29
65 91 500	4	Mounting shaft	5	–	–	–	20	50	50	90	15	M12	1.14
65 91 617	3	Felt gear. helical LH	6	17	108.2	120	20	–	60	–	–	–	0.51
65 91 618	1	Felt gear. straight	6	18	108.0	120	20	–	60	–	–	–	0.51
65 91 629	2	Felt gear. helical RH	6	17	108.2	120	20	–	60	–	–	–	0.51
65 91 600	4	Mounting shaft	6	–	–	–	20	50	60	100	15	M12	1.20
65 91 817	3	Felt gear. helical LH	8	17	144.3	160	20	–	80	–	–	–	1.24
65 91 818	1	Felt gear. straight	8	18	144.0	160	20	–	80	–	–	–	1.24
65 91 829	2	Felt gear. helical RH	8	17	144.3	160	20	–	80	–	–	–	1.24
65 91 800	4	Mounting shaft	8	–	–	–	20	50	80	120	15	M12	1.31

[1] 5 mm Circular Pitch [2] 10 mm Circular Pitch

The application of the lubricant is very critical and the proper applicator should be selected carefully. The applicator should place the lubricant along the tooth flanks and minimize any splattering or dripping. This is critical when the rack & pinion drive is directly above a product or process.
For applications where the life of the rack & pinion is critical and requires virtually no splatter, the felt gear applicators are recommended. The lubricant is pumped through the felt gear mounting shaft (Fig. 4) and into the felt gear where it is released through small holes in-between every other tooth. The straight felt gear applicator can mate with the pinion or the rack; the helical felt gear applicator can mate with pinion (RH) or the rack (LH).

Sliding Brush Applicator

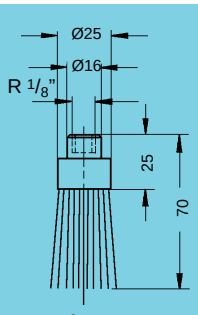


Fig. 1

Order code	Fig.	Description	Wt. (lb)
65 91 010	1	Sliding brush applicator, round, with female thread, R ¼"	0.037

For applications where the placement of lubricant is not that critical, the sliding brush applicator is recommended. The brush can be used to lubricate either the rack or pinion and will distribute grease uniformly over the face width of the gearing. This applicator should only be used in vertical, downward positions to minimize splatter. If necessary, the brush can be mounted directly to the automatic lubricator.

Hose Connection Set

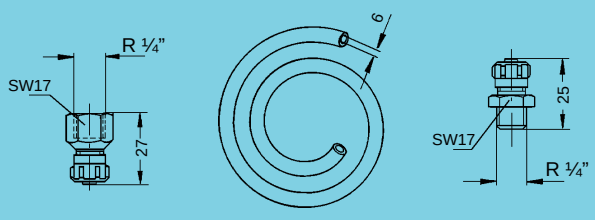


Fig. 2

Order code	Fig.	Description	Wt. (lb)
65 91 020	2	Hose connection set, L = 6.5 feet, with one male fitting and one female alum. fitting, R ¼"	0.055

The applicators can be attached to a lubrication system or the automatic lubricator (page 69) with a hose connection set.

Mounting Guidelines of Rack & Pinions

Racks can be mounted in any position. In environments where debris (sawdust, etc.) is present, the rack should be mounted with the teeth facing down or covered to minimize contamination. Racks are typically mounted on their side faces due to the mounting hole locations; mounting holes can be drilled in the back face if necessary. It is recommended that a small right-angle ”ledge” be provided on the mounting surface to locate the rack on two faces. This makes it easier to accurately mount several pieces of rack in succession.

The mounting and alignment of rack & pinion drives is critical to the performance and lifetime of the axis. The following instructions are meant to be general guidelines on how to achieve an accurate mounting of a rack & pinion drive.

1. Mount and align the linear slides (rails) to the axis base. Measure the location of the rail in relation to the rack mounting surface with a dial indicator. A shoulder should be provided on the mounting surface to locate the back of the rack. The rack mounting surface tolerance will affect the contact pattern of the drive; the rack shoulder tolerance will affect the backlash of the drive. The more accurate these surfaces are, the better the axis will perform.
2. Attach the first rack segment to the rack mounting surface. The mounting holes in the rack require hex-socket cap screws, which should be tightened to 7 lb.ft. for the M6 and 15 lb.ft. for the M8. Measure the location of the rail in relation to the pitchline of the rack segment with a dial indicator. To locate the pitchline of the rack, a pin is placed in-between the rack teeth and an over-pin tolerance is measured:

Size	**Module 2.0**	**Module 3.0**	**Module 4.0**
Pin Size	Ø 0.138”	Ø 0.197”	Ø 0.276”
Size	**Module 5.0**	**Module 6.0**	**Module 8.0**
Pin Size	Ø 0.354”	Ø 0.394”	Ø 0.551”

   If the tolerances are found to be high, the rack should be shimmed accordingly and the rack mounting surface and shoulder should be checked again.
3. Attach the next rack segment to the rack mounting surface. A companion rack should be used to properly space the gap in-between helical rack segments; a 0.25 meter piece of rack should be used in-between straight rack segments (see diagram). Again measure the location from the rail in relation to the rack segment. Continue mounting the rack segments for the entire travel length using the same procedure.
4. Mount the pinion to the rail carriage. Make sure the pinion engages the total face width of the rack. Check of the alignment of the rack & pinion by marking or ”bluing” the pinion teeth with a high spot paste (Dykem) and slowly running the axis in both directions. This will show the tooth contact pattern between the rack & pinion; a contact pattern across the majority of the tooth flank on both the rack and pinion is desired. If the contact pattern is shifted to one side of the tooth flanks, some form of misalignment is present.
5. Measure the linear backlash between the rack & pinion along the entire axis travel length. The minimum backlash using a hardened & ground pinion should be as follows:

Rack Quality	**Minimum Backlash**
Induction Hardened	0.1 mm (0.004”)
Quenched & Tempered	0.05 mm (0.002”)
Hardened & Ground	0.02 mm (0.0008”)

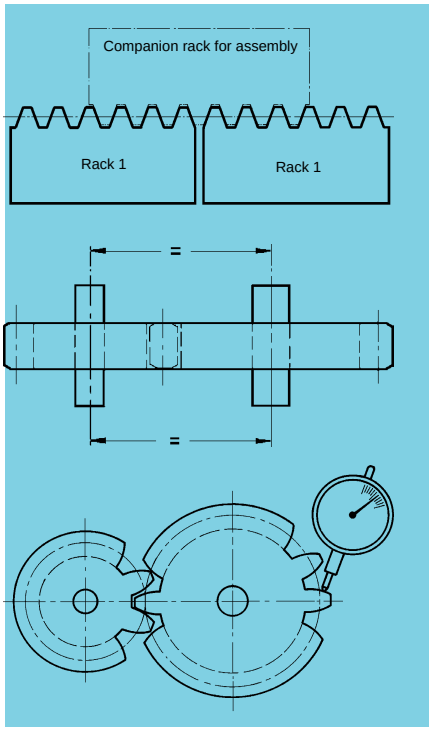
   If the backlash is found to be less in any location along the travel length, the pinion should be pulled away from the rack (increasing the center distance). If it is found to be more, the pinion location could be left as is or moved closer to the rack (decreasing the center distance) if needed for the desired accuracy of the axis.
6. Run the axis through the entire rack travel length to check for any problems, such as binding or excessive noise. If either is found, the alignment of the axis must be checked again. Finally, drill dowel pin holes into the rack mounting surface using the starter holes in racks. Place dowel pins in the holes (two for each rack segment).

Guide bushing for round racks

The guide bushings are practically maintenance free and thus suitable for normal, low-stress service. It may be necessary to provide a lubricant reservoir, by mounting two collar bushings with a gap in-between them. If high loads and/or axial movement are expected, please consult us. The bore in the housing should be manufactured to H7 tolerance. After pressing in (with pin tolerance m5), a tolerance range of H7 can be expected inside the bushing.

Safety instructions

The following preventive measures are necessary: Ensure there is no contact with rotating elements (output shaft, gears, rack, etc) and the gearbox mounting screws are tight. Avoid contact with lubricants, refer to safety data sheets.



To find the correct motor mounting flange and input coupling needed to mate the desired servo-motor, the following table is a guide based on the motor shaft and flange dimensions. The pairing of servo-motors to servo-worm reducers only considers the servo shaft and flange dimensions; the servo-motor performance with the reducer must also be checked, as well as the individual application requirements. For specific servo-motor manufacturers and models, see page 75.

Unit Size	Shaft Diameter	Shaft Length	Pilot Diameter	Bolt Circle	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling
3	10	32	80	100	58 43 3..	58 83 3..	65 43 110
	11	23	60	75	58 43 5..	58 83 5..	65 43 111
a_o=	14	30	50	95	58 43 2..	58 83 2..	65 43 114
50 mm	14	30	60	75	58 43 5..	58 83 5..	64 43 914
	14	30	80	100	58 43 3..	58 83 3..	65 43 114
	14	30	95	115	58 43 1..	58 83 1..	65 43 114
	16	40	60	75	58 43 5..	58 83 5..	65 43 116
	16	40	95	115	58 43 1..	58 83 1..	65 43 116
	19	40	95	115	58 43 1..	58 83 1..	65 43 119
	19	50	95	115	58 43 4..	58 83 4..	65 43 119
	19	40	95	130	58 43 8..	58 83 8..	65 43 919
	19	50	110	130	58 43 9..	58 83 9..	65 43 919
	24	50	110	130	58 43 9..	58 83 9..	65 43 924
4	14	30	95	115	58 44 1..	58 84 1..	65 44 114
	14	30	95	165	58 44 4..	58 84 4..	65 44 114
a_o=	16	40	95	115	58 44 1..	58 84 1..	65 44 116
63 mm	19	28	130	165	58 44 2..	58 84 2..	65 44 219
	19	40	95	115	58 44 1..	58 84 1..	65 44 119
	19	40	95	130	58 44 3..	58 84 3..	65 44 119
	19	40	110	130	58 44 5..	58 84 5..	65 44 119
	19	40	130	215	58 44 9..	58 84 9..	65 44 919
	24	50	110	130	58 44 6..	58 84 6..	65 44 024
	24	50	110	165	58 44 0..	58 84 0..	65 44 024
	24	50	130	165	58 44 2..	58 84 2..	65 44 024
	28	40	110	130	58 44 6..	58 84 6..	65 44 928
	32	58 - 60	130	215	58 44 9..	58 84 9..	65 44 932
5	24	50	110	165	58 45 0..	58 85 0..	65 46 024
	24	50	130	165	58 45 2..	58 85 2..	65 46 024
a_o=	28	42	180	215	58 45 8..	58 85 8..	65 46 928
80 mm	32	50	130	165	58 45 4..	58 85 4..	65 .46 932
	32	58 - 60	130	215	58 45 9..	58 85 9..	65 46 932
	32	58 - 60	180	215	58 45 8..	58 85 8..	65 46 932
	35	79	114.3	200	58 45 0..	58 85 0..	265 26 089
			(4.50")		+ 557 90 002	+ 557 90 002	
	38	80 - 85	180	215	58 45 7..	58 85 7..	65 46 938
	48	58	180	215	58 45 8..	58 85 8..	65 47 948
6	24	50	110	165	58 46 0..	58 86 0..	65 46 024
	24	50	130	165	58 46 2..	58 86 2..	65 46 024
a_o=	28	42	180	215	58 46 8..	58 86 8..	65 46 928
100 mm	32	50	130	165	58 46 4..	58 86 4..	65 46 932
	32	58 - 60	130	215	58 46 9..	58 86 9..	65 46 932
	32	58 - 60	180	215	58 46 8..	58 86 8..	65 46 932
	35	79	114.3	200	58 46 0..	58 86 0..	265 26 089
			(4.50")		+ 557 90 002	+ 557 90 002	
	38	80 - 85	180	215	58 46 7..	58 86 7..	65 46 938
	48	58	180	215	58 46 8..	58 86 8..	65 47 948
7	28	60	180	215	58 47 0..	58 87 0..	65 46 928
	32	58 - 60	180	215	58 47 0..	58 87 0..	65 46 932
a_o=	38	80 - 85	180	215	58 47 1..	58 87 1..	65 46 938
125 mm	48	58	180	215	58 47 0..	58 87 0..	65 47 948

All dimensions are in millimeters, except where noted, and are subject to change.

This list of servo-motors can be mounted to servo-worm reducers with standard coupling and flanges. For manufacturers and servo-motors not listed here, there may already be existing solutions using special parts (intermediate flange, couplings), or mounting solutions can be found in a short time – please consult us.

The pairing of servo-motors to servo-worm reducers only considers the servo shaft and flange dimensions; the servo-motor performance with the reducer must also be checked, as well as the individual application requirements.

Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
ABB				
SDM251-xxxxx-072	**58 43 5..**	**58 83 5..**	**65 43 111**	
SDM251-xxxxx-092	**58 43 3..**	**58 83 3..**	**65 43 114**	
SDM251-xxxxx-110	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SDM251-xxxxx-140	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SDM301-xxxxx-110	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SDM301-xxxxx-140	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SDM301-xxxxx-190	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
SDM302-xxxxx-090	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SDM302-xxxxx-100	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
SDM302-xxxxx-112	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
443 / 444	**58 44 5..**	**58 84 5..**	**65 44 119**	
445	**58 45 2..**	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
544	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 45 119**	
545	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
641 / 651.x.xx.1	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
644 / 654.x.xx.0	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
644 / 654.x.xx.1	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
644 / 654.x.xx.9	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
645 / 655.x.xx.0.x.x.x.x.x.x.L	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
645 / 655 x.xx.0.x.x.x.x.x.x.N	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.098
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.098
645 / 655.x.xx.1.x.x.x.x.x.x.N	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
645 / 655.x.xx.4.x.x.x.x.x.x.L	**58 44 0..**	**58 84 0..**	**65 44 024**	
	58 45 0..	**58 85 0..**	**65 46 024**	
	58 46 0..	**58 86 0..**	**65 46 024**	
645 / 655.x.xx.9.x.x.x.x.x.x.N	**58 44 9..**	**58 84 9..**	**65 44 932**	
	58 45 9..	**58 85 9..**	**65 46 932**	
	58 46 9..	**58 86 9..**	**65 46 932**	
861.x.xx.1	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
864.x.xx.0	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 45 5..	**58 84 5..**	**65 44 119**	
864.x.xx.1	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
864.x.xx.9	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	

* No suitable motor mounting flanges or input couplings are currently available, please consult us

Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
Allen Bradley				
1326AB-Axx, metric	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 43 119**	
1326AB-B4xxx	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
1326AB-B5xxx	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
1326AB-Cxx, metric	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
1326 AS- B3	**58 43 3..**	**58 83 3..**	**65 43 114**	
1326 AS- B4	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
1326 AS- B6	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
1326 AB- B4	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
1326 AB- B5	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
1326 AB- B7	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
H - 2005	**58 43 5..**	**58 83 5..**	**65 43 111**	
H - 3007	**58 43 3..**	**58 83 3..**	**65 43 114**	
H - 3016	**58 43 3..**	**58 83 3..**	**65 43 114**	
H - 6100 / 6200 / 6300	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
F - 6100 / 6200 / 6300	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
AMK				
DV 5 / DS 5 - ...	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DV 7 - ...	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DV 10 - ...	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
DH 10 - ...	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Atlas Copco				
AHD /AHR 92	**58 43 3..**	**58 83 3..**	**65 43 114**	
AHD / AHR 115	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
AHD / AHR 142	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
AHD / AHR 190	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Baldor A. S. R.				
BSM 3 SE	**58 43 1..**	**58 83 1..**	**65 44 116**	
	58 44 1..	**58 84 1..**	**65 44 116**	
BSM 4 SE	**58 44 2..**	**58 84 2..**	**65 44 119**	
BSM 6 SE	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
BSM 63 A	**58 43 5..**	**58 83 5..**	**65 43 111**	
BSM 80 A/B	**58 43 3..**	**58 83 3..**	**65 43 119**	
BSM 90 A/B	**58 44 6..**	**58 84 6..**	**65 44 024**	
SAV.MF20500-1A	**58 44 5..**	**58 84 5..**	**65 44 932**	
BSM 100 A/B	**58 45 4..**	**58 85 4..**	**65 46 928**	2.65.25.098
	58 46 0..	**58 86 0..**	**65 46 928**	2.65.25.098
Baumüller				
DS 35	**58 43 5..**	**58 83 5..**	**65 43 111**	
DS 36	**58 43 5..**	**58 83 5..**	**65 43 111**	
DS 45	**58 43 3..**	**58 83 3..**	**65 43 114**	
DS 56	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	

* No suitable motor mounting flanges or input couplings are currently available, please consult us

Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
DS 71	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DS 100	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Bautz				
M40	**58 43 3..**	**58 83 3..**	**65 43 114**	
M50	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
M71	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
M90	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
F634	**58 44 4..**	**58 84 4..**	**65 44 114**	
F804	**58 44 9..**	**58 84 4..**	**65 44 919**	
Bosch				
SE - D1.010	**58 43 5..**	**58.83.5..**	**65.43.111**	
SE - B2.010/020/030/040	**58 43 1..**	**58 83 1..**	**65 43 114**	
	58 44 1..	**58 84 1..**	**65 44 114**	
SE - LB3.033/055/075/095	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SE - B3.033/055/075/095	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
SE - B4/-C4.090/130/170/210	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SE - B5.320/440/570/700	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
SE - KB4.020/040/060/090	**58 44 2..**	**58 84 2..**	**65 44 219**	
SF (R) - A2.00130020/0026/0041	**58 43 1..**	**58 83 1..**	**65 43 114**	
	58 44 1..	**58 84 1..**	**65 44 114**	
SF (R) - A3.0042/0068/0093	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
SF (R) - A4.0091/0125/0172/0230	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SF (R) - A5.0250/0460/0700	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Control Techniques				
75 DS A	**58 43 5..**	**58 83 5..**	**65 43 111**	
75 DS B/C/D	**58 43 5..**	**58 83 5..**	**65 43 914**	
95 DS A	**58 43 3..**	**58 83 3..**	**65 43 114**	
95 DS B/C/D/E	**58 43 3..**	**58 83 3..**	**65 43 119**	
115 DS A/B/C	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
142 DS A/B/C/D/E	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
CTM 4-07	**58 43 5..**	**58 83 5..**	**65 43 111**	
CTM 4-09	**58 43 3..**	**58 83 3..**	**65 43 114**	
CTM 4-11	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
CTM2-/CTF2-/CTH2-/CTV2-	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
CTM 4-19	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Custom Servo Motors				
MPM89xxxx, MS conn.	**58 43 3..**	**58 83 3..**	**65 43 114**	
MPM1141xxx, MS conn.	**58 43 9..**	**58 83 9..**	**65 43 919**	
MPM1142xxx, MS conn.	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
MPM1143xxx, MS conn.	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
MPM1421xxx, MS conn.	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	

* No suitable motor mounting flanges or input couplings are currently available, please consult us

Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
MPM1422xxx, MS conn.	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
MPM1423xxx, MS conn.	**58 45 4..**	**58 85 4..**	**65 46 932**	
MPM1424xxx, MS conn.	**58 45 4..**	**58 85 4..**	**65 46 932**	
MPM1901xxxx, MS conn.	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
MPM1902xxxx, MS conn.	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
MPM1903xxxx, MS conn.	**58 45 8..**	**58 85 8..**	**65 47 948**	
	58 46 8..	**58 86 8..**	**65 47 948**	
	58 47 0..	**58 87 0..**	**65 47 948**	
MPM1904xxxx, MS conn.	**58 45 8..**	**58 85 8..**	**65 47 948**	
	58 46 8..	**58 86 8..**	**65 47 948**	
	58 47 0..	**58 87 0..**	**65 47 948**	
Dietz				
DS M2/F2 - 01/02/03/04	**58 43 3..**	**58 83 3..**	**65 43 114**	
DS M2/F2 - 11/12/13/14/15	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DS M1/F1/H1/V1 - 11/12/13/14/15	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DS M2/F2 - 21/22/23/24/25	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DS M1/F1/H1/V1 - 21/22/23/24/25	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DS M1/F1/H1/V1 - 31/32/33/34	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
ELAU				
SB 56	**58 43 5..**	**58 83 5..**	**65 43 111**	
SB 70	**58 43 5..**	**58 83 5..**	**65 43 111**	
SB 105	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SB 145	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SB 205	**58 45 7..**	**58 85 7..**	**65 46 938**	
	58 46 7..	**58 86 7..**	**65 46 938**	
	58 47 1..	**58 87 1..**	**65 46 938**	
Elmo				
PSA 90/6 - ...	**58 43 1..**	**58 83 1..**	**65 43 119**	
PSA 90/6 - ...	**58 44 1..**	**58 84 1..**	**65 44 119**	
PSA 130/6 - ...	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
Emod				
EC 45 / 6 ..	**58 43 3..**	**58 83 3..**	**65 43 114**	
EC 56 / 6 ..	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
EC 71 / 6 ..	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
EC 90 / 6 ..	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
FAGOR				
FXM 11 / 12 / 13 / 14	**58 43 3..**	**58 83 3..**	**65 43 114**	
FXM 31 / 32 / 33 / 34	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
FXM 53 / 54 / 55	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
FXM 73 / 74 / 75 / 76 / 77 / 78	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
FANUC				
α M2,5	**58 43 3..**	**58 83 3..**	**65 43 114**	
α (HV) 12/20/22/30/40/M22/M30/	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
α (HV) L25/l50/C12/C22	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
β 1 / 2	**58 43 1..**	**58 83 1..**	**65 43 114**	
	58 44 1..	**58 84 1..**	**65 44 114**	
β 3 / 6	**58 44 2..**	**58 84 2..**	**65 44 119**	
Ferrocontrol				
HD 92	**58 43 3..**	**58 83 3..**	**65 43 114**	
HD 115	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
HD 142	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
BMR 190	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Georgii Kobold				
KSA 426 / 444 / 446 / 449 / 4212 / 4412	**58 43 1..**	**58 83 1..**	**65 43 114**	
KSA 628 /648 / 6412 / 6216 / 6416	**58 44 2..**	**58 84 2..**	**65 44 119**	
KSA 8212 / 8412 / 8416 / 8220	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
KSY 264 / 266 / 268	**58 43 5..**	**58 83 5..**	**65 43 111**	
KSY 464 / 468 / 4612	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
KSY 644.. / 648..	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
KSY 666 / 668 / 6612 / 6616	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
KSY 8612 / 8616 / 8620	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Groschopp				
EK87-60 / 120SR	**58 43 3..**	**58 83 3..**	**65 43 119**	
	58 44 3..	**58 84 3..**	**65 44 919**	2.65.24.089
Parker Hannifin / HAUSER				
HDX 70	**58 43 5..**	**58 83 5..**	**65 43 111**	
HDX 92	**58 43 3..**	**58 83 3..**	**65 43 119**	
HDX 115	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
HDX 142	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
HBMR 190	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Indramat				
MHD /MAC /MDD /MKD 041	**58 43 2..**	**58 83 2..**	**65 43 114**	
MAC 63 / MDD 065	**58 43 1..**	**58 83 1..**	**65 43 114**	
	58 44 1..	**58 84 1..**	**65 44 114**	
MHD /MAC /MDD /MKD 071	**58 43 8..**	**58 83 8..**	**65 43 919**	
	58 44 3..	**58 84 3..**	**65 44 119**	
	58 45 0..	**58 85 0..**	**5.81.20.002**	2.65.25.093
	58 46 0..	**48 86 0..**	**5.81.20.002**	2.65.25.093
MAC / MDD / MKD 090	**58 44 0..**	**58 84 0..**	**65 44 024**	
	58 45 0..	**58 85 0..**	**65 46 024**	
	58 46 0..	**58 86 0..**	**65 46 024**	
MHD 093	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.098
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.098
MAC / MDD / 093	**58 44 0..**	**58 84 0..**	**65 44 024**	
	58 45 0..	**58 85 0..**	**65 46 024**	
	58 46 0..	**58 86 0..**	**65 46 024**	
MDD 095	**58 44 0..**	**58 84 0..**	**65 44 219**	
MAC /MDD /MKD 112	**58 44 9..**	**58 84 9..**	**65 44 932**	
	58 45 9..	**58 85 9..**	**65 46 932**	
	58 46 9..	**58 86 9..**	**65 46 932**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
MAC / MDD 115	**58 44 9..**	**58 84 9..**	**65 44 932**	
	58 45 9..	**58 85 9..**	**65 46 932**	
	58 46 9..	**58 86 9..**	**65 46 932**	
Infranor / Mavilor				
BL 7	**58 43 5..**	**58 83 5..**	**65 43 111**	
BL 11	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
BL 14	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
KEB				
05.SM. F60	**58 43 1..***	**58 83 1..***	**65 43 919**	
B 1 / 2 / 3	**58 43 5..**	**58 83 5..**	**65 43 111**	
01 / 02 / 03 / 04	**58 43 3..**	**58 83 3..**	**65 43 114**	
11 / 12 / 13 / 14	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
21 / 22 / 23 / 24	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
F1 / F2 / F3	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
KONCAR				
EKM 56 - 4	**58 43 3..**	**58 83 3..**	**65 43 114**	
EKM 71 - 4	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
EKM 90 - 6	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
EKM 112 - 6	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Kollmorgen Industrial Drives				
B106	**58 43 5..**	**58 83 5..**	**65 43 914**	
B204 / B206	**58 43 3..**	**58 83 3..**	**65 43 114**	
B40x	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
B602 / B604	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
B606	**58 45 4..**	**58 85 4..**	**65 46 932**	
	58 46 4..	**58 86 4..**	**65 46 932**	
B802 / B804	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
B806	**58 45 8..**	**58 85 8..**	**65 47 948**	
	58 46 8..	**58 86 8..**	**65 47 948**	
	58 47 0..	**58 87 0..**	**65 47 948**	
Kollmorgen / Seidel				
SM 45 / 6 SM 45/47	**58 43 3..**	**58 83 3..**	**65 43 114**	
SM 56 / 6 SM 56/57	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SM 71 / 6 SM 71/77	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
6 SM 100/107/109	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Lenze				
MDSKS 056 - 23 / 33	**58 43 3..**	**58 83 3..**	**65 43 114**	
MDSKA 056 - 22	**58 43 3..**	**58 83 3..**	**65 43 114**	
MDSKS 071 - 13 / 23 / 33	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
MDSKA 071 - 22	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
MDSKA 080 - 22	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
MDSKA 090 - 22	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
MDSKA 100 - 22	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
MDSKA 112 - 22	**58 45 7..**	**58 85 7..**	**65 46 938**	
	58 46 7..	**58 86 7..**	**65 46 938**	
	58 47 1..	**58 87 1..**	**65 46 938**	
Loher				
ZV.A-045 AB/BB/CB/DB-06C	**58 43 4..**	**58 83 4..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
ZV.A-056 AB/BB/CB/DB/EB-06C	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 5..	**58 84 5..**	**65 44 119**	
ZV.A-071 AB/BB/CB-06C	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
ZV.A-071 DB/EB/FB/GB-06C	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.097
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.097
LUST				
PSM / H / F / V - N4 / N5/ N6	**58 43 5..**	**58 83 5..**	**65 43 111**	
PSM / H / F / V - 01 / 02 / 03	**58 43 3..**	**58 83 3..**	**65 43 114**	
ASM / H / F / V - 11 / 12 / 13 / 14 / 15	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
PSM / H / F / V - 11 / 12 / 13 / 14	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
ASM / H / F / V - 21 / 22 / 23 / 24 / 25	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
PSM / H / F / V - 21 / 22 / 23 / 24	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
ASM / H / F / V - 31 / 32 / 33 / 34	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
MATTKE				
MBK 25	**58 43 5..**	**58 83 5..**	**65 43 111**	
MBK 30	**58 43 5..**	**58 83 5..**	**65 43 111**	
MBK 40/50	**58 43 3..**	**58 83 3..**	**65 43 119**	
MBK 70	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
Mitsubishi				
HA 100 / 200 / 300 / 700 N	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
HA 103 / 203 / 303 / 703 N	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
HA 200 / 300 L	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
MOOG				
G423	**58 43 5..**	**58 83 5..**	**65 43 911**	
G424	**58 43 1..**	**58 83 1..**	**65 43 119**	
G425	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
G426	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
NEMA				
213TC / 215TC	**58 45 0..**	**58 85 0..**	**65 46 834**	265 26 070
	58 46 0..	**58 86 0..**	**65 46 834**	265 26 070
NUM				
BMH 075 - 1, BML 075 - 1	**58 43 5..**	**58 83 5..**	**65 43 111**	
BMH 075 - 2/4, BMG 075 - 1/2, BML 075-3	**58 43 5..**	**58 83 5..**	**65 43 914**	
BMH 095 - 2/3/5, BMG 095 - 2/3	**58 43 3..**	**58 83 3..**	**65 43 119**	
	58 44 3..	**58 84 3..**	**65 44 919**	2.65.24.089
BMH 115 - 2 / 3	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
BMH 115 - 4/6, BMG 115 - 2/3	**58 44 6..**	**58 84 6..**	**65 44 024**	
BMH 142 - 2 / 3 / 4	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
BMH 142 - 7, BMG 142 - 2/3/4/7	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.097
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.097
BMH 190 - 2 / 3 / 4 / 5	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
BMH 190 - 7/A, BMG 190 - 2/3	**58 45 7..**	**58 85 7..**	**65 46 938**	
	58 46 7..	**58 86 7..**	**65 46 938**	
	58 47 1..	**58 87 1..**	**65 46 938**	
Pacific Scientific				
R 40 / F40 metric	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 6..	**58 84 6..**	**65 44 119**	
R 60 metric	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
R 80 metric	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
SK 42/43/44/45	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 6..	**58 84 6..**	**65 44 119**	
SK 52/53/54/55/57	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SK 63/64/65/66/67/69	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Parvex				
XD 310 / 320	**58 43 5..**	**58 83 5..**	**65 43 911**	
XD 610 / 620 / 630 / 640	**58 44 6..**	**58 84 6..**	**65 44 024**	
XD 810 / 820 / 830 / 840	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
XD 910 / 914 / 920 / 924 / 930 / 940	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
LX 310 / 320 B	**58 43 5..**	**58 83 5..**	**65 43 111**	
LX 410 / 420 / 430 / 440 C	**58 43 3..**	**58 83 3..**	**65 43 119**	
LX 620 / 630 / 650 C	**58 44 6..**	**58 84 6..**	**65 44 024**	
LS 610 / 620 E	**58 44 6..**	**58 84 6..**	**65 44 024**	
LD 630 / 640 E	**58 44 6..**	**58 84 6..**	**65 44 024**	
LS 810 / 820 E	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
LD 825 / 830 / 840 E	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
LS 910 / 914 / 920 E	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
LD 924 / 930 E	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Reliance Electric				
184 TC	**58 45 0..**	**58 85 0..**	**5 02 17 015**	2.65.26.070
	58 46 0..	**58 86 0..**	**5 02 17 015**	2.65.26.070
L 215 3C	**58 45 0..**	**58 85 0..**	**65 46 834**	2.65.26.071
	58 46 0..	**58 86 0..**	**65 46 834**	2.65.26.071
ATS				
SDS 45	**58 43 3..**	**58 83 3..**	**65 43 114**	
SDS 56	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
SDS 71	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
SDS 90	**58 45 8..**	**58 85 8..**	**65 46 932**	
SDS 90	**58 46 8..**	**58 86 8..**	**65 46 932**	
SDS 100	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
SEM				
HD 70	**58 43 5..**	**58 83 5..**	**65 43 111**	
HD / HR / HJ 92	**58 43 3..**	**58 83 3..**	**65 43 114**	
HD / HR / HJ 115	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
HD / HR / HJ 142	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
HD 190	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
SEW				
DFY 56	**58 43 3..**	**58 83 3..**	**65 43 114**	
DFY 71	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DFY 90	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DFY 112	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Siemens				
1 FT 5 032/034/036	**58 43 5..**	**58 83 5..**	**65 43 111**	
1 FT 5 042/044/046	**58 43 3..**	**58 83 3..**	**65 43 114**	
1 FT 5 062/064/066	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
1 FT 5 070/071/073	**58 44 2..**	**58 84 2..**	**65 44 219**	
1 FT 5 072/074/076	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
1 FT 5 100/101/103	**58 45 8..**	**58 85 8..**	**65 46 928**	
	58 46 8..	**58 86 8..**	**65 46 928**	
	58 47 0..	**58 87 0..**	**65 46 928**	
1 FT 5 102/104/106/108	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
1 FT6 031/034	**58 43 5..**	**58 83 5..**	**65 43 914**	
1 FT6 041/044	**58 43 3..**	**58 83 3..**	**65 43 119**	
	58 44 3..	**58 84 3..**	**65 44 919**	2.65.24.089
1 FT6 061/062/064	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
1 FT6 081/082/084/086	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.098
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.098
1FT6 102/105/108	**58 45 7..**	**58 85 7..**	**65 46 938**	
	58 46 7..	**58 86 7..**	**65 46 938**	
	58 47 1..	**58 87 1..**	**65 46 938**	
1 FK6 032	**58 43 5..**	**58 83 5..**	**65 43 914**	
1 FK6 040/042	**58 43 3..**	**58 83 3..**	**65 43 119**	
	58 44 3..	**58 84 3..**	**65 44 919**	2.65.24.089
1 FK 6 060/063	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
1 FK6 080/083	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.098
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.098
1FK6 100/101/103	**58 45 7..**	**58 85 7..**	**65 46 938**	
	58 46 7..	**58 86 7..**	**65 46 938**	
	58 47 1..	**58 87 1..**	**65 46 938**	
SIG Positec Berger Lahr				
DSM 4 - 07.x	**58 43 5..**	**58 83 5..**	**65 43 111**	
DSM 4 - 09.x	**58 43 3..**	**58 83 3..**	**65 43 114**	
DSM 4 - 11.x	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DSM 4 - 14.x	**58 44 2..**	**58 44 2..**	**65 44 024**	
	58 45 2..	**58 45 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DSM 4 - 19.x	**58 45 8..**	**58 45 8..**	**65 46 932**	
	58 46 8..	**58 46 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	

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Motor Manufacturers & Models	Servo-Worm Reducer Keyway Output	Servo-Worm Reducer Compression Output	Input Coupling	Adapter Flange
Stöber				
ES 42	**58 43 1..**	**58 83 1..**	**65 43 114**	
	58 44 1..	**58 84 1..**	**65 44 114**	
ES 44 / 52	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
ES 54	**58 43 9..**	**58 83 9..**	**65 43 924**	
	58 44 6..	**58 84 6..**	**65 44 024**	
ES 72 / 74	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
ES 76	**58 44 0..**	**58 84 0..**	**65 44 932**	2.65.25.098
	58 45 4..	**58 85 4..**	**65 46 932**	
	58 46 0..	**58 86 0..**	**65 46 932**	2.65.25.098
Stromag				
FIP / FAP / FLP 10 / 20 / 30 / 40	**58 43 3..**	**58.83.3..**	**65 43 114**	
FIP / FAP / FLP 11 / 21 / 31	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
FOP / FHP / FCP 12 / 22 / 32 / 42 / 52	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
FOP / FHP/ FCP 13 / 23 / 33 / 43 / 53 / 63	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
System Antriebstechnik				
DS M2 - N1/N2/N3	**58 43 5..**	**58 83 5..**	**65 43 111**	
DS M2/F2/H2/V2 - 01/02/03/04	**58 43 3..**	**58 83 3..**	**65 43 114**	
DS M1/F1/H1/V1 - 11/12/13/14/15	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DS M2/F2/H2/V2 - 11/12/13/14	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
DS M1/F1/H1/V1 - 21/22/23/24/25	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DS M2/F2/H2/V2 - 21/22/23/24	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
DS M1/F1/H1/V1 - 31/32/33/34	**58 45 8..**	**58 85 8..**	**65 46 932**	
	58 46 8..	**58 86 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
VICKERS				
FAS N0	**58 43 5..**	**58 83 5..**	**65 43 914**	
FAS K1 / N1 / T1	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
FAS K2 / N2 / T2	**58 44 2..**	**58 44 2..**	**65 44 024**	
	58 45 2..	**58 45 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
FAS N7	**58 43 9..**	**58 83 9..**	**65 43 919**	
	58 44 6..	**58 84 6..**	**65 44 119**	
FAS K3 / T3 M2,M3,V2,V3	**58 45 8..**	**58 45 8..**	**65 46 932**	
	58 46 8..	**58 46 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
FAS T3 M2-V2/M3-V3	**58 45 8..**	**58 45 8..**	**65 46 932**	
	58 46 8..	**58 46 8..**	**65 46 932**	
	58 47 0..	**58 87 0..**	**65 46 932**	
Warner Electric				
MO 090	**58 43 3..**	**58.83.3..**	**65 43 114**	
MO 100	**58 43 1..**	**58 83 1..**	**65 43 119**	
	58 44 1..	**58 84 1..**	**65 44 119**	
MO 145	**58 44 2..**	**58 84 2..**	**65 44 024**	
	58 45 2..	**58 85 2..**	**65 46 024**	
	58 46 2..	**58 86 2..**	**65 46 024**	
Yaskawa				
SGMG - 12/20/30 AxB / - 20/30/44 AxA	**58 45 0..**	**58 85 0..**	**5.57.90.002**	2.65.26.089
	58 46 0..	**58 86 0..**	**5.57.90.002**	2.65.26.089
SGMS - 10/15/20 AxA	**58 43 4..**	**58 83 4..**	**65 43 924**	

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