



ANDANTEX

MODULAR RACK & PINION SYSTEM

INTRODUCTION

Andantex, USA has introduced new products under the **REDEX ANDANTEX** brand name and joined forces with world class rack manufacturers to provide North American customers complete solutions to Rack and pinion Axis drives.

The complete solution is built from standard building blocks and it consists of:

- Racks & Pinions
- Precision speed reducer
- Automatic Rack Lubrication system
- Servo-Motor mounting flange
- Engineering selection and guidance to optimize the solution
- Installation instructions and assistance

The axis building blocks consist of:

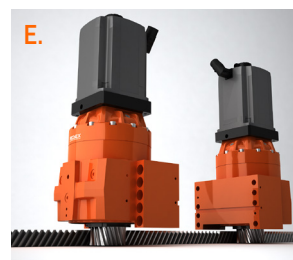
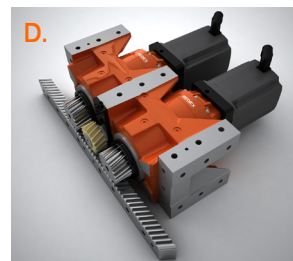
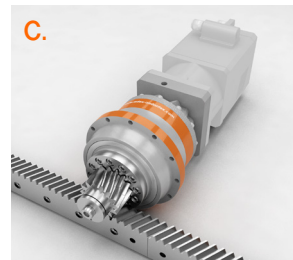
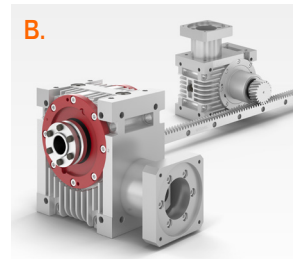
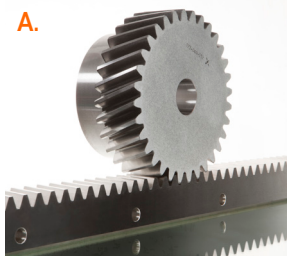
- A. Modular rack & pinion system** providing standard rack sections for building any length or precision linear axis.
- B. HPG Servo-Worm reducers** for positioning applications
- C. SRP High-Tech servo-planetary reducers** for precise positioning, contouring and heavily loaded applications.
- D. DRP+ DualDrive & TwinDrive reducers** for Zero-Backlash applications
- E. KRPX & KRP+ Rigid side mount or flange mount rack & pinion drive dedicated reducers** including Zero-Backlash achieved by mechanical or electrical preload

The range of products insures that Andantex can provide the rack & pinion drive system with the correct balance of precision, power and price for typical linear motion applications:

- Axis requiring precise positioning and repeatability
- Traveling gantry horizontal and vertical axis drives
- Pick and place robots
- Replacements for long ballscrew axis drives
- Zero-Backlash positioning and contouring drives

These applications are found in the following industries and machines:

- Machine Tool
 - Gantry Milling Machine
 - Moving Column Jig Boring Machines
 - Large Turning Machines
- Carbon Fiber Placement machines
- Material Handling Machinery
- Ultrasonic inspection Machinery
- Cutting Machines
 - Laser
 - Waterjet
 - Plasma cutting
 - Stone cutting



CONTENTS

Modular Rack & Pinion System - Description

This system consists of a standard range of straight, circumferential pitch, and helical racks and pinions. The modular design permits rack lengths from 0.5 meters to 3 meters to be linked end to end achieving any desired travel length from standard components. Racks & pinions are available with different materials, heat treatments and quality levels to insure the correct balance of power, precision and price to meet application requirements. The table below summarizes this point:

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AVAILABLE QUALITY LEVELS

| Description | Material | Hardness | Quality* | Relative Torque Capacity* | Relative Pitch Error* | Relative Cost |
|---------------------------------|---|----------------|----------|---------------------------|-----------------------|---------------|
| Hardened & Ground Q5 | C45 | 55 Rc | ~AGMA 13 | ◆◆◆◆ | ★ | \$\$\$\$ |
| Hardened & Ground High Strength | 16MnCr5 (AISI 51 L17) | 60 Rc | ~AGMA 12 | ◆◆◆◆◆◆ | ★★ | \$\$\$ + 1/2 |
| Hardened & Ground | 16MnCr5 (AISI 51L17) C45 (AISI 1045) | 60 Rc 55 Rc | ~AGMA 12 | ◆◆◆◆ | ★★ | \$\$\$ |
| Quenched & Tempered | 42CrMo4V (AISI 4140) | 27 Rc | ~AGMA 10 | ◆◆ | ★★★ | \$\$ |
| Induction Hardened | C45 (AISI 1045) | 55 Rc | ~AGMA 8 | ◆◆◆ | ★★★★★ | \$ + 1/2 |
| Soft | C45 (AISI 1045) | 15 Rc | ~AGMA 9 | ◆ | ★★★★ | \$ |

*Note all AGMA quality grades in this catalog are based on AGMA standard 2000-A88. The new AGMA quality numbers defined in AGMA 2015-1-A01 are similar to the DIN numbers shown.

Cost effective automatic lubrication systems are available to insure long life and trouble free operation.

The modular rack & pinion system is the primary building block of a linear axis drive.

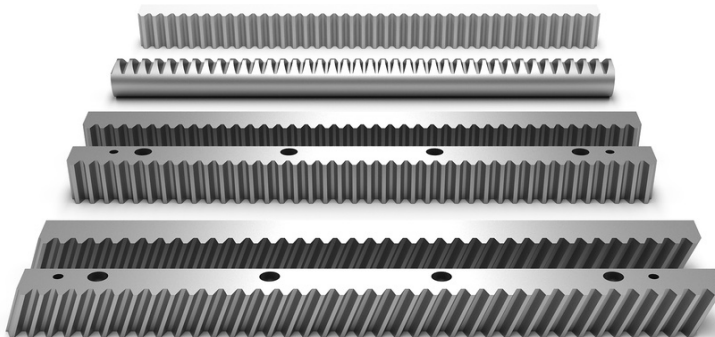
Rack and pinions are manufactured by: Güdel or WMH Herion.

The standard range is available in modules, M, 1.0 to 10.0 (Diametral pitch, P, 25.4 to 2.54) with lengths up to 3 meters allowing loads from 1 Lb. to 100,000 Lbs. to be moved at speeds from 0 to 1000 ft/s (5 M/s). Rack lengths up to 4 meters (2 meters with ground teeth) and modules up to 30 are available on request.

RACK CAPABILITIES

Standard Range:

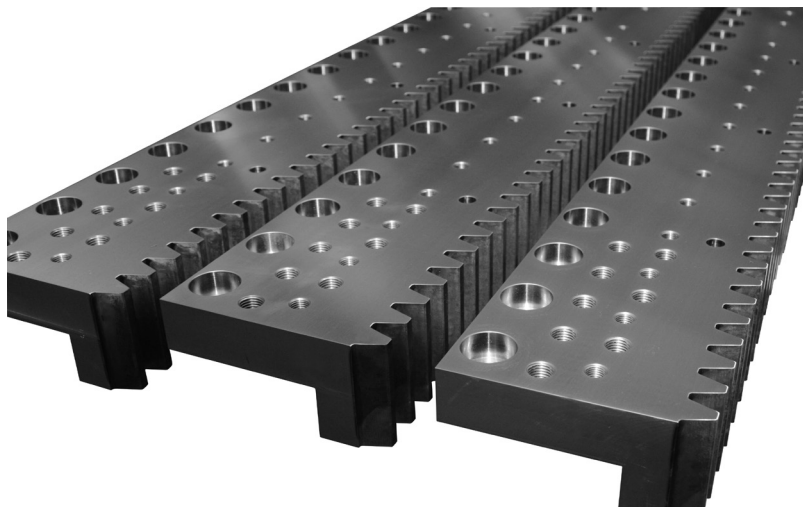
The index on the next page provides an overview of our Standard range of straight (spur) and helical tooth racks. Racks in the standard range are usually in stock allowing for short delivery times. The standard range consists of rectangular and round profile steel racks in modules 1 – 10 with lengths up to 3 meters and quality from AGMA 8 to AGMA 13.



Custom Racks:

In addition to the standard range, Andantex can provide Straight or Helical racks to customer designs with:

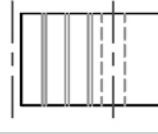

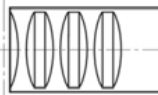


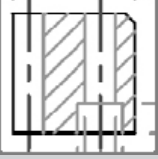
- Precision milled teeth in modules 0.5 - 30 (diametral pitch 50.8 to 0.85) in lengths up to 4 meters.
- Ground Teeth in modules 1-16 (diametral pitch 25.4 to 1.6) in lengths up to 3 meters.
- Quality Levels of up to AGMA 14 (DIN 4)
- Material hardened or plated
- Round Sections
- Stainless Steel
- Plastic



Part Numbering System



RANGE OF RACKS

| Style | Series | Module | Heat Treatment | Quality Level | Page | |
|---|--|---|--------------------------------|--|----------------------|----------------------|
| TEETH STRAIGHT (SPUR)  | A10 _ _ _ | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 6 h 23 (-AGMA 12) | 6 | |
| | A10 _ _ _Q5 | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 5 h 22 (-AGMA 13) | 7 | |
| | A12 _ _ _ | 2, 3, 4 | Hardened & Ground | 6 h 23 (-AGMA 12) | 8 | |
| | A20 _ _ _ | 2, 3, 4, 5 | Quenched & Tempered | 8 h 27 (-AGMA 10) | 9 | |
| | A30 _ _ _ | 1, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Soft | 9 h 27 (-AGMA 9) | 10 | |
| | A32 _ _ _ | 2, 3, 4, 5, 6, 8, 10 | Soft | 9 h 27 (-AGMA 9) | 11 | |
| | A40 _ _ _ | 2, 3, 4, 5, 6 | Induction Hardened | 10 h 27 (-AGMA 8) | 12 | |
| | A42 _ _ _ | 1, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Induction Hardened | 10 h 27 (-AGMA 8) | 13 | |
| | A44 _ _ _ | 2, 3, 4, 6, 8, 10 | Induction Hardened | 10 h 27 | 14 | |
| | A50 _ _ _ | 2, 5, 7.5, 10 circular pitch, p | Hardened & Ground | 6 h 23 (-AGMA 12) | 15 | |
| CROSS SECTION  | A60 _ _ _ | 10, 12.5, 16, 20, 25 circular pitch, p | Induction Hardened | 9 h 25 (-AGMA 9) | 16 | |
| | A70 _ _ _ | 2, 5, 7.5, 10, 12.5 circular pitch, p | Soft | 7 h 25 (-AGMA 11) | 17 | |
| | A80 _ _ _ | 1, 1.5, 2, 3, 4 | Stainless Steel | 8 h 27 (-AGMA 10) | 18 | |
| | TEETH STRAIGHT (SPUR)  | A90 _ _ _ | 1, 1.5, 2, 3, 4 | Alloy Steel | 8 h 27 (-AGMA 10) | 19 |
| | | A92 _ _ _ | 1, 1.5, 2, 3 | Stainless Steel | 8 h 27 (-AGMA 10) | 20 |
| | CROSS SECTION  | A94 _ _ _ | 1, 1.5, 2, 2.5, 3, 4, 5 | Soft | 8 h 27 (-AGMA 10) | 21 |
| | | TEETH HELICAL  | A11 _ _ _ | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 6 h 23 (-AGMA 12) |
| | A11 _ _ _Q5 | | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 5 h 22 (-AGMA 13) | 23 |
| A13 _ _ _ | 2, 3, 4 | | Hardened & Ground | 6 h 23 (-AGMA 12) | 24 | |
| CROSS SECTION  | A19 _ _ _ | 3, 4, 5, 6 | Helical High-Strength | 6 h 23 (-AGMA 12) | 25 | |
| | A21 _ _ _ | 2, 3, 4, 5 | Quenched & Tempered | 8 h 27 (-AGMA 10) | 26 | |
| | A31 _ _ _ | 2, 3, 4, 5, 6, 8, 10 | Soft | 9 h 27 (-AGMA 9) | 27 | |
| | A41 _ _ _ | 2, 3, 4, 5, 6 | Induction Hardened | 10 h 27 (-AGMA 8) | 28 | |
| Helical, Straight (Spur), 90° & 180° | <u>Racks machined for linear guides</u> | 2, 3, 4 Circular pitch 5, 10 | Hardened & Ground or Soft | 6 h 23 (-AGMA 12) or 9 h 27 (-AGMA 9) | 29 | |
| Helical, Straight (Spur), 90° & 180° | <u>Rack, Rail & Bearing Block Assemblies</u> | 2, 3, 4 Circular pitch 5, 10 | Hardened & Ground or Soft | 6 h 23 (-AGMA 12) or 9 h 27 (-AGMA 9) | 29 | |

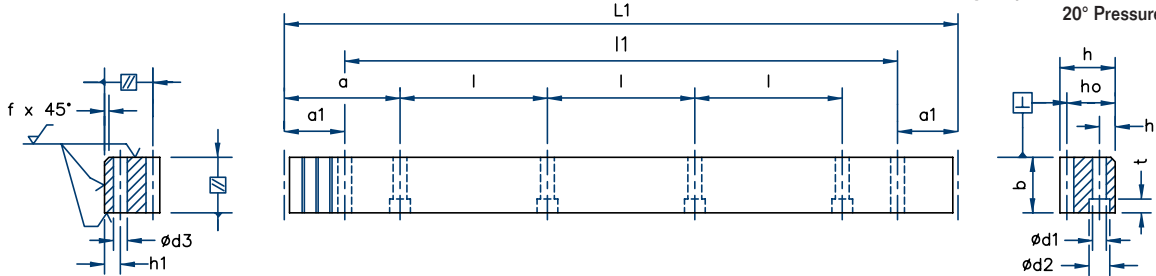
*Note all AGMA quality grades in this catalog are based on AGMA standard 2000-A88. The new AGMA quality numbers defined in AGMA 2015-1-A01 are similar to the DIN numbers shown.

MODULAR RACK & PINION SYSTEM

RACKS WITH STRAIGHT (SPUR) TEETH

SERIES A10

Case Hardened & Ground Teeth
Tooth Quality DIN 6 h 23 (-AGMA12)
20° Pressure Angle



| Module | L1 | l1 | teeth | b | h | ho | f | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|--------|-------|----|----|------|---|-------|--------|-----------|---------------|----|----|----|-------|------|-------|----------|--------------|
| 1.5 | 499.5 | 441.5 | 106 | 19 | 19 | 17.5 | 2 | 62.44 | 124.88 | 4 | 8 | 7 | 11 | 7 | 29 | 5.7 | 0.029 | 1.3 | A10-1.50-050 |
| 1.5 | 499.5 | | 106 | 19 | 19 | 17.5 | 2 | | | | Without Holes | | | | | | 0.029 | 1.3 | A10-1.51-050 |
| 1.5 | 999.0 | 941 | 212 | 19 | 19 | 17.5 | 2 | 62.44 | 124.88 | 8 | 8 | 7 | 11 | 7 | 29 | 5.7 | 0.043 | 2.6 | A10-1.50-100 |
| 1.5 | 999.0 | | 212 | 19 | 19 | 17.5 | 2 | | | | Without Holes | | | | | | 0.043 | 2.6 | A10-1.51-100 |
| 1.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | |
| 2.0 | 502.7 | 440.1 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 2.1 | A10-020-050 |
| 2.0 | 502.7 | | 80 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | | | 2.1 | A10-021-050 |
| 2.0 | 1005.3 | 942.7 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.036 | 4.2 | A10-020-100 |
| 2.0 | 1005.3 | | 160 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | | 0.036 | 4.2 | A10-021-100 |
| 2.0 | 2010.6 | 1948 | 320 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 16 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.058 | 8 | A10-020-200 |
| 2.0 | 2010.6 | | 320 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | | 0.058 | 8 | A10-021-200 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | |
| 2.5 | 502.7 | 440.1 | 64 | 24 | 24 | 21.5 | 2 | 62.83 | 125.66 | 4 | 9 | 7 | 11 | 7 | 31.3 | 5.7 | 0.027 | 2.0 | A10-2.50-050 |
| 2.5 | 502.7 | | 64 | 24 | 24 | 21.5 | 2 | | | | Without Holes | | | | | | 0.027 | 2.0 | A10-2.51-050 |
| 2.5 | 1005.3 | 942.7 | 128 | 24 | 24 | 21.5 | 2 | 62.83 | 125.66 | 8 | 9 | 7 | 11 | 7 | 31.3 | 5.7 | 0.036 | 4.1 | A10-2.50-100 |
| 2.5 | 1005.3 | | 128 | 24 | 24 | 21.5 | 2 | | | | Without Holes | | | | | | 0.036 | 4.1 | A10-2.51-100 |
| 2.5 | 2010.6 | 1948 | 256 | 24 | 24 | 21.5 | 2 | 62.83 | 125.66 | 16 | 9 | 7 | 11 | 7 | 31.3 | 5.7 | 0.053 | 8 | A10-2.50-200 |
| 2.5 | 2010.6 | | 256 | 24 | 24 | 21.5 | 2 | | | | Without Holes | | | | | | 0.053 | 8 | A10-2.51-200 |
| 2.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | |
| 3.0 | 508.9 | 440.1 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3 | A10-030-050 |
| 3.0 | 508.9 | | 54 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | | 3 | A10-031-050 |
| 3.0 | 1017.9 | 949.1 | 108 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.036 | 6 | A10-030-100 |
| 3.0 | 1017.9 | | 108 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | 0.036 | 6 | A10-031-100 |
| 3.0 | 2035.8 | 1967.0 | 216 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 16 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.055 | 11.5 | A10-030-200 |
| 3.0 | 2035.8 | | 216 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | 0.055 | 11.5 | A10-031-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |
| 4.0 | 502.7 | 427.7 | 40 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.3 | A10-040-050 |
| 4.0 | 502.7 | | 40 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | | 5.3 | A10-041-050 |
| 4.0 | 1005.3 | 930.3 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.040 | 10.5 | A10-040-100 |
| 4.0 | 1005.3 | | 80 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | 0.040 | 10.5 | A10-041-100 |
| 4.0 | 2010.6 | 1935.6 | 160 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 21 | A10-040-200 |
| 4.0 | 2010.6 | | 160 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | | 21 | A10-041-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |
| 5.0 | 502.6 | 442.4 | 32 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.1 | 11.7 | | 6.7 | A10-050-050 |
| 5.0 | 502.6 | | 32 | 49 | 49 | 34 | 3 | | | | Without Holes | | | | | | | 6.7 | A10-051-050 |
| 5.0 | 1005.3 | 945 | 64 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.1 | 11.7 | 0.040 | 13.4 | A10-050-100 |
| 5.0 | 1005.3 | | 64 | 49 | 49 | 34 | 3 | | | | Without Holes | | | | | | 0.040 | 13.4 | A10-051-100 |
| 5.0 | 2010.6 | 1950.4 | 128 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 30.1 | 11.7 | | 26.8 | A10-050-200 |
| 5.0 | 2010.6 | | 128 | 49 | 49 | 34 | 3 | | | | Without Holes | | | | | | | 26.8 | A10-051-200 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |
| 6.0 | 508.9 | 446.1 | 27 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 4 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 10.1 | A10-060-050 |
| 6.0 | 508.9 | | 27 | 59 | 49 | 43 | 3 | | | | Without Holes | | | | | | | 10.1 | A10-061-050 |
| 6.0 | 1017.8 | 955 | 54 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.040 | 20.2 | A10-060-100 |
| 6.0 | 1017.8 | | 54 | 59 | 49 | 43 | 3 | | | | Without Holes | | | | | | 0.040 | 20.2 | A10-061-100 |
| 6.0 | 2035.8 | 1973 | 108 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 16 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 40.4 | A10-060-200 |
| 6.0 | 2035.8 | | 108 | 59 | 49 | 43 | 3 | | | | Without Holes | | | | | | | 40.4 | A10-061-200 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |
| 8.0 | 502.7 | 449.5 | 20 | 79 | 79 | 71.0 | 3 | 62.83 | 125.66 | 4 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 22.4 | A10-080-050 |
| 8.0 | 502.7 | | 20 | 79 | 79 | 71.0 | 3 | | | | Without Holes | | | | | | | 22.4 | A10-081-050 |
| 8.0 | 1005.3 | 952 | 40 | 79 | 79 | 71.0 | 3 | 62.83 | 125.66 | 8 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | 0.040 | 44.8 | A10-080-100 |
| 8.0 | 1005.3 | | 40 | 79 | 79 | 71.0 | 3 | | | | Without Holes | | | | | | 0.040 | 44.8 | A10-081-100 |
| 8.0 | 2010.6 | 1957.3 | 80 | 79 | 79 | 71.0 | 3 | 62.83 | 125.66 | 16 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 89.5 | A10-080-200 |
| 8.0 | 2010.6 | | 80 | 79 | 79 | 71.0 | 3 | | | | Without Holes | | | | | | | 89.5 | A10-081-200 |
| 8.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |
| 10.0 | 1005.3 | 754 | 32 | 99 | 99 | 89 | 3 | 62.83 | 125.66 | 8 | 32 | 33 | 48 | 32 | 125.7 | 19.7 | 0.040 | 69 | A10-100-100 |
| 10.0 | 1005.3 | | 32 | 99 | 99 | 89 | 3 | | | | Without Holes | | | | | | 0.040 | 69 | A10-101-100 |
| 10.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | |

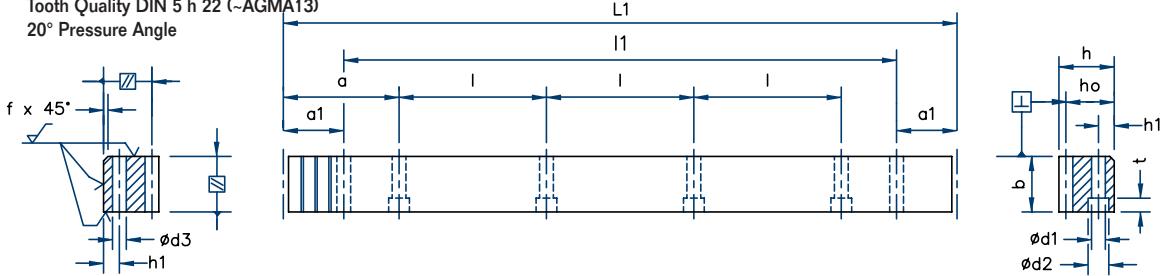
Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting. Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

800-713-6170 • www.andantex.com • info@andantex.com

SERIES A10Q5

Case Hardened & Ground Teeth
Tooth Quality DIN 5 h 22 (~AGMA13)
20° Pressure Angle



RACKS WITH STRAIGHT (SPUR) TEETH

| Module | L1 | l1 | teeth | b | h | h ₀ | f | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part No. |
|--------|-----------------------------|-------|-------|----|----|----------------|---|-------|--------|-----------|----|----|----|----|-------|------|-------|----------|-----------------|
| 1.5 | 499.51 | 441.5 | 106 | 19 | 19 | 17.5 | 2 | 62.44 | 124.88 | 4 | 8 | 7 | 11 | 7 | 29 | 5.7 | 0.021 | 1.3 | A10-1.50-050-Q5 |
| 1.5 | 999.03 | 941.0 | 212 | 19 | 19 | 17.5 | 2 | 62.44 | 124.88 | 8 | 8 | 7 | 11 | 7 | 29 | 5.7 | 0.030 | 2.6 | A10-1.50-100-Q5 |
| 1.5 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-1.51-999 |
| 2.0 | 502.65 | 440.1 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.018 | 2.1 | A10-020-050-Q5 |
| 2.0 | 1005.31 | 942.7 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.025 | 4.2 | A10-020-100-Q5 |
| 2.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-021-999 |
| 2.5 | 502.65 | 440.1 | 64 | 24 | 24 | 21.5 | 2 | 62.83 | 125.66 | 4 | 9 | 7 | 11 | 7 | 31.3 | 5.7 | 0.019 | 2.0 | A10-2.50-050-Q5 |
| 2.5 | 1005.31 | 942.7 | 128 | 24 | 24 | 21.5 | 2 | 62.83 | 125.66 | 8 | 9 | 7 | 11 | 7 | 31.3 | 5.7 | 0.025 | 4.1 | A10-2.50-100-Q5 |
| 2.5 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-2.51-999 |
| 3.0 | 508.94 | 440.1 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.020 | 3 | A10-030-050-Q5 |
| 3.0 | 1017.88 | 949.1 | 108 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.026 | 6 | A10-030-100-Q5 |
| 3.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-031-999 |
| 4.0 | 502.65 | 427.7 | 40 | 39 | 39 | 35 | 2 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.021 | 5.4 | A10-040-050-Q5 |
| 4.0 | 1005.31 | 930.3 | 80 | 39 | 39 | 35 | 2 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.026 | 10.8 | A10-040-100-Q5 |
| 4.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-041-999 |
| 5.0 | 502.65 | 442.3 | 32 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.020 | 6.6 | A10-050-050-Q5 |
| 5.0 | 1005.31 | 944.9 | 64 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.024 | 13.1 | A10-050-100-Q5 |
| 5.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-051-999 |
| 6.0 | 508.94 | 446.1 | 27 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 4 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.022 | 10.1 | A10-060-050-Q5 |
| 6.0 | 1017.88 | 955 | 54 | 59 | 49 | 43 | 3 | 63.62 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.026 | 20.3 | A10-060-100-Q5 |
| 6.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-061-999 |
| 8.0 | 502.65 | 449.3 | 20 | 79 | 79 | 71.0 | 3 | 62.83 | 125.66 | 4 | 25 | 22 | 33 | 21 | 26.7 | 19.7 | 0.021 | 22.1 | A10-080-050-Q5 |
| 8.0 | 1005.31 | 952 | 40 | 79 | 79 | 71.0 | 3 | 62.83 | 125.66 | 8 | 25 | 22 | 33 | 21 | 26.7 | 19.7 | 0.024 | 44.3 | A10-080-100-Q5 |
| 8.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-081-999 |
| 10.0 | 502.65 | 252.3 | 16 | 99 | 99 | 89 | 3 | 62.83 | 125.66 | 4 | 32 | 33 | 48 | 32 | 125.2 | 19.7 | 0.020 | 34.8 | A10-100-050-Q5 |
| 10.0 | 1005.31 | 755 | 32 | 99 | 99 | 89 | 3 | 62.83 | 125.66 | 8 | 32 | 33 | 48 | 32 | 125.2 | 19.7 | 0.023 | 69 | A10-100-100-Q5 |
| 10.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | | A10-101-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

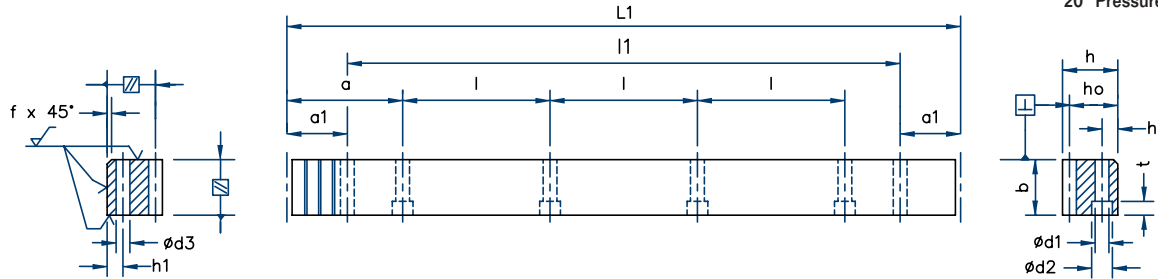
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

RACKS WITH STRAIGHT (SPUR) TEETH

SERIES A12

Case Hardened & Ground Teeth
Tooth Quality DIN 6 h 23 (~AGMA12)
20° Pressure Angle



| Module | L1 | l1 | teeth | b | h | ho | f | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|-------|-------|----|----|----|---|-------|--------|-----------|---------------|----|----|---|------|-------|-------|-------------|-------------|
| 2.0 | 502.7 | 440.1 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 2.1 | | A12-020-050 |
| 2.0 | 502.7 | | 80 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | 2.1 | | A12-021-050 | |
| 2.0 | 1005.3 | 942.7 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.036 | 4.2 | A12-020-100 |
| 2.0 | 1005.3 | | 160 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | 0.036 | 4.2 | A12-021-100 | |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | A10-021-999 |
| 3.0 | 508.9 | 440.1 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3 | A12-030-050 |
| 3.0 | 508.9 | | 54 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | 3 | A12-031-050 | |
| 3.0 | 1017.9 | 949.1 | 108 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.036 | 6 | A12-030-100 |
| 3.0 | 1017.9 | | 108 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | 0.036 | 6 | A12-031-100 | |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-031-999 |
| 4.0 | 502.7 | 427.7 | 40 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.3 | A12-040-050 |
| 4.0 | 502.7 | | 40 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | 5.3 | A12-041-050 | |
| 4.0 | 1005.3 | 930.3 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.04 | 10.6 | A12-040-100 |
| 4.0 | 1005.3 | | 80 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | 0.04 | 10.6 | A12-041-100 | |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-041-999 |

Material AISI 5115 (16MnCr5) Teeth induction hardened to 60 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

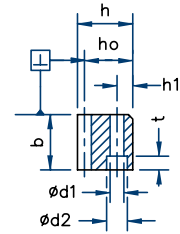
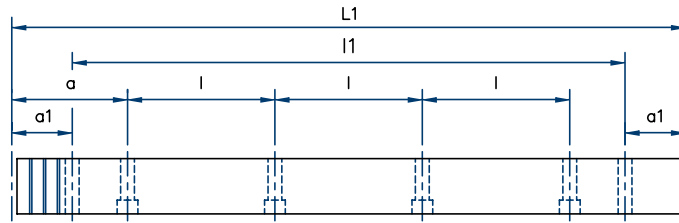
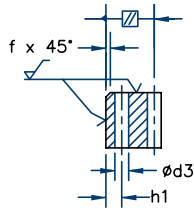
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A20

Quenched & Tempered Material
Quality DIN 8 h 27 (-AGMA10)
20° Pressure Angle



| Module | L1 | l1 | teeth | b | h | h0 | f | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|--------|-------|----|----|----|---|-------|--------|-----------|---------------|----|----|----|------|------|-------|-------------|---------------|
| 2.0 | 502.7 | 440.1 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 2.2 | A20-020-050 |
| 2.0 | 502.7 | | 80 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | 2.2 | A20-021-050 | |
| 2.0 | 1005.3 | 942.7 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.063 | 4.3 | A20-020-100 |
| 2.0 | 1005.3 | | 160 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | 0.063 | 4.3 | A20-021-100 |
| 2.0 | 2010.6 | 1948 | 320 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 16 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 8.6 | A20-020-200 |
| 2.0 | 2010.6 | | 320 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | 8.6 | A20-021-200 | |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | A10-021-999-W |
| 3.0 | 508.9 | 440.1 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3.1 | A20-030-050 |
| 3.0 | 508.9 | | 54 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | 3.1 | A20-031-050 | |
| 3.0 | 1017.9 | 949.1 | 108 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.071 | 6.2 | A20-030-100 |
| 3.0 | 1017.9 | | 108 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | 0.071 | 6.2 | A20-031-100 |
| 3.0 | 2035.8 | 1967 | 216 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 16 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 12.4 | A20-030-200 |
| 3.0 | 2035.8 | | 216 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | 12.4 | A20-031-200 | |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-031-999-W |
| 4.0 | 502.7 | 427.7 | 40 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.5 | A20-040-050 |
| 4.0 | 502.7 | | 40 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | 5.5 | A20-041-050 | |
| 4.0 | 1005.3 | 930.3 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.08 | 11 | A20-040-100 |
| 4.0 | 1005.3 | | 80 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | 0.08 | 11 | A20-041-100 |
| 4.0 | 2010.6 | 1935.6 | 160 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 22 | A20-040-200 |
| 4.0 | 2010.6 | | 160 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | 22 | A20-041-200 | |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-041-999-W |
| 5.0 | 502.7 | 442.3 | 32 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 6.8 | A20-050-050 |
| 5.0 | 502.7 | | 32 | 49 | 39 | 34 | 3 | | | | without holes | | | | | | 6.8 | A20-051-050 | |
| 5.0 | 1005.3 | 945.0 | 64 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.08 | 13.6 | A20-050-100 |
| 5.0 | 1005.3 | | 64 | 49 | 39 | 34 | 3 | | | | without holes | | | | | | 0.08 | 13.6 | A20-051-100 |
| 5.0 | 2010.6 | 1950.0 | 128 | 49 | 39 | 34 | 3 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 27.2 | A20-050-200 |
| 5.0 | 2010.6 | | 128 | 49 | 39 | 34 | 3 | | | | without holes | | | | | | 27.2 | A20-051-200 | |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-051-999-W |

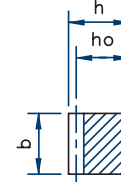
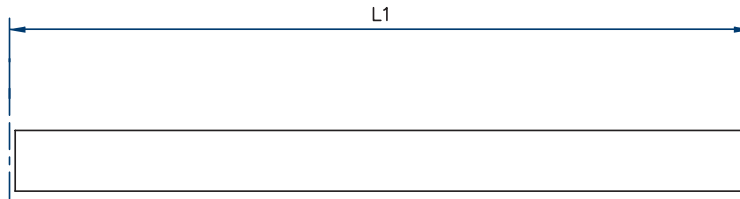
Material AISI 4140 (42CrMo4V) with tensile strength = 900 N/mm² (130,500 PSI).
Back and contact face ground. Rack ends are machined for continuous mounting.
Fp is the max cumulative pitch error for the corresponding rack length.
Dimensions are in mm and are subject to change - consult factory.

RACKS

WITH STRAIGHT (SPUR) TEETH

SERIES A30

Soft Rack
Tooth Quality DIN 9 h 27 (~AGMA 9)
20° Pressure Angle



| Module | L1 | teeth | b | h | ho | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|---------|-------|-----|-------|-------|---|---|-----------|-----------------------------|----|----|---|----|----|-------|----------|---------------|
| 1.0 | 499.51 | 159 | 10 | 9.8 | 8.8 | | | | without holes | | | | | | | 0.35 | A30-011-050 |
| 1.0 | 999.03 | 318 | 10 | 9.8 | 8.8 | | | | without holes | | | | | | 0.09 | 0.7 | A30-011-100 |
| 1.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A30-011-999 |
| 1.5 | 499.51 | 106 | 15 | 14.8 | 13.3 | | | | without holes | | | | | | | 0.8 | A30-1.51-050 |
| 1.5 | 999.03 | 212 | 15 | 14.8 | 13.3 | | | | without holes | | | | | | 0.09 | 1.6 | A30-1.51-100 |
| 1.5 | 1998.05 | 424 | 15 | 14.8 | 13.3 | | | | without holes | | | | | | | 3.1 | A30-1.51-200 |
| 1.5 | | | | | | | | | Companion Rack for assembly | | | | | | | | A30-1.51-999 |
| 2.0 | 502.65 | 80 | 20 | 19.75 | 17.75 | | | | without holes | | | | | | | 1.4 | A30-021-050 |
| 2.0 | 1005.31 | 160 | 20 | 19.75 | 17.75 | | | | without holes | | | | | | 0.09 | 2.8 | A30-021-101 |
| 2.0 | 2010.62 | 320 | 20 | 19.75 | 17.75 | | | | without holes | | | | | | | 5.6 | A30-021-201 |
| 2.0 | 3015.9 | 480 | 20 | 19.75 | 17.75 | | | | without holes | | | | | | | 8.5 | A30-021-300 |
| 2.0 | | | | | | | | | Companion Rack For Assembly | | | | | | | | A10-021-999-W |
| 2.5 | 502.65 | 64 | 25 | 24.75 | 22.25 | | | | without holes | | | | | | | 2.1 | A30-2.51-050 |
| 2.5 | 1005.31 | 128 | 25 | 24.75 | 22.25 | | | | without holes | | | | | | 0.100 | 4.2 | A30-2.51-101 |
| 2.5 | 2010.62 | 256 | 25 | 24.75 | 22.25 | | | | without holes | | | | | | | 8.4 | A30-2.51-201 |
| 2.5 | 3015.93 | 384 | 25 | 24.75 | 22.25 | | | | without holes | | | | | | | 12.6 | A30-2.51-301 |
| 2.5 | | | | | | | | | Companion Rack For Assembly | | | | | | | | A30-2.51-999 |
| 3.0 | 508.94 | 54 | 30 | 29.75 | 26.75 | | | | without holes | | | | | | | 3.1 | A30-031-051 |
| 3.0 | 1017.88 | 108 | 30 | 29.75 | 26.75 | | | | without holes | | | | | | 0.100 | 6.2 | A30-031-101 |
| 3.0 | 2035.75 | 216 | 30 | 29.75 | 26.75 | | | | without holes | | | | | | | 12.4 | A30-031-201 |
| 3.0 | 3053.62 | 324 | 30 | 29.75 | 26.75 | | | | without holes | | | | | | | 19.3 | A30-031-300 |
| 3.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-031-999-W |
| 4.0 | 502.65 | 40 | 40 | 39.7 | 35.7 | | | | without holes | | | | | | | 5.5 | A30-041-050 |
| 4.0 | 1005.31 | 80 | 40 | 39.7 | 35.7 | | | | without holes | | | | | | 0.110 | 11 | A30-041-100 |
| 4.0 | 2010.62 | 160 | 40 | 39.7 | 35.7 | | | | without holes | | | | | | | 22 | A30-041-201 |
| 4.0 | 3015.92 | 240 | 40 | 39.7 | 35.7 | | | | without holes | | | | | | | 33.9 | A30-041-300 |
| 4.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-041-999-W |
| 5.0 | 502.65 | 32 | 50 | 49.7 | 44.7 | | | | without holes | | | | | | | 8.6 | A30-051-050 |
| 5.0 | 1005.31 | 64 | 50 | 49.7 | 44.7 | | | | without holes | | | | | | 0.110 | 17.2 | A30-051-100 |
| 5.0 | 2010.62 | 128 | 50 | 49.7 | 44.7 | | | | without holes | | | | | | | 34.4 | A30-051-200 |
| 5.0 | 3015.93 | 192 | 50 | 49.7 | 44.7 | | | | without holes | | | | | | | 51.6 | A30-051-300 |
| 5.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-051-999-W |
| 6.0 | 508.94 | 27 | 60 | 59.65 | 53.65 | | | | without holes | | | | | | | 12.3 | A30-061-050 |
| 6.0 | 1017.88 | 54 | 60 | 59.65 | 53.65 | | | | without holes | | | | | | 0.110 | 24.5 | A30-061-101 |
| 6.0 | 2035.75 | 108 | 60 | 59.65 | 53.65 | | | | without holes | | | | | | | 49 | A30-061-201 |
| 6.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-061-999-W |
| 8.0 | 502.65 | 20 | 80 | 79.6 | 71.6 | | | | without holes | | | | | | | 21.4 | A30-081-050 |
| 8.0 | 1005.31 | 40 | 80 | 79.6 | 71.6 | | | | without holes | | | | | | 0.110 | 42.7 | A30-081-100 |
| 8.0 | 2010.62 | 80 | 80 | 79.6 | 71.6 | | | | without holes | | | | | | | 85.4 | A30-081-200 |
| 8.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-081-999-W |
| 10.0 | 1005.3 | 32 | 100 | 99.6 | 89.6 | | | | without holes | | | | | | 0.110 | 70.6 | A30-101-100 |
| 10.0 | | | | | | | | | Companion Rack for Assembly | | | | | | | | A10-101-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI).
Rack ends are machined for continuous mounting.

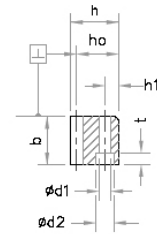
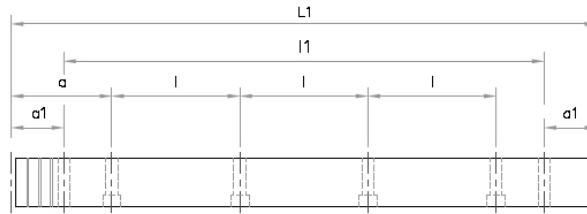
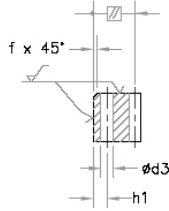
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A32

Soft Rack
Quality DIN 9 h 27 (-AGMA 9)
20° Pressure Angle



| Module | L1 | l1 | teeth | b | h | ho | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|--------|-------|-----|-------|-------|-------|--------|-----------|----|----|----|----|-------|------|-------|----------|---------------|
| 2.0 | 502.65 | 440.1 | 80 | 20 | 19.75 | 17.75 | 62.80 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 1.4 | A32-020-050 |
| 2.0 | 1005.31 | 942.7 | 160 | 20 | 19.75 | 17.75 | 62.80 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.090 | 2.8 | A32-020-100 |
| 2.0 | 2010.62 | 1948.0 | 320 | 20 | 19.75 | 17.75 | 62.80 | 125.66 | 16 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 5.6 | A32-020-200 |
| 2.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-021-999-W |
| 3.0 | 508.94 | 440.1 | 54 | 30 | 29.75 | 26.75 | 63.60 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3.1 | A32-030-050 |
| 3.0 | 1017.88 | 949.1 | 108 | 30 | 29.75 | 26.75 | 63.60 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.100 | 6.2 | A32-030-100 |
| 3.0 | 2035.75 | 1967.0 | 216 | 30 | 29.75 | 26.75 | 63.60 | 127.23 | 16 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 12.4 | A32-030-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-031-999-W |
| 4.0 | 502.65 | 427.7 | 40 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.5 | A32-040-050 |
| 4.0 | 1005.31 | 930.3 | 80 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.110 | 11.0 | A32-040-100 |
| 4.0 | 2010.62 | 1935.6 | 160 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 22.0 | A32-040-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-041-999-W |
| 5.0 | 502.65 | 442.3 | 32 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 8.6 | A32-050-050 |
| 5.0 | 1005.31 | 945 | 64 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.110 | 17.2 | A32-050-100 |
| 5.0 | 2010.62 | 1950.3 | 128 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 34.4 | A32-050-200 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-051-999-W |
| 6.0 | 508.94 | 446.1 | 27 | 60 | 59.65 | 53.65 | 63.62 | 127.23 | 4 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 12.3 | A32-060-050 |
| 6.0 | 1017.88 | 955 | 54 | 60 | 59.65 | 53.65 | 63.62 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.110 | 24.5 | A32-060-100 |
| 6.0 | 2035.75 | 1972.9 | 108 | 60 | 59.65 | 53.65 | 63.62 | 127.23 | 16 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 49.0 | A32-060-200 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-061-999-W |
| 8.0 | 502.65 | 449.5 | 20 | 80 | 79.60 | 71.60 | 62.83 | 125.66 | 4 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 21.4 | A32-080-050 |
| 8.0 | 1005.31 | 952.0 | 40 | 80 | 79.60 | 71.60 | 62.83 | 125.66 | 8 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | 0.110 | 42.7 | A32-080-100 |
| 8.0 | 2010.62 | 1957.3 | 80 | 80 | 79.60 | 71.60 | 62.83 | 125.66 | 16 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 85.4 | A32-080-200 |
| 8.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-081-999-W |
| 10.0 | 1005.31 | 754.0 | 32 | 100 | 99.60 | 89.60 | 62.83 | 125.66 | 8 | 32 | 33 | 48 | 32 | 125.7 | 19.7 | 0.110 | 70.6 | A32-100-100 |
| 10.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | A10-101-999-W |

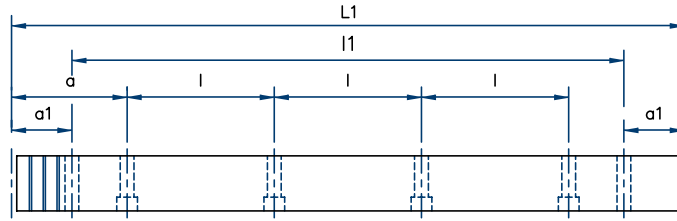
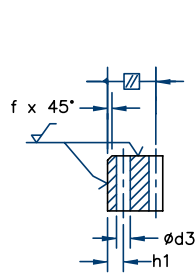
Material AISI 1045 (C45) with tensile strength = 650 N/mm2 (95,000 PSI).
Rack ends are machined for continuous mounting

Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

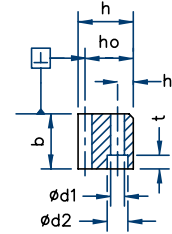
MODULAR RACK & PINION SYSTEM

RACKS WITH STRAIGHT (SPUR) TEETH



SERIES A40

Induction Hardened Teeth
Quality DIN 10 h 27 (~AGMA 8)
20° Pressure Angle



| Module | L1 | l1 | teeth | b | h | ho | f | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|--------|-------|----|----|----|---|-------|--------|-----------|---------------|----|----|----|------|------|-------|----------|---------------|
| 2.0 | 502.7 | 440.1 | 80 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 2.1 | A40-020-050 |
| 2.0 | 502.7 | | 80 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | | 2.1 | A40-021-050 |
| 2.0 | 1005.3 | 942.7 | 160 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.140 | 4.2 | A40-020-100 |
| 2.0 | 1005.3 | | 160 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | 0.140 | 4.2 | A40-021-100 |
| 2.0 | 2010.61 | 1948 | 320 | 24 | 24 | 22 | 2 | 62.83 | 125.66 | 16 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 8.4 | A40-020-200 |
| 2.0 | 2010.61 | | 320 | 24 | 24 | 22 | 2 | | | | without holes | | | | | | | 8.4 | A40-021-200 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | A10-021-999-W |
| 3.0 | 508.9 | 440.1 | 54 | 29 | 29 | 26 | 2 | 63.62 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3 | A40-030-050 |
| 3.0 | 508.9 | | 54 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | | 3 | A40-031-050 |
| 3.0 | 1017.9 | 949.1 | 108 | 29 | 29 | 26 | 2 | 63.63 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.160 | 6 | A40-030-100 |
| 3.0 | 1017.9 | | 108 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | 0.160 | 6 | A40-031-100 |
| 3.0 | 2035.75 | 1967.0 | 216 | 29 | 29 | 26 | 2 | 63.63 | 127.23 | 16 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 12 | A40-030-200 |
| 3.0 | 2035.75 | | 216 | 29 | 29 | 26 | 2 | | | | without holes | | | | | | | 12 | A40-031-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-031-999-W |
| 4.0 | 502.7 | 427.7 | 40 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.3 | A40-040-050 |
| 4.0 | 502.7 | | 40 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | | 5.3 | A40-041-050 |
| 4.0 | 1005.3 | 930.3 | 80 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.180 | 10.5 | A40-040-100 |
| 4.0 | 1005.3 | | 80 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | 0.180 | 10.5 | A40-041-100 |
| 4.0 | 2010.61 | 1935.6 | 160 | 39 | 39 | 35 | 3 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 21.2 | A40-040-200 |
| 4.0 | 2010.61 | | 160 | 39 | 39 | 35 | 3 | | | | without holes | | | | | | | 21.2 | A40-041-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-041-999-W |
| 5.0 | 502.65 | 442.3 | 32 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 6.9 | A40-050-050 |
| 5.0 | 502.65 | | 32 | 49 | 49 | 34 | 3 | | | | without holes | | | | | | | 6.9 | A40-051-050 |
| 5.0 | 1005.3 | 945 | 64 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.180 | 13.8 | A40-050-100 |
| 5.0 | 1005.3 | | 64 | 49 | 49 | 34 | 3 | | | | without holes | | | | | | 0.180 | 13.8 | A40-051-100 |
| 5.0 | 2010.61 | 1950.3 | 128 | 49 | 49 | 34 | 3 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 27.6 | A40-050-200 |
| 5.0 | 2010.61 | | 128 | 49 | 49 | 34 | 3 | | | | without holes | | | | | | | 27.6 | A40-051-200 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-051-999-W |
| 6.0 | 508.93 | 446.1 | 27 | 59 | 59 | 43 | 3 | 63.62 | 127.23 | 4 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 10.5 | A40-060-050 |
| 6.0 | 508.93 | | 27 | 59 | 59 | 43 | 3 | | | | without holes | | | | | | | 10.5 | A40-061-050 |
| 6.0 | 1017.87 | 955 | 54 | 59 | 59 | 43 | 3 | 63.62 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.180 | 21 | A40-060-100 |
| 6.0 | 1017.87 | | 54 | 59 | 59 | 43 | 3 | | | | without holes | | | | | | 0.180 | 21 | A40-061-100 |
| 6.0 | 2035.75 | 1972.9 | 108 | 59 | 59 | 43 | 3 | 63.62 | 127.23 | 16 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 42 | A40-060-200 |
| 6.0 | 2035.75 | | 108 | 59 | 59 | 43 | 3 | | | | without holes | | | | | | | 42 | A40-061-200 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A10-061-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth are induction hardened to 50-55Rc. Back and contact faces are machined after hardening. Only teeth are induction hardened allowing subsequent drilling and pinning of the rack. Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

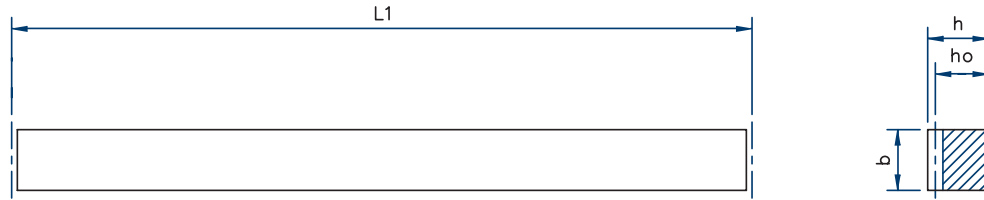
Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A42

Induction Hardened Teeth
Tooth Quality DIN 10 h 27 (-AGMA 8)
20° Pressure Angle

RACKS WITH STRAIGHT (SPUR) TEETH



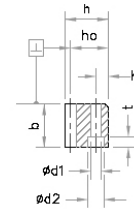
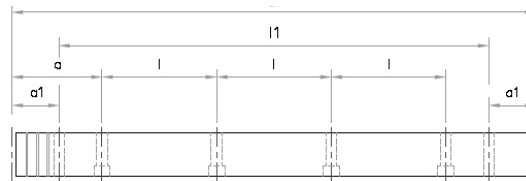
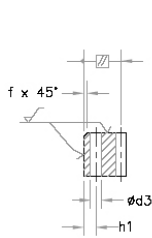
| Module | L1 | teeth | b | h | ho | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. |
|--------|-----------------------------|-------|-----|-------|-------|---|---|-------|----|---------------|----|---|----|----|-------|------|---------------|
| 1.0 | 499.51 | 159 | 10 | 9.8 | 8.8 | | | | | Without Holes | | | | | | 0.34 | A42-011-050 |
| 1.0 | 999.02 | 318 | 10 | 9.8 | 8.8 | | | | | Without Holes | | | | | 0.140 | 0.68 | A42-011-100 |
| 1.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | A30-011-999 |
| 1.5 | 499.51 | 106 | 15 | 14.8 | 13.3 | | | | | Without Holes | | | | | | 0.78 | A42-1.51-050 |
| 1.5 | 999.02 | 212 | 15 | 14.8 | 13.3 | | | | | Without Holes | | | | | 0.140 | 1.55 | A42-1.51-100 |
| 1.5 | 1998.05 | 424 | 15 | 14.8 | 13.3 | | | | | Without Holes | | | | | | 3.1 | A42-1.51-200 |
| 1.5 | Companion Rack for assembly | | | | | | | | | | | | | | | | A30-1.51-999 |
| 2.0 | 502.65 | 80 | 20 | 19.75 | 17.75 | | | | | Without Holes | | | | | | 1.4 | A42-021-050 |
| 2.0 | 1005.31 | 160 | 20 | 19.75 | 17.75 | | | | | Without Holes | | | | | 0.140 | 2.8 | A42-021-101 |
| 2.0 | 2010.62 | 320 | 20 | 19.75 | 17.75 | | | | | Without Holes | | | | | | 5.6 | A42-021-201 |
| 2.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-021-999-W |
| 2.5 | 502.65 | 64 | 25 | 24.75 | 22.25 | | | | | Without Holes | | | | | | 2.1 | A42-2.51-050 |
| 2.5 | 1005.31 | 128 | 25 | 24.75 | 22.25 | | | | | Without Holes | | | | | 0.160 | 4.2 | A42-2.51-101 |
| 2.5 | 2010.62 | 256 | 25 | 24.75 | 22.25 | | | | | Without Holes | | | | | | 8.4 | A42-2.51-201 |
| 2.5 | Companion Rack for assembly | | | | | | | | | | | | | | | | A30-2.51-999 |
| 3.0 | 508.94 | 54 | 30 | 29.75 | 26.75 | | | | | Without Holes | | | | | | 3.1 | A42-031-051 |
| 3.0 | 1017.88 | 108 | 30 | 29.75 | 26.75 | | | | | Without Holes | | | | | 0.160 | 6.2 | A42-031-101 |
| 3.0 | 2035.75 | 216 | 30 | 29.75 | 26.75 | | | | | Without Holes | | | | | | 12.4 | A42-031-201 |
| 3.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-031-999-W |
| 4.0 | 502.65 | 40 | 40 | 39.7 | 35.7 | | | | | Without Holes | | | | | | 5.5 | A42-041-050 |
| 4.0 | 1005.31 | 80 | 40 | 39.7 | 35.7 | | | | | Without Holes | | | | | 0.180 | 11 | A42-041-100 |
| 4.0 | 2010.62 | 160 | 40 | 39.7 | 35.7 | | | | | Without Holes | | | | | | 22 | A42-041-201 |
| 4.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-041-999-W |
| 5.0 | 502.65 | 32 | 50 | 49.7 | 44.7 | | | | | Without Holes | | | | | | 8.6 | A42-051-050 |
| 5.0 | 1005.31 | 64 | 50 | 49.7 | 44.7 | | | | | Without Holes | | | | | 0.180 | 17.2 | A42-051-100 |
| 5.0 | 2010.62 | 128 | 50 | 49.7 | 44.7 | | | | | Without Holes | | | | | | 34.4 | A42-051-200 |
| 5.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-051-999-W |
| 6.0 | 508.93 | 27 | 60 | 59.65 | 53.65 | | | | | Without Holes | | | | | | 12.3 | A42-061-050 |
| 6.0 | 1017.88 | 54 | 60 | 59.65 | 53.65 | | | | | Without Holes | | | | | 0.180 | 24.5 | A42-061-101 |
| 6.0 | 2035.75 | 108 | 60 | 59.65 | 53.65 | | | | | Without Holes | | | | | | 49 | A42-061-201 |
| 6.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-061-999-W |
| 8.0 | 502.65 | 20 | 80 | 79.6 | 71.6 | | | | | Without Holes | | | | | | 21.4 | A42-081-050 |
| 8.0 | 1005.31 | 40 | 80 | 79.6 | 71.6 | | | | | Without Holes | | | | | 0.180 | 42.7 | A42-081-100 |
| 8.0 | 2010.62 | 80 | 80 | 79.6 | 71.6 | | | | | Without Holes | | | | | | 85.4 | A42-081-200 |
| 8.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-081-999-W |
| 10.0 | 1005.31 | 32 | 100 | 99 | 89.6 | | | | | Without Holes | | | | | 0.180 | 70.6 | A42-101-100 |
| 10.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | A10-101-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth are induction hardened to 50-55Rc. Only teeth are induction hardened allowing subsequent drilling and pinning of the rack. Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

RACKS WITH STRAIGHT (SPUR) TEETH



SERIES A44

Induction Hardened Teeth
Tooth Quality DIN 10 h 27 (~AGMA 8)
20° Pressure Angle

| Module | L1 | I1 | teeth | b | h | h0 | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. |
|--------|-----------------------------|--------|-------|-----|-------|-------|-------|--------|-------|----|----|----|----|-------|------|-------|------|---------------|
| 2.0 | 502.65 | 440.1 | 80 | 20 | 19.75 | 17.75 | 62.83 | 125.66 | 4 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 1.4 | A44-020-050 |
| 2.0 | 1005.31 | 942.7 | 160 | 20 | 19.75 | 17.75 | 62.83 | 125.66 | 8 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | 0.140 | 2.8 | A44-020-100 |
| 2.0 | 2010.62 | 1948.0 | 320 | 20 | 19.75 | 17.75 | 62.83 | 125.66 | 16 | 8 | 7 | 11 | 7 | 31.3 | 5.7 | | 5.6 | A44-020-200 |
| 2.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-021-999-W |
| 3.0 | 508.94 | 440.1 | 54 | 30 | 29.75 | 26.75 | 63.6 | 127.23 | 4 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 3.1 | A44-030-050 |
| 3.0 | 1017.88 | 949.1 | 108 | 30 | 29.75 | 26.75 | 63.6 | 127.23 | 8 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | 0.160 | 6.2 | A44-030-100 |
| 3.0 | 2035.75 | 1967.0 | 216 | 30 | 29.75 | 26.75 | 63.6 | 127.23 | 16 | 9 | 10 | 15 | 9 | 34.4 | 7.7 | | 12.4 | A44-030-200 |
| 3.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-031-999-W |
| 4.0 | 502.65 | 427.7 | 40 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 4 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 5.5 | A44-040-050 |
| 4.0 | 1005.31 | 930.3 | 80 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 8 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | 0.180 | 11.0 | A44-040-100 |
| 4.0 | 2010.62 | 1935.6 | 160 | 40 | 39.70 | 35.70 | 62.83 | 125.66 | 16 | 12 | 10 | 15 | 9 | 37.5 | 7.7 | | 22.0 | A44-040-200 |
| 4.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-041-999-W |
| 5.0 | 502.65 | 442.3 | 32 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 4 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 8.6 | A44-050-050 |
| 5.0 | 1005.31 | 945.0 | 64 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 8 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | 0.180 | 17.2 | A44-050-100 |
| 5.0 | 2010.62 | 1950.3 | 128 | 50 | 49.70 | 44.70 | 62.83 | 125.66 | 16 | 12 | 14 | 20 | 13 | 30.2 | 11.7 | | 34.4 | A44-050-200 |
| 5.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-051-999-W |
| 6.0 | 508.94 | 446.1 | 27 | 60 | 59.65 | 53.65 | 63.6 | 127.23 | 4 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 12.3 | A44-060-050 |
| 6.0 | 1017.88 | 955.0 | 54 | 60 | 59.65 | 53.65 | 63.6 | 127.23 | 8 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | 0.180 | 24.5 | A44-060-101 |
| 6.0 | 2035.75 | 1972.9 | 108 | 60 | 59.65 | 53.65 | 63.6 | 127.23 | 16 | 16 | 18 | 26 | 17 | 31.4 | 15.7 | | 49 | A44-060-200 |
| 6.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-061-999-W |
| 8.0 | 502.65 | 449.5 | 20 | 80 | 79.6 | 71.6 | 62.83 | 125.66 | 4 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 21.4 | A44-080-050 |
| 8.0 | 1005.31 | 952.0 | 40 | 80 | 79.6 | 71.6 | 62.83 | 125.66 | 8 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | 0.180 | 42.7 | A44-080-100 |
| 8.0 | 2010.62 | 1957.3 | 80 | 80 | 79.6 | 71.6 | 62.83 | 125.66 | 16 | 25 | 22 | 33 | 21 | 26.6 | 19.7 | | 85.4 | A44-080-200 |
| 8.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-081-999-W |
| 10.0 | 1005.31 | 754.00 | 32 | 100 | 99.6 | 89.6 | 62.83 | 125.66 | 8 | 32 | 33 | 48 | 32 | 125.7 | 19.7 | 0.180 | 70.6 | A44-100-100 |
| 10.0 | Companion Rack for assembly | | | | | | | | | | | | | | | | | A10-101-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth are induction hardened to 50-55Rc. Only teeth are induction hardened allowing subsequent drilling and pinning of the rack. Rack ends are machined for continuous mounting.

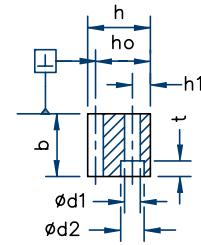
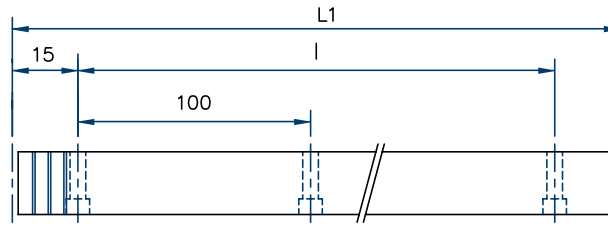
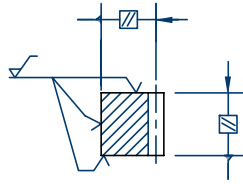
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A50

Case Hardened & Ground Teeth
Quality DIN 6 h 23 (-AGMA12)
20° Pressure Angle



WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH

| Circular Pitch, p | Module | L1 | l | teeth | b | h | h _o | No. holes | h1 | d1 | d2 | t | Fp | mass kg. | Part No. |
|-------------------|-----------------------------|-----------------------------|------|-------|------|------|----------------|-----------|------|-----|----|-----|-------|-------------|------------------|
| 2.0 | 0.637 | 330 | 300 | 165 | 9.5 | 19.5 | 18.86 | 3 | 10.5 | 5.8 | 10 | 5.7 | 0.032 | 0.45 | A50-020-033 |
| 2.0 | 0.637 | 1030 | 1000 | 515 | 9.5 | 19.5 | 18.86 | 10 | 10.5 | 5.8 | 10 | 5.7 | 0.068 | 1.4 | A50-020-103 |
| 2.0 | 0.637 | Companion Rack for assembly | | | | | | | | | | | | | A50-021-999 |
| 5.0 | 1.592 | 330 | 300 | 66 | 14.5 | 24.5 | 22.91 | 3 | 13 | 7 | 11 | 6.8 | 0.023 | 0.85 | A50-050-033 |
| 5.0 | 1.592 | 1030 | 1000 | 206 | 14.5 | 24.5 | 22.91 | 10 | 13 | 7 | 11 | 6.8 | 0.043 | 2.6 | A50-050-103 |
| 5.0 | 1.592 | 330 | 300 | 66 | 19.5 | 29.5 | 27.91 | 3 | 15.5 | 9 | 15 | 9 | 0.023 | 1.35 | A50-050-033-19.5 |
| 5.0 | 1.592 | 1030 | 1000 | 206 | 19.5 | 29.5 | 27.91 | 10 | 15.5 | 9 | 15 | 9 | 0.043 | 4.2 | A50-050-103-19.5 |
| 5.0 | Companion Rack for assembly | | | | | | | | | | | | | A50-051-999 | |
| 7.5 | 2.387 | 330 | 300 | 44 | 24.7 | 33 | 30.61 | 3 | 18.5 | 9 | 15 | 9 | 0.024 | 1.9 | A50-7.50-033 |
| 7.5 | 2.387 | 1230 | 1200 | 164 | 24.7 | 33 | 30.61 | 12 | 18.5 | 9 | 15 | 9 | 0.041 | 7 | A50-7.50-123 |
| 7.5 | 2.387 | Companion Rack for assembly | | | | | | | | | | | | | A50-7.51-999 |
| 10.0 | 3.183 | 330 | 300 | 33 | 34.6 | 46.6 | 43.42 | 3 | 28.6 | 11 | 18 | 11 | 0.025 | 3.7 | A50-100-033 |
| 10.0 | 3.183 | 1230 | 1200 | 123 | 34.6 | 46.6 | 43.42 | 12 | 28.6 | 11 | 18 | 11 | 0.04 | 13.9 | A50-100-123 |
| 10.0 | 3.183 | Companion Rack for assembly | | | | | | | | | | | | | A50-101-999 |

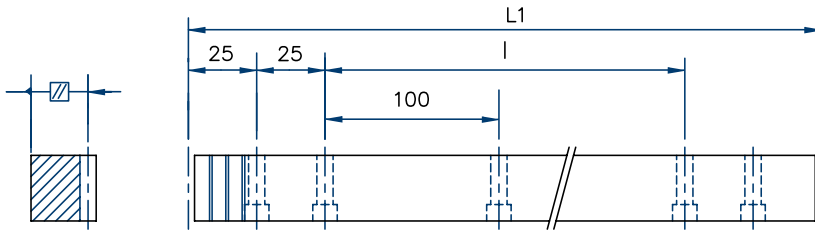
Material AISI 6150 (58CrMoV4). Teeth induction hardened to 50-60 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

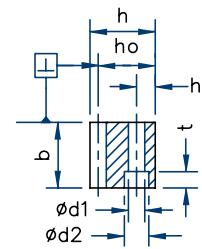
RACKS

WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH



SERIES A60

Induction Hardened Teeth
Quality DIN 9 h 25 (-AGMA 9)
20° Pressure Angle



| Circular Pitch, p | Module | L1 | l | teeth | b | h | h _o | No. holes | h ₁ | d ₁ | d ₂ | t | F _p | mass kg. | Part No. |
|-------------------|--------|-----------------------------|------|-------|----|----|----------------|-----------|----------------|----------------|----------------|------|----------------|----------|---------------|
| 10.0 | 3.183 | 800 | 700 | 80 | 29 | 29 | 25.82 | 10 | 11.5 | 9 | 15 | 9 | 0.092 | 4.8 | A60-100-080 |
| 10.0 | 3.183 | 1200 | 1100 | 120 | 29 | 29 | 25.82 | 14 | 11.5 | 9 | 15 | 9 | 0.108 | 7.2 | A60-100-120 |
| 10.0 | 3.183 | 2000 | 1900 | 200 | 29 | 29 | 25.82 | 22 | 11.5 | 9 | 15 | 9 | 0.142 | 12 | A60-100-200 |
| 10.0 | 3.183 | Companion Rack for assembly | | | | | | | | | | | | | A50-101-999 |
| 12.5 | 3.979 | 800 | 700 | 64 | 39 | 39 | 35.02 | 10 | 14 | 11 | 18 | 11 | 0.094 | 9.8 | A60-12.50-080 |
| 12.5 | 3.979 | 1200 | 1100 | 96 | 39 | 39 | 35.02 | 14 | 14 | 11 | 18 | 11 | 0.108 | 13.5 | A60-12.50-120 |
| 12.5 | 3.979 | 2000 | 1900 | 160 | 39 | 39 | 35.02 | 22 | 14 | 11 | 18 | 11 | 0.137 | 22.5 | A60-12.50-200 |
| 12.5 | 3.979 | Companion Rack for assembly | | | | | | | | | | | | | A60-12.51-999 |
| 16.0 | 5.093 | 800 | 700 | 50 | 49 | 49 | 43.91 | 10 | 24 | 13.5 | 20 | 13 | 0.088 | 14.2 | A60-160-080 |
| 16.0 | 5.093 | 1200 | 1100 | 75 | 49 | 49 | 43.91 | 14 | 24 | 13.5 | 20 | 13 | 0.099 | 21.2 | A60-160-120 |
| 16.0 | 5.093 | 2000 | 1900 | 125 | 49 | 49 | 43.91 | 22 | 24 | 13.5 | 20 | 13 | 0.121 | 35.3 | A60-160-200 |
| 16.0 | 5.093 | Companion Rack for assembly | | | | | | | | | | | | | A60-161-999 |
| 20.0 | 6.366 | 800 | 700 | 40 | 59 | 59 | 52.63 | 10 | 29 | 13.5 | 20 | 13 | 0.094 | 20.2 | A60-200-080 |
| 20.0 | 6.366 | 1200 | 1100 | 60 | 59 | 59 | 52.63 | 14 | 29 | 13.5 | 20 | 13 | 0.104 | 30.3 | A60-200-120 |
| 20.0 | 6.366 | 2000 | 1900 | 100 | 59 | 59 | 52.63 | 22 | 29 | 13.5 | 20 | 13 | 0.125 | 50.5 | A60-200-200 |
| 20.0 | 6.366 | Companion Rack for assembly | | | | | | | | | | | | | A60-201-999 |
| 25.0 | 7.958 | 800 | 700 | 32 | 79 | 79 | 71.04 | 10 | 39 | 17.5 | 26 | 17.5 | 0.09 | 35.7 | A60-250-080 |
| 25.0 | 7.958 | 1200 | 1100 | 48 | 79 | 79 | 71.04 | 14 | 39 | 17.5 | 26 | 17.5 | 0.098 | 53.6 | A60-250-120 |
| 25.0 | 7.958 | 2000 | 1900 | 80 | 79 | 79 | 71.04 | 22 | 39 | 17.5 | 26 | 17.5 | 0.115 | 89.3 | A60-250-200 |
| 25.0 | 7.958 | Companion Rack for assembly | | | | | | | | | | | | | A60-251-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm^2 (95,000 PSI).

Teeth are induction hardened to 50-55Rc. Back and contact faces are machined after hardening.

Only teeth are induction hardened allowing subsequent drilling and pinning of the rack.

Rack ends are machined for continuous mounting.

F_p is the max cumulative pitch error for the corresponding rack length.

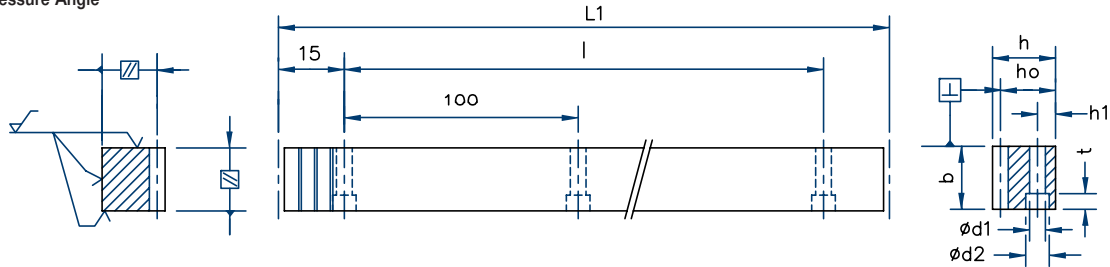
Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A70

Soft Teeth
Tooth Quality DIN 7 h 25 (-AGMA 11)
20° Pressure Angle

RACKS WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH



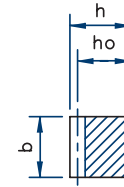
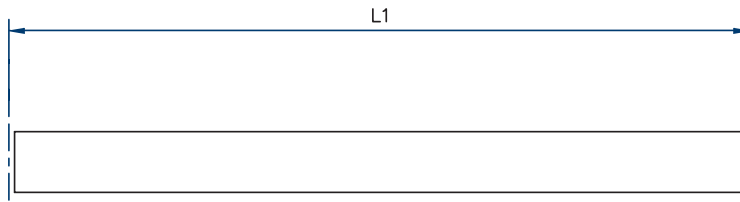
| Circular Pitch, p | Module | L1 | teeth | b | h | h _o | l | No. holes | h1 | d1 | d2 | t | Fp | mass kg. | Part No. |
|-------------------|--------|------|-------|------|------|----------------|------|-----------|------|-----------------------------|----|-----|-------|----------|------------------|
| 2.0 | 0.637 | 1000 | 500 | 9.5 | 9.5 | 8.86 | | | | Without Holes | | | | 0.7 | A70-021-100 |
| 2.0 | 0.637 | 1030 | 515 | 9.5 | 19.5 | 18.86 | 1000 | 11 | 10.5 | 5.8 | 10 | 5.7 | 0.079 | 1.4 | A70-020-103 |
| 2.0 | 0.637 | | | | | | | | | Companion Rack for assembly | | | | | A50-021-999 |
| 5.0 | 1.592 | 1000 | 200 | 14.5 | 14.5 | 12.9 | | | | Without Holes | | | | 1.5 | A70-051-100 |
| 5.0 | 1.592 | 1030 | 206 | 14.5 | 24.5 | 22.91 | 1000 | 11 | 13 | 7 | 11 | 6.8 | 0.058 | 2.6 | A70-050-103 |
| 5.0 | 1.592 | 1030 | 206 | 19.5 | 29.5 | 27.91 | 1000 | 11 | 15.5 | 9 | 15 | 9 | 0.058 | 4.2 | A70-050-103-19.5 |
| 5.0 | 1.592 | | | | | | | | | Companion Rack for assembly | | | | | A50-051-999 |
| 7.5 | 2.387 | 1005 | 134 | 19.5 | 19.5 | 17.11 | | | | Without Holes | | | | 2.6 | A70-7.51-100 |
| 7.5 | 2.387 | 1230 | 164 | 24.7 | 33 | 30.61 | 1200 | 13 | 18.5 | 9 | 15 | 9 | 0.057 | 7 | A70-7.50-123 |
| 7.5 | 2.387 | | | | | | | | | Companion Rack for assembly | | | | | A50-7.51-999 |
| 10.0 | 3.183 | 1000 | 100 | 29.5 | 29.5 | 26.32 | | | | Without Holes | | | | 6.1 | A70-101-100 |
| 10.0 | 3.183 | 1230 | 123 | 34.6 | 46.6 | 43.42 | 1200 | 13 | 28.6 | 11 | 18 | 11 | 0.055 | 13.9 | A70-100-123 |
| 10.0 | 3.183 | | | | | | | | | Companion Rack for assembly | | | | | A50-101-999 |
| 12.5 | 3.979 | 1000 | 80 | 39.5 | 39.5 | 35.52 | | | | Without Holes | | | | 11 | A70-12.51-100 |
| 12.5 | 3.979 | | | | | | | | | Companion Rack for assembly | | | | | A60-12.51-999 |

Material AISI 6150 (58CrMoV4) with holes and AISI 1045 (C45) without holes. Teeth are precision cut and racks are ground on all sides. Ends are machined for continuous mounting. Fp is the max cumulative pitch error for the corresponding rack length. Dimensions are in mm and are subject to change - consult factory.

RACKS WITH STRAIGHT (SPUR) TEETH

SERIES A80

Stainless Steel, Soft Rack
Tooth Quality DIN 8 h 27 (~AGMA 10)
20° Pressure Angle



| Module | L1 | teeth | b | h | ho | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. | |
|--------|---------|-------|----|-------|-------|---|---|-----------|----|----|----|---|----|----|----|----------|-----------------------------|---------------|
| 1.0 | 499.51 | 159 | 10 | 9.80 | 8.80 | | | | | | | | | | | 0.34 | A80-011-050 | |
| 1.0 | 999.03 | 318 | 10 | 9.80 | 8.80 | | | | | | | | | | | 0.68 | A80-011-100 | |
| 1.0 | | | | | | | | | | | | | | | | | Companion Rack for Assembly | A30-011-999 |
| 1.5 | 499.51 | 106 | 15 | 14.80 | 13.30 | | | | | | | | | | | 0.8 | A80-1.51-050 | |
| 1.5 | 999.03 | 212 | 15 | 14.80 | 13.30 | | | | | | | | | | | 1.6 | A80-1.51-100 | |
| 1.5 | | | | | | | | | | | | | | | | | Companion Rack for assembly | A30-1.51-999 |
| 2.0 | 502.65 | 80 | 20 | 19.75 | 17.75 | | | | | | | | | | | 1.4 | A80-021-050 | |
| 2.0 | 999.03 | 159 | 20 | 19.75 | 17.75 | | | | | | | | | | | 2.8 | A80-021-100 | |
| 2.0 | 1998.05 | 318 | 20 | 19.75 | 17.75 | | | | | | | | | | | 5.6 | A80-021-200 | |
| 2.0 | | | | | | | | | | | | | | | | | Companion Rack For Assembly | A10-021-999-W |
| 3.0 | 499.51 | 53 | 30 | 29.75 | 26.75 | | | | | | | | | | | 3.1 | A80-031-050 | |
| 3.0 | 999.03 | 106 | 30 | 29.75 | 26.75 | | | | | | | | | | | 6.2 | A80-031-100 | |
| 3.0 | 1998.05 | 212 | 30 | 29.75 | 26.75 | | | | | | | | | | | 12.4 | A80-031-200 | |
| 3.0 | | | | | | | | | | | | | | | | | Companion Rack for Assembly | A10-031-999-W |
| 4.0 | 1005.31 | 80 | 40 | 39.70 | 35.70 | | | | | | | | | | | 11 | A80-041-100 | |
| 4.0 | 1998.05 | 159 | 40 | 39.70 | 35.70 | | | | | | | | | | | 22 | A80-041-200 | |
| 4.0 | | | | | | | | | | | | | | | | | Companion Rack for Assembly | A10-041-999-W |

Material AISI 303 (X8CrNiS 18-9). Rack ends are machined for continuous mounting.

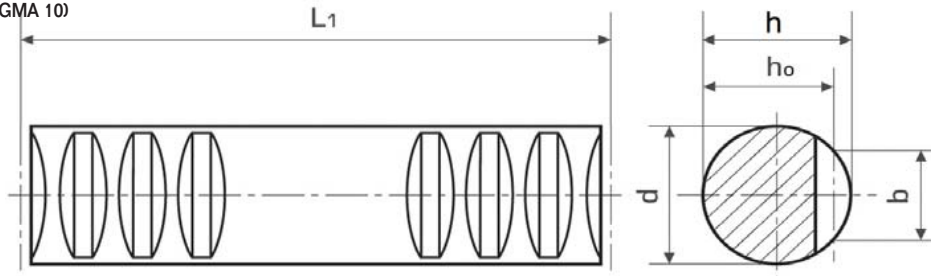
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A90

Alloy Steel
Tooth Quality 8h27 (-AGMA 10)
20° Pressure Angle



ROUND RACKS WITH STRAIGHT (SPUR) TEETH

| Module | L1 | teeth | d _{h6} | b | h | ho | Fp | mass kg. | Part no. |
|--------|---------|-------|-----------------|------|----|------|------|----------|--------------|
| 1.0 | 499.51 | 159 | 10 | 6.0 | 10 | 9.0 | .056 | 0.66 | A90-011-050 |
| 1.0 | 999.02 | 318 | 10 | 6.0 | 10 | 9.0 | .063 | 1.3 | A90-011-100 |
| 1.5 | 499.51 | 106 | 15 | 9.0 | 15 | 13.5 | .056 | 0.84 | A90-1.51-050 |
| 1.5 | 999.02 | 212 | 15 | 9.0 | 15 | 13.5 | .063 | 1.7 | A90-1.51-100 |
| 2.0 | 502.65 | 80 | 20 | 12.0 | 20 | 18.0 | .056 | 1.1 | A90-021-050 |
| 2.0 | 999.02 | 159 | 20 | 12.0 | 20 | 18.0 | .063 | 2.2 | A90-021-100 |
| 3.0 | 499.51 | 53 | 30 | 18.0 | 30 | 27 | .063 | 2.5 | A90-031-050 |
| 3.0 | 999.02 | 106 | 30 | 18.0 | 30 | 27 | .071 | 5.1 | A90-031-100 |
| 3.0 | 1998.05 | 212 | 30 | 18.0 | 30 | 27 | | 10.2 | A90-031-200 |
| 4.0 | 502.65 | 40 | 40 | 24.0 | 40 | 36.0 | .071 | 4.5 | A90-041-050 |
| 4.0 | 1005.30 | 80 | 40 | 24.0 | 40 | 36.0 | .080 | 9.1 | A90-041-100 |
| 4.0 | 2010.62 | 160 | 40 | 24.0 | 40 | 36.0 | | 18.2 | A90-041-100 |

Material ETG 100 is a high quality alloy steel with tensile strength = 1000 N/mm² (145,000 PSI)

The outside diameter is ground to tolerance h6 and rack ends are machined for continuous mounting

Fp is the cumulative pitch error for the corresponding rack length

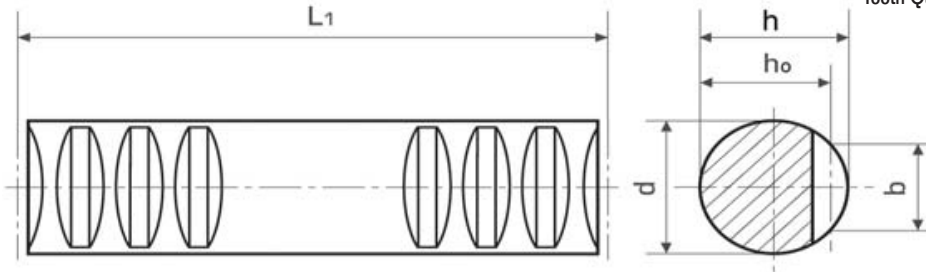
Please see support bushings on Page 21

Dimensions are in mm and are subject to change - consult factory

ROUND RACKS WITH STRAIGHT (SPUR) TEETH

SERIES A92

Stainless Steel
Tooth Quality 8h27 (-AGMA 10)
20° Pressure Angle



| Module | L1 | teeth | d_{hg} | b | h | ho | Fp | mass kg. | Part no. |
|--------|--------|-------|----------|------|----|------|------|----------|--------------|
| 1.0 | 499.51 | 159 | 10 | 6.2 | 10 | 9.0 | .056 | 0.66 | A92-011-050 |
| 1.0 | 999.02 | 318 | 10 | 6.2 | 10 | 9.0 | .063 | 1.3 | A92-011-100 |
| 1.5 | 499.51 | 106 | 15 | 9.3 | 15 | 13.5 | .056 | 0.84 | A92-1.51-050 |
| 1.5 | 999.02 | 212 | 15 | 9.3 | 15 | 13.5 | .063 | 1.7 | A92-1.51-100 |
| 2.0 | 502.65 | 80 | 20 | 12.5 | 20 | 18.0 | .056 | 1.1 | A92-021-050 |
| 2.0 | 999.02 | 159 | 20 | 12.5 | 20 | 18.0 | .063 | 2.2 | A92-021-100 |
| 3.0 | 499.51 | 53 | 30 | 18.5 | 30 | 27 | .063 | 2.5 | A92-031-050 |
| 3.0 | 999.02 | 106 | 30 | 18.5 | 30 | 27 | .071 | 5.1 | A92-031-100 |

Material AISI 303 (X8CrNiS 18-9)

The outside diameter tolerance is h9 and rack ends are machined for continuous mounting

Fp is the cumulative pitch error for the corresponding rack length

Please see support bushings on page 21

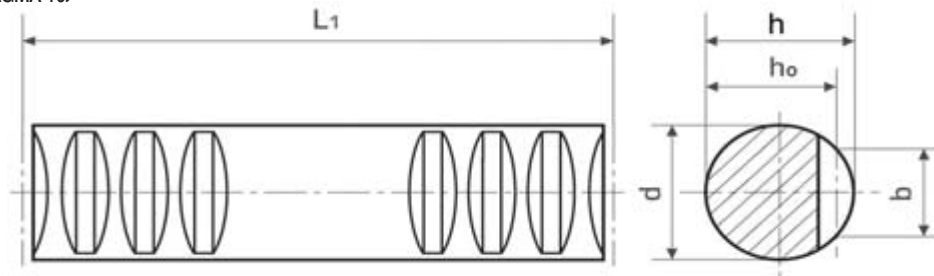
Dimensions are in mm and are subject to change - consult factory

MODULAR RACK & PINION SYSTEM

SERIES A94

Soft
Tooth Quality 8h27 (~AGMA 10)
20° Pressure Angle

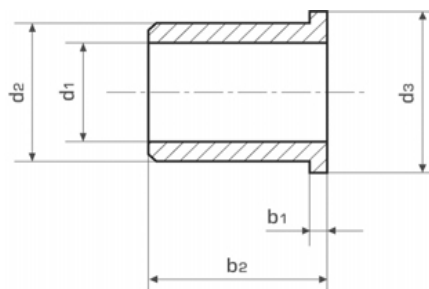
ROUND RACKS WITH STRAIGHT (SPUR) TEETH



| Module | L1 | teeth | d_{h11} | b | h | ho | Fp | mass kg. | Part no. |
|--------|---------|-------|-----------|------|----|------|------|----------|--------------|
| 1.0 | 499.51 | 159 | 15 | 7.5 | 15 | 14.0 | .056 | 0.66 | A94-011-050 |
| 1.0 | 999.02 | 318 | 15 | 7.5 | 15 | 14.0 | .063 | 1.3 | A94-011-100 |
| 1.5 | 499.51 | 106 | 17 | 9.6 | 17 | 15.5 | .056 | 0.84 | A94-1.51-050 |
| 1.5 | 999.02 | 212 | 17 | 9.6 | 17 | 15.5 | .063 | 1.7 | A94-1.51-100 |
| 2.0 | 502.65 | 80 | 20 | 12.0 | 20 | 18.0 | .056 | 1.1 | A94-021-050 |
| 2.0 | 999.02 | 159 | 20 | 12.0 | 20 | 18.0 | .063 | 2.2 | A94-021-100 |
| 2.5 | 502.65 | 64 | 25 | 15.0 | 25 | 22.5 | .056 | 1.8 | A94-2.51-050 |
| 2.5 | 997.45 | 127 | 25 | 15.0 | 25 | 22.5 | .063 | 3.6 | A94-2.51-100 |
| 3.0 | 499.51 | 53 | 30 | 18.0 | 30 | 27.0 | .063 | 2.5 | A94-031-050 |
| 3.0 | 999.02 | 106 | 30 | 18.0 | 30 | 27.0 | .071 | 5.1 | A94-031-100 |
| 4.0 | 502.65 | 40 | 40 | 24.0 | 40 | 36.0 | .071 | 4.5 | A94-041-050 |
| 4.0 | 1005.30 | 80 | 40 | 24.0 | 40 | 36.0 | .080 | 9.1 | A94-041-100 |
| 5.0 | 502.65 | 32 | 50 | 30.0 | 50 | 45.0 | .071 | 7.1 | A94-051-050 |
| 5.0 | 1005.30 | 64 | 50 | 30.0 | 50 | 45.0 | .080 | 14.3 | A94-051-100 |
| 5.0 | 2010.60 | 128 | 50 | 30.0 | 50 | 45.0 | | 28.6 | A94-051-200 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI)
The outside diameter tolerance h11 and rack ends are machined for continuous mounting
Fp is the cumulative pitch error for the corresponding rack length
See Support bushings below.

Oil Impregnated bronze bushings with MoS₂ providing nearly maintenance free round rack supports



SUPPORT BUSHINGS

| d1* | d2 r7 | d3 | b1 | b2 | (kg) | Part no. |
|-----|-------|----|----|----|------|-------------|
| 10 | 16 | 22 | 3 | 16 | 0.02 | 141-010-000 |
| 15 | 21 | 26 | 3 | 16 | 0.03 | 141-015-000 |
| 20 | 26 | 32 | 3 | 25 | 0.04 | 141-020-000 |
| 30 | 38 | 46 | 4 | 30 | 0.11 | 141-030-000 |
| 40 | 50 | 60 | 5 | 50 | 0.27 | 141-040-000 |
| 50 | 60 | 70 | 5 | 63 | 0.58 | 141-050-000 |

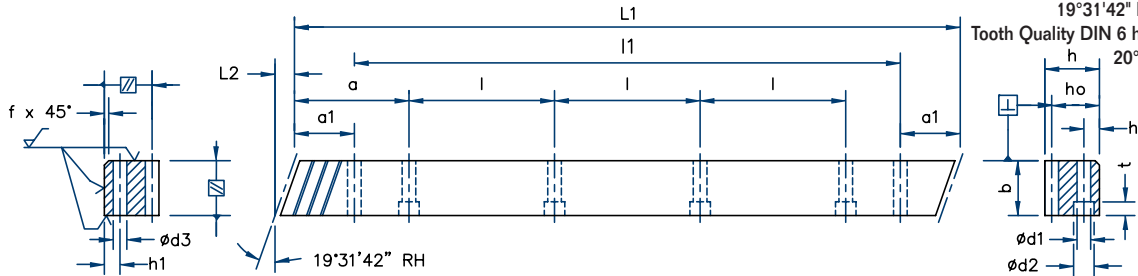
* For Ød1 = 10 - 40 mm - tolerance = E7; For Ød1 = 50 mm - tolerance E8
Dimensions are in mm and are subject to change - consult factory

MODULAR RACK & PINION SYSTEM

RACKS WITH RH HELICAL TEETH

SERIES A11

Case Hardened & Ground Teeth
19°31'42" R.H. Helix Angle
Tooth Quality DIN 6 h 23 (-AGMA12)
20° Pressure Angle



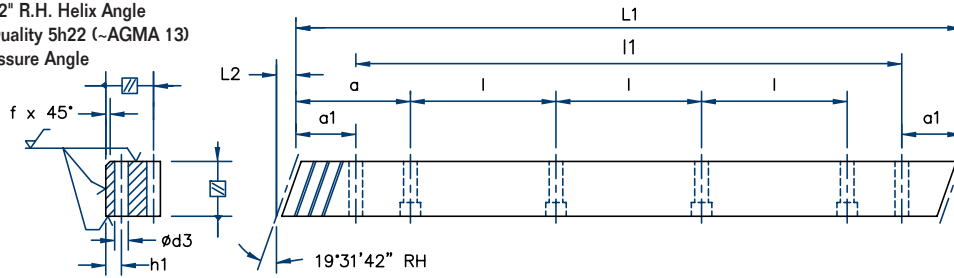
| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|-------|-------|----|----|------|---|--------|------|-----|-----------|---------------|----|----|----|-------|------|-------|----------|--------------|
| 1.5 | 500 | 6.7 | 100 | 19 | 19 | 17.5 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.029 | 1.3 | A11-1.50-050 |
| 1.5 | 500 | 6.7 | 100 | 19 | 19 | 17.5 | 2 | | | | | Without Holes | | | | | | 0.029 | 1.3 | A11-1.51-050 |
| 1.5 | 1000 | 6.7 | 200 | 19 | 19 | 17.5 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.043 | 2.6 | A11-1.50-100 |
| 1.5 | 1000 | 6.7 | 200 | 19 | 19 | 17.5 | 2 | | | | | Without Holes | | | | | | 0.043 | 2.6 | A11-1.51-100 |
| 1.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-1.51-999 |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 2.1 | A11-020-050 |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | | | | | Without Holes | | | | | | | 2.1 | A11-021-050 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.036 | 4.2 | A11-020-100 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | | | | | Without Holes | | | | | | 0.036 | 4.2 | A11-021-100 |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | 1936.6 | 62.5 | 125 | 16 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.058 | 8.2 | A11-020-200 |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | | | | | Without Holes | | | | | | 0.058 | 8.2 | A11-021-200 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-021-999 |
| 2.5 | 500 | 8.5 | 60 | 24 | 24 | 21.5 | 2 | 436.6 | 62.5 | 125 | 4 | 9 | 7 | 11 | 7 | 31.7 | 5.7 | 0.027 | 2.0 | A11-2.50-050 |
| 2.5 | 500 | 8.5 | 60 | 24 | 24 | 21.5 | 2 | | | | | Without Holes | | | | | | 0.027 | 2.0 | A11-2.51-050 |
| 2.5 | 1000 | 8.5 | 120 | 24 | 24 | 21.5 | 2 | 936.6 | 62.5 | 125 | 8 | 9 | 7 | 11 | 7 | 31.7 | 5.7 | 0.036 | 4.1 | A11-2.50-100 |
| 2.5 | 1000 | 8.5 | 120 | 24 | 24 | 21.5 | 2 | | | | | Without Holes | | | | | | 0.036 | 4.1 | A11-2.51-100 |
| 2.5 | 2000 | 8.5 | 240 | 24 | 24 | 21.5 | 2 | 1936.6 | 62.5 | 125 | 16 | 9 | 7 | 11 | 7 | 31.7 | 5.7 | 0.053 | 8.2 | A11-2.50-200 |
| 2.5 | 2000 | 8.5 | 240 | 24 | 24 | 21.5 | 2 | | | | | Without Holes | | | | | | 0.053 | 8.2 | A11-2.51-200 |
| 2.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-2.51-999 |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 2.9 | A11-030-050 |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | | | | | Without Holes | | | | | | | 2.9 | A11-031-050 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 930 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.036 | 5.9 | A11-030-100 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | | | | | Without Holes | | | | | | 0.036 | 5.9 | A11-031-100 |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | 1930 | 62.5 | 125 | 16 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.054 | 11.2 | A11-030-200 |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | | | | | Without Holes | | | | | | 0.054 | 11.2 | A11-031-200 |
| 3.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-031-999 |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | 433.0 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 5.4 | A11-040-050 |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | | | | | Without Holes | | | | | | | 5.4 | A11-041-050 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.040 | 10.7 | A11-040-100 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | | | | | Without Holes | | | | | | 0.040 | 10.7 | A11-041-100 |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 3 | 1933.4 | 62.5 | 125 | 16 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 21.4 | A11-040-200 |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 3 | | | | | Without Holes | | | | | | | 21.4 | A11-041-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999 |
| 5.0 | 500 | 17.4 | 30 | 49 | 49 | 34 | 3 | 425 | 62.5 | 125 | 4 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | | 6.5 | A11-050-050 |
| 5.0 | 500 | 17.4 | 30 | 49 | 49 | 34 | 3 | | | | | Without Holes | | | | | | | 6.5 | A11-051-050 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 49 | 34 | 3 | 925 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.040 | 13 | A11-050-100 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 49 | 34 | 3 | | | | | Without Holes | | | | | | 0.040 | 13 | A11-051-100 |
| 5.0 | 2000 | 17.4 | 120 | 49 | 49 | 34 | 3 | 1925 | 62.5 | 125 | 16 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | | 26 | A11-050-200 |
| 5.0 | 2000 | 17.4 | 120 | 49 | 49 | 34 | 3 | | | | | Without Holes | | | | | | | 26 | A11-051-200 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-051-999 |
| 6.0 | 500 | 20.9 | 25 | 59 | 59 | 43 | 3 | 425 | 62.5 | 125 | 4 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | | 9.9 | A11-060-050 |
| 6.0 | 500 | 20.9 | 25 | 59 | 59 | 43 | 3 | | | | | Without Holes | | | | | | | 9.9 | A11-061-050 |
| 6.0 | 1000 | 20.9 | 50 | 59 | 59 | 43 | 3 | 925 | 62.5 | 125 | 8 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | 0.040 | 19.8 | A11-060-100 |
| 6.0 | 1000 | 20.9 | 50 | 59 | 59 | 43 | 3 | | | | | Without Holes | | | | | | 0.040 | 19.8 | A11-061-100 |
| 6.0 | 2000 | 20.9 | 100 | 59 | 59 | 43 | 3 | 1925 | 62.5 | 125 | 16 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | | 36.2 | A11-060-200 |
| 6.0 | 2000 | 20.9 | 100 | 59 | 59 | 43 | 3 | | | | | Without Holes | | | | | | | 36.2 | A11-061-200 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-061-999 |
| 8.0 | 480 | 28 | 18 | 79 | 79 | 71 | 3 | 240 | 60.0 | 120 | 4 | 25 | 22 | 33 | 21 | 120.0 | 19.7 | | 21 | A11-080-050 |
| 8.0 | 480 | 28 | 18 | 79 | 79 | 71 | 3 | | | | | Without Holes | | | | | | | 21 | A11-081-050 |
| 8.0 | 960 | 28 | 36 | 79 | 79 | 71 | 3 | 720 | 60.0 | 120 | 8 | 25 | 22 | 33 | 21 | 120.0 | 19.7 | 0.040 | 42.5 | A11-080-100 |
| 8.0 | 960 | 28 | 36 | 79 | 79 | 71 | 3 | | | | | Without Holes | | | | | | 0.040 | 42.5 | A11-081-100 |
| 8.0 | 1920 | 28 | 72 | 79 | 79 | 71 | 3 | 1680 | 60.0 | 120 | 16 | 25 | 22 | 33 | 21 | 120 | 19.7 | | 85 | A11-080-200 |
| 8.0 | 1920 | 28 | 72 | 79 | 79 | 71 | 3 | | | | | Without Holes | | | | | | | 85 | A11-081-200 |
| 8.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-081-999 |
| 10.0 | 1000 | 35.11 | 30 | 99 | 99 | 89 | 3 | 750 | 62.5 | 125 | 8 | 32 | 33 | 48 | 32 | 125 | 19.7 | 0.040 | 69 | A11-100-100 |
| 10.0 | 1000 | 35.11 | 30 | 99 | 99 | 89 | 3 | | | | | Without Holes | | | | | | 0.040 | 69 | A11-101-100 |
| 10.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-101-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSD). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting. Fp is the max cumulative pitch error for the corresponding rack length. Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A11-Q5

Case Hardened & Ground Teeth
 19°31'42" R.H. Helix Angle
 Tooth Quality 5h22 (-AGMA 13)
 20° Pressure Angle



RACKS WITH RH HELICAL TEETH

| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|-------|-------|----|----|------|---|-------|------|-----|-----------|----|----|----|----|-------|------|-------|----------|-----------------|
| 1.5 | 500 | 6.7 | 100 | 19 | 19 | 17.5 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.021 | 1.3 | A11-1.50-050-Q5 |
| 1.5 | 1000 | 6.7 | 200 | 19 | 19 | 17.5 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.030 | 2.6 | A11-1.50-100-Q5 |
| 1.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.018 | 2.1 | A11-020-050-Q5 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.025 | 4.2 | A11-020-100-Q5 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | |
| 2.5 | 500 | 8.5 | 60 | 24 | 24 | 21.5 | 2 | 436.6 | 62.5 | 125 | 4 | 9 | 7 | 11 | 7 | 31.7 | 5.7 | 0.019 | 2.0 | A11-2.50-050-Q5 |
| 2.5 | 1000 | 8.5 | 120 | 24 | 24 | 21.5 | 2 | 936.6 | 62.5 | 125 | 8 | 9 | 7 | 11 | 7 | 31.7 | 5.7 | 0.024 | 4.1 | A11-2.50-100-Q5 |
| 2.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.020 | 3 | A11-030-050-Q5 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 930 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.026 | 68 | A11-030-100-Q5 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | 433 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.021 | 5.4 | A11-040-050-Q5 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.026 | 10.8 | A11-040-100-Q5 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |
| 5.0 | 500 | 17.4 | 30 | 49 | 39 | 34 | 3 | 425 | 62.5 | 125 | 4 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.020 | 6.5 | A11-050-050-Q5 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 39 | 34 | 3 | 925 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.024 | 13.1 | A11-050-100-Q5 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |
| 6.0 | 500 | 20.9 | 25 | 59 | 49 | 43 | 3 | 425 | 62.5 | 125 | 4 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | 0.022 | 10.0 | A11-060-050-Q5 |
| 6.0 | 1000 | 20.9 | 50 | 59 | 49 | 43 | 3 | 925 | 62.5 | 125 | 8 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | 0.026 | 20.3 | A11-060-100-Q5 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |
| 8.0 | 480 | 28 | 18 | 79 | 79 | 71 | 3 | 240 | 60.0 | 120 | 4 | 25 | 22 | 33 | 21 | 120.0 | 19.7 | 0.021 | 22 | A11-080-050-Q5 |
| 8.0 | 960 | 28 | 36 | 79 | 79 | 71 | 3 | 720 | 60.0 | 120 | 8 | 25 | 22 | 33 | 21 | 120.0 | 19.7 | 0.024 | 44.3 | A11-080-100-Q5 |
| 8.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |
| 10.0 | 500 | 35.1 | 15 | 99 | 99 | 89 | 3 | 250 | 62.5 | 125 | 4 | 32 | 33 | 48 | 32 | 125 | 19.7 | 0.020 | 34 | A11-100-050-Q5 |
| 10.0 | 1000 | 35.11 | 30 | 99 | 99 | 89 | 3 | 750 | 62.5 | 125 | 8 | 32 | 33 | 48 | 32 | 125 | 19.7 | 0.023 | 68 | A11-100-100-Q5 |
| 10.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

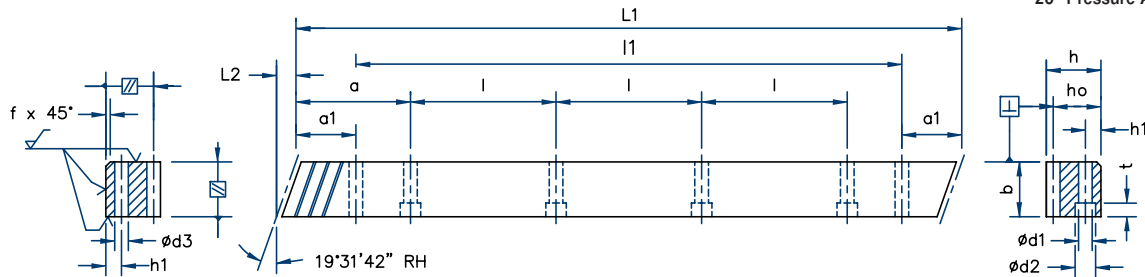
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

RACKS WITH RH HELICAL TEETH

SERIES A13

Case Hardened & Ground Teeth
19°31'42" R.H. Helix Angle
Tooth Quality DIN 6 h 23 (-AGMA12)
20° Pressure Angle



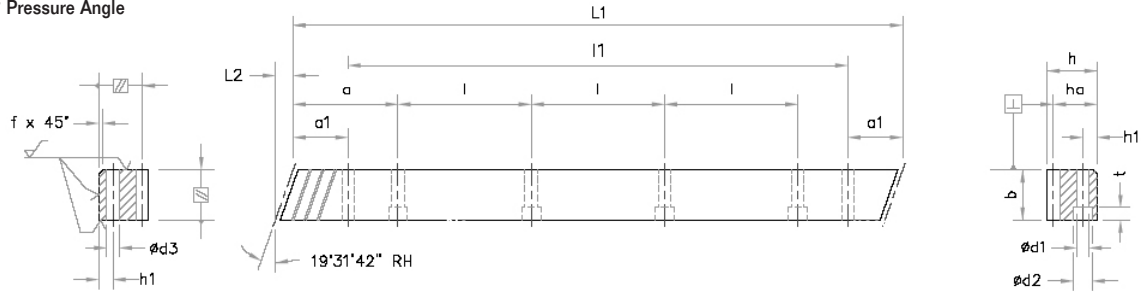
| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|------|-------|----|----|----|---|-------|------|-----|---------------|----|----|----|---|------|-----|-------|----------|---------------|
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 2.1 | A13-020-050 |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | | | | 2.1 | A13-021-050 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.036 | 4.2 | A13-020-100 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | | | | Without Holes | | | | | | | 0.036 | 4.2 | A13-021-100 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 3 | A13-030-050 |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | | | 3 | A13-031-050 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 930 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.036 | 6 | A13-030-100 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | | | | Without Holes | | | | | | | 0.036 | 6 | A13-031-100 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | 433 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 5.3 | A13-040-050 |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | | | 5.3 | A13-041-050 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.040 | 10.6 | A13-040-100 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | | | | Without Holes | | | | | | | 0.040 | 10.6 | A13-041-100 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999-W |

Material AISI 5115 (16MnCr5) Teeth induction hardened to 60 Rc: ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.
Fp is the max cumulative pitch error for the corresponding rack length.
Dimensions are in mm and are subject to change - consult factory.

SERIES A19 - HIGH STRENGTH RACKS

Case Hardened & Ground Teeth
 19°31'42" R.H. Helix Angle
 Tooth Quality DIN 6 h 23 (~AGMA12)
 20° Pressure Angle

RACKS
 WITH RH HELICAL TEETH



**PLEASE CONTACT ANDANTEX FOR DIMENSIONS
 AND RATINGS OF THIS NEW PRODUCT**

Material AISI 5115 (16MnCr5) Teeth flanks and root carburized and induction hardened to 60 Rc: ground on all sides after hardeneing.

Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

Fp is the max cumulatve pitch error for the corresponding rack length.

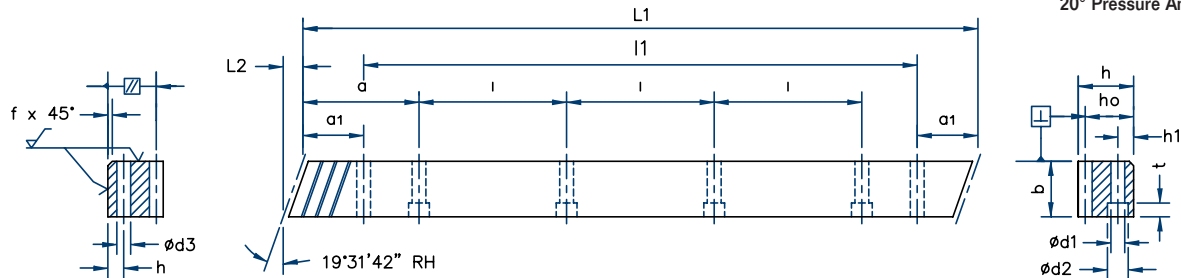
Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

RACKS WITH RH HELICAL TEETH

SERIES A21

Quenched & Tempered Material
19°31'42" R.H. Helix Angle
Tooth Quality DIN 8 h 27 (~AGMA10)
20° Pressure Angle



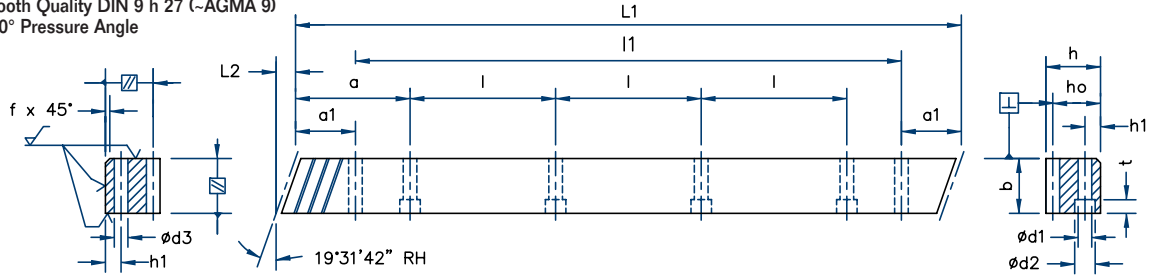
| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|------|-------|----|----|----|---|---------------|------|-----|-----------|----|----|----|----|------|------|-------|-------------|---------------|
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 2.1 | A21-020-050 | |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | without holes | | | | | | | | | | 2.1 | A21-021-050 | |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.063 | 4.2 | A21-020-100 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | without holes | | | | | | | | | | 0.063 | 4.2 | A21-021-100 |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | 1936.6 | 62.5 | 125 | 16 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 8.6 | A21-020-200 | |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | without holes | | | | | | | | | | 8.6 | A21-021-200 | |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | 3 | A21-030-050 | |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | without holes | | | | | | | | | | 3 | A21-031-050 | |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 930 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.071 | 6 | A21-030-100 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | without holes | | | | | | | | | | 0.071 | 6 | A21-031-100 |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | 1930 | 62.5 | 125 | 16 | 9 | 10 | 15 | 9 | 35 | 7.7 | 12.2 | A21-030-200 | |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | without holes | | | | | | | | | | 12.2 | A21-031-200 | |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 2 | 433 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 5.5 | A21-040-050 | |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 2 | without holes | | | | | | | | | | 5.5 | A21-041-050 | |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 2 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.080 | 10.9 | A21-040-100 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 2 | without holes | | | | | | | | | | 0.080 | 10.9 | A21-041-100 |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 2 | 1933.4 | 62.5 | 125 | 16 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 21.8 | A21-040-200 | |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 2 | without holes | | | | | | | | | | 21.8 | A21-041-200 | |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999-W |
| 5.0 | 500 | 17.4 | 30 | 49 | 39 | 34 | 2 | 425 | 62.5 | 125 | 4 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 6.5 | A21-050-050 | |
| 5.0 | 500 | 17.4 | 30 | 49 | 39 | 34 | 2 | without holes | | | | | | | | | | 6.5 | A21-051-050 | |
| 5.0 | 1000 | 17.4 | 60 | 49 | 39 | 34 | 2 | 925 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.080 | 13 | A21-050-100 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 39 | 34 | 2 | without holes | | | | | | | | | | 0.080 | 13 | A21-051-100 |
| 5.0 | 2000 | 17.4 | 120 | 49 | 39 | 34 | 2 | 1925 | 62.5 | 125 | 16 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 26 | A21-050-200 | |
| 5.0 | 2000 | 17.4 | 120 | 49 | 39 | 34 | 2 | without holes | | | | | | | | | | 26 | A21-051-200 | |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-051-999-W |

Material AISI 4140 (42CrMo4V) with tensile strength = 900 N/mm² (130,500 PSI).
Back and contact faces ground. Rack ends are machined for continuous mounting.
Fp is the max cumulative pitch error for the corresponding rack length.
Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

SERIES A31

Soft
19°31'42" R.H. Helix Angle
Tooth Quality DIN 9 h 27 (~AGMA 9)
20° Pressure Angle



RACKS WITH RH HELICAL TEETH

| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|------|-------|-----|-------|-------|---|--------|------|-----|-----------|---------------|----|----|----|-------|------|-------|----------|---------------|
| 1.5 | 1000 | 6.0 | 200 | 17 | 16.80 | 15.30 | 1 | 936.6 | 62.5 | 125 | 8 | 6 | 6 | 10 | 6 | 31.7 | 5.7 | 0.090 | 2.0 | A31-1.50-100 |
| 1.5 | 1000 | 6.0 | 200 | 17 | 16.80 | 15.30 | 1 | | | | | Without Holes | | | | | | 0.090 | 2.0 | A31-1.51-100 |
| 1.5 | 1500 | 6.0 | 300 | 17 | 16.80 | 15.30 | 1 | 1436.6 | 62.5 | 125 | 12 | 6 | 6 | 10 | 6 | 31.7 | 5.7 | | 3.0 | A31-1.50-150 |
| 1.5 | 1500 | 6.0 | 300 | 17 | 16.80 | 15.30 | 1 | | | | | Without Holes | | | | | | | 3.0 | A31-1.51-150 |
| 1.5 | 2000 | 6.0 | 400 | 17 | 16.80 | 15.30 | 1 | 1936.6 | 62.5 | 125 | 16 | 6 | 6 | 10 | 6 | 31.7 | 5.7 | | 4.0 | A31-1.50-200 |
| 1.5 | 2000 | 6.0 | 400 | 17 | 16.80 | 15.30 | 1 | | | | | Without Holes | | | | | | | 4.0 | A31-1.51-200 |
| 1.5 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-1.51-999 |
| 2.0 | 500 | 8.9 | 75 | 25 | 24.75 | 22.75 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 2.2 | A31-020-050 |
| 2.0 | 500 | 8.9 | 75 | 25 | 24.75 | 22.75 | 2 | | | | | Without Holes | | | | | | | 2.2 | A31-021-050 |
| 2.0 | 1000 | 8.9 | 150 | 25 | 24.75 | 22.75 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.090 | 4.4 | A31-020-100 |
| 2.0 | 1000 | 8.9 | 150 | 25 | 24.75 | 22.75 | 2 | | | | | Without Holes | | | | | | 0.090 | 4.4 | A31-021-100 |
| 2.0 | 1500 | 8.9 | 225 | 25 | 24.75 | 22.75 | 2 | 1436.6 | 62.5 | 125 | 12 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 6.6 | A31-020-150 |
| 2.0 | 1500 | 8.9 | 225 | 25 | 24.75 | 22.75 | 2 | | | | | Without Holes | | | | | | | 6.6 | A31-021-150 |
| 2.0 | 2000 | 8.9 | 300 | 25 | 24.75 | 22.75 | 2 | 1936.6 | 62.5 | 125 | 16 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 8.8 | A31-020-200 |
| 2.0 | 2000 | 8.9 | 300 | 25 | 24.75 | 22.75 | 2 | | | | | Without Holes | | | | | | | 8.8 | A31-021-200 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 500 | 10.6 | 50 | 30 | 29.75 | 26.75 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 3.1 | A31-030-050 |
| 3.0 | 500 | 10.6 | 50 | 30 | 29.75 | 26.75 | 2 | | | | | Without Holes | | | | | | | 3.1 | A31-031-050 |
| 3.0 | 1000 | 10.6 | 100 | 30 | 29.75 | 26.75 | 2 | 930 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.100 | 6.2 | A31-030-100 |
| 3.0 | 1000 | 10.6 | 100 | 30 | 29.75 | 26.75 | 2 | | | | | Without Holes | | | | | | 0.100 | 6.2 | A31-031-100 |
| 3.0 | 2000 | 10.6 | 200 | 30 | 29.75 | 26.75 | 2 | 1930 | 62.5 | 125 | 16 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 12.5 | A31-030-200 |
| 3.0 | 2000 | 10.6 | 200 | 30 | 29.75 | 29.75 | 2 | | | | | Without Holes | | | | | | | 12.5 | A31-031-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 506.67 | 14.2 | 38 | 40 | 39.7 | 35.7 | 3 | 433 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 5.6 | A31-040-050 |
| 4.0 | 506.67 | 14.2 | 38 | 40 | 39.7 | 35.7 | 3 | | | | | Without Holes | | | | | | | 5.6 | A31-041-050 |
| 4.0 | 1000 | 14.2 | 75 | 40 | 39.7 | 35.7 | 3 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.110 | 11.1 | A31-040-100 |
| 4.0 | 1000 | 14.2 | 75 | 40 | 39.7 | 35.7 | 3 | | | | | Without Holes | | | | | | 0.110 | 11.1 | A31-041-100 |
| 4.0 | 2000 | 14.2 | 150 | 40 | 39.7 | 35.7 | 3 | 1933.4 | 62.5 | 125 | 16 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 22.2 | A31-040-200 |
| 4.0 | 2000 | 14.2 | 150 | 40 | 39.7 | 35.7 | 3 | | | | | Without Holes | | | | | | | 22.2 | A31-041-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999-W |
| 5.0 | 1000 | 17.7 | 60 | 50 | 39.7 | 34.7 | 3 | 925 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.110 | 13.2 | A31-050-100 |
| 5.0 | 1000 | 17.7 | 60 | 50 | 39.7 | 34.7 | 3 | | | | | Without Holes | | | | | | 0.110 | 13.2 | A31-051-100 |
| 5.0 | 2000 | 17.7 | 120 | 50 | 39.7 | 34.7 | 3 | 1925 | 62.5 | 125 | 16 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | | 26.5 | A31-050-200 |
| 5.0 | 2000 | 17.7 | 120 | 50 | 39.7 | 34.7 | 3 | | | | | Without Holes | | | | | | | 26.5 | A31-051-200 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-051-999-W |
| 6.0 | 1000 | 21.3 | 50 | 60 | 49.7 | 43.7 | 3 | 925 | 62.5 | 125 | 8 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | 0.110 | 20.1 | A31-060-100 |
| 6.0 | 1000 | 21.3 | 50 | 60 | 49.7 | 43.7 | 3 | | | | | Without Holes | | | | | | 0.110 | 20.1 | A31-061-100 |
| 6.0 | 2000 | 21.3 | 100 | 60 | 49.7 | 43.7 | 3 | 1925 | 62.5 | 125 | 16 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | | 40.2 | A31-060-200 |
| 6.0 | 2000 | 21.3 | 100 | 60 | 49.7 | 43.7 | 3 | | | | | Without Holes | | | | | | | 40.2 | A31-061-200 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-061-999-W |
| 8.0 | 960 | 28.4 | 36 | 80 | 79.6 | 71.6 | 3 | 720 | 60.0 | 120 | 8 | 25 | 25 | 33 | 21 | 120.0 | 19.7 | 0.110 | 44.8 | A31-080-100 |
| 8.0 | 960 | 28.4 | 36 | 80 | 79.6 | 71.6 | 3 | | | | | Without Holes | | | | | | 0.110 | 44.8 | A31-081-100 |
| 8.0 | 1920 | 28.4 | 72 | 80 | 79.6 | 71.6 | 3 | 1680 | 60.0 | 120 | 16 | 25 | 25 | 33 | 21 | 120 | 19.7 | | 89.7 | A31-080-200 |
| 8.0 | 1920 | 28.4 | 72 | 80 | 79.6 | 71.6 | 3 | | | | | Without Holes | | | | | | | 89.7 | A31-081-200 |
| 8.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-081-999-W |
| 10.0 | 1000 | 35.5 | 30 | 100 | 99 | 89 | 3 | 750 | 62.5 | 125 | 8 | 32 | 33 | 48 | 32 | 125 | 19.7 | | 69.8 | A31-100-100 |
| 10.0 | 1000 | 35.5 | 30 | 100 | 99 | 89 | 3 | | | | | Without Holes | | | | | | | 69.8 | A31-101-100 |
| 10.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-101-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Rack ends are machined for continuous mounting.

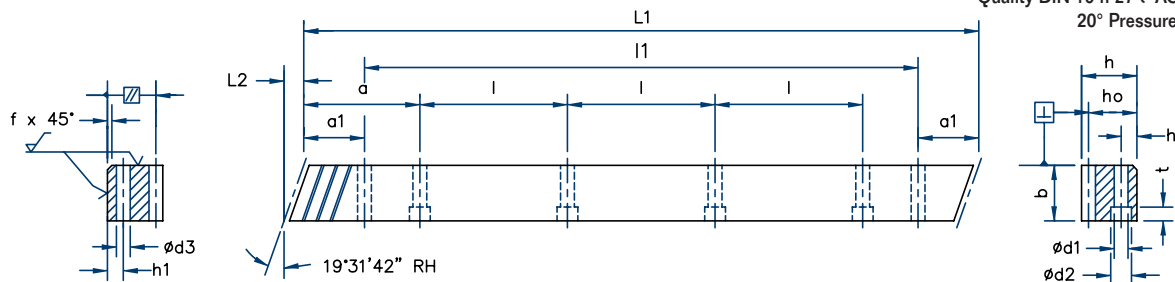
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

RACKS WITH RH HELICAL TEETH

SERIES A41

Induction Hardened Teeth
19°31'42" R.H. Helix Angle
Quality DIN 10 h 27 (~AGMA 8)
20° Pressure Angle



| Module | L1 | L2 | teeth | b | h | ho | f | l1 | a | l | No. holes | h1 | d1 | d2 | t | a1 | d3 | Fp | mass kg. | Part no. |
|--------|-----------------------------|------|-------|----|----|----|---|--------|------|-----|-----------|---------------|----|----|----|------|------|-------|----------|---------------|
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | 436.6 | 62.5 | 125 | 4 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 2.1 | A41-020-050 |
| 2.0 | 500 | 8.5 | 75 | 24 | 24 | 22 | 2 | | | | | without holes | | | | | | | 2.1 | A41-021-050 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | 936.6 | 62.5 | 125 | 8 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | 0.140 | 4.2 | A41-020-100 |
| 2.0 | 1000 | 8.5 | 150 | 24 | 24 | 22 | 2 | | | | | without holes | | | | | | 0.140 | 4.2 | A41-021-100 |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | 1936.6 | 62.5 | 125 | 16 | 8 | 7 | 11 | 7 | 31.7 | 5.7 | | 8.4 | A41-020-200 |
| 2.0 | 2000 | 8.5 | 300 | 24 | 24 | 22 | 2 | | | | | without holes | | | | | | | 8.4 | A41-021-200 |
| 2.0 | Companion Rack For Assembly | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | 430 | 62.5 | 125 | 4 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 3 | A41-030-050 |
| 3.0 | 500 | 10.3 | 50 | 29 | 29 | 26 | 2 | | | | | without holes | | | | | | | 3 | A41-031-050 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | 930.6 | 62.5 | 125 | 8 | 9 | 10 | 15 | 9 | 35 | 7.7 | 0.160 | 6 | A41-030-100 |
| 3.0 | 1000 | 10.3 | 100 | 29 | 29 | 26 | 2 | | | | | without holes | | | | | | 0.160 | 6 | A41-031-100 |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | 1930.6 | 62.5 | 125 | 16 | 9 | 10 | 15 | 9 | 35 | 7.7 | | 12 | A41-030-200 |
| 3.0 | 2000 | 10.3 | 200 | 29 | 29 | 26 | 2 | | | | | without holes | | | | | | | 12 | A41-031-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | 433 | 62.5 | 125 | 4 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 5.3 | A41-040-050 |
| 4.0 | 506.67 | 13.8 | 38 | 39 | 39 | 35 | 3 | | | | | without holes | | | | | | | 5.3 | A41-041-050 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | 933.4 | 62.5 | 125 | 8 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | 0.180 | 10.6 | A41-040-100 |
| 4.0 | 1000 | 13.8 | 75 | 39 | 39 | 35 | 3 | | | | | without holes | | | | | | 0.180 | 10.6 | A41-041-100 |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 3 | 1933.4 | 62.5 | 125 | 16 | 12 | 10 | 15 | 9 | 33.3 | 7.7 | | 21.2 | A41-040-200 |
| 4.0 | 2000 | 13.8 | 150 | 39 | 39 | 35 | 3 | | | | | without holes | | | | | | | 21.2 | A41-041-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999-W |
| 5.0 | 500 | 17.4 | 30 | 49 | 49 | 34 | 3 | 425 | 62.5 | 125 | 4 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | | 6.5 | A41-050-050 |
| 5.0 | 500 | 17.4 | 30 | 49 | 49 | 34 | 3 | | | | | without holes | | | | | | | 6.5 | A41-051-050 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 49 | 34 | 3 | 925 | 62.5 | 125 | 8 | 12 | 14 | 20 | 13 | 37.5 | 11.7 | 0.180 | 13 | A41-050-100 |
| 5.0 | 1000 | 17.4 | 60 | 49 | 49 | 34 | 3 | | | | | without holes | | | | | | 0.180 | 13 | A41-051-100 |
| 5.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-051-999-W |
| 6.0 | 500 | 20.9 | 25 | 59 | 59 | 43 | 3 | 425 | 62.5 | 125 | 4 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | | 9.9 | A41-060-050 |
| 6.0 | 500 | 20.9 | 25 | 59 | 59 | 43 | 3 | | | | | without holes | | | | | | | 9.9 | A41-061-050 |
| 6.0 | 1000 | 20.9 | 50 | 59 | 59 | 43 | 3 | 925 | 62.5 | 125 | 8 | 16 | 18 | 26 | 17 | 37.5 | 15.7 | 0.180 | 19.8 | A41-060-100 |
| 6.0 | 1000 | 20.9 | 50 | 59 | 59 | 43 | 3 | | | | | without holes | | | | | | 0.180 | 19.8 | A41-061-100 |
| 6.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-061-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth are induction hardened to 50-55Rc. Back and contact faces are machined after hardening. Only teeth are induction hardened allowing subsequent drilling and pinning of the rack. Rack ends are machined for continuous mounting.

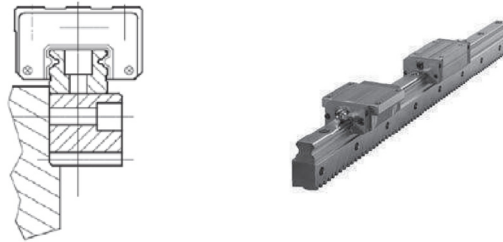
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

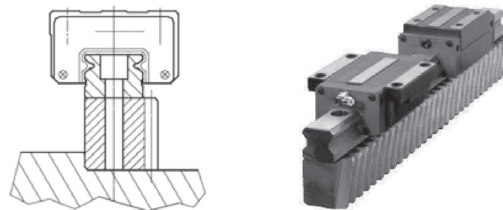
RACKS MACHINED FOR LINEAR GUIDEWAYS

| Series | Style | Module | Heat Treatment | Quality Level* | Page |
|---------|-------------------------------|------------------------|-------------------|-------------------|------|
| A52 ___ | Straight (spur) for rail 180° | 5,10 circular pitch, p | Hardened & Ground | 6 h 23 (~AGMA 12) | 30 |
| A54 ___ | Straight (spur) for rail 90° | 5,10 circular pitch, p | Hardened & Ground | 6 h 23 (~AGMA 12) | 30 |
| A72 ___ | Straight (spur) for rail 180° | 5,10 circular pitch, p | Soft | 9 h 27 (~AGMA 9) | 31 |
| A74 ___ | Straight (spur) for rail 90° | 5,10 circular pitch, p | Soft | 9 h 27 (~AGMA 9) | 31 |
| A15 ___ | Helical for Rail 180° | 2, 3, 4 | Hardened & Ground | 6 h 23 (~AGMA 12) | 32 |
| A17 ___ | Helical for Rail 90° | 2, 3, 4 | Hardened & Ground | 6 h 23 (~AGMA 12) | 32 |
| A33 ___ | Helical for Rail 180° | 2, 3, 4 | Soft | 9 h 27 (~AGMA 9) | 33 |
| A35 ___ | Helical for Rail 90° | 2, 3, 4 | Soft | 9 h 27 (~AGMA 9) | 33 |

180° RACK GUIDEWAY DESIGN



90° RACK GUIDEWAY DESIGN



RACK, RAIL & BEARING BLOCK ASSEMBLY

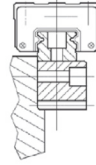
| Series | Style | Module | Heat Treatment | Quality Level* | Page |
|--------------------|-------------------------------|------------------------|---------------------------|---------------------------------------|------|
| Z2 ___R Z4 ___R | Straight (spur) for rail 180° | 5,10 circular pitch, p | Hardened & Ground or Soft | 6 h 23 (~AGMA 12) 9 h 27 (~AGMA 9) | 34 |
| Z2 ___Z Z4 ___Z | Straight (spur) for rail 90° | 5,10 circular pitch, p | Hardened & Ground or Soft | 6 h 23 (~AGMA 12) 9 h 27 (~AGMA 9) | 35 |
| Z1 ___R Z3 ___R | Helical with rail 180° | 2, 3, 4 | Hardened & Ground or Soft | 6 h 23 (~AGMA 12) 9 h 27 (~AGMA 9) | 36 |
| Z1 ___Z Z3 ___Z | Helical with rail 90° | 2, 3, 4 | Hardened & Ground or Soft | 6 h 23 (~AGMA 12) 9 h 27 (~AGMA 9) | 37 |

*Note all AGMA quality grades in this catalog are based on AGMA standard 2000-A88. The new AGMA quality numbers defined in AGMA 2015-1-A01 are similar to the DIN numbers shown.

MODULAR RACK & PINION SYSTEM

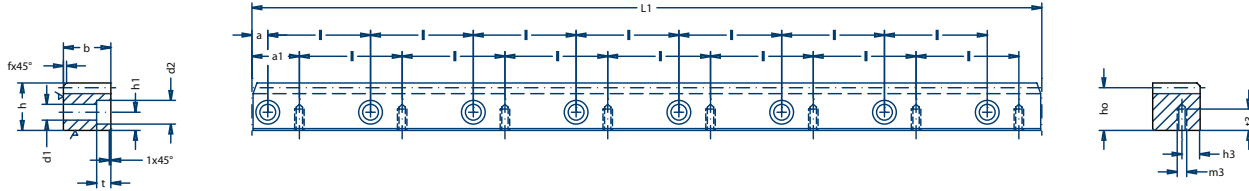
RACKS

WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH
MACHINED FOR LINEAR RAILS MOUNTED 180° FROM TOOTH SIDE



SERIES A52

Case Hardened & Ground Teeth
Tooth Quality DIN 6 h 23 (~AGMA12)
20° Pressure Angle

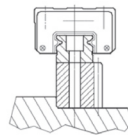


| Circular Pitch, p | Module | L1 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | m3 | h3 | t3 | Fp | kg. | Part no. |
|-------------------|--------|-----------------------------|-------|----|-------|-------|---|----|----|-------|------|------|----|---|----|----|------|------|-------|-----|----------------|
| 5.0 | 1.591 | 960 | 192 | 19 | 19.50 | 17.9 | 1 | 10 | 60 | 16 | 7.5 | 5.8 | 10 | 6 | 30 | M4 | 7.5 | 8.0 | 0.032 | 2.7 | A52-050-100 |
| 5.0 | 1.591 | 960 | 192 | 24 | 24.50 | 22.91 | 1 | 10 | 60 | 16 | 10.0 | 7.0 | 11 | 7 | 30 | M5 | 10.0 | 11.0 | 0.032 | 4.2 | A52-050-100-24 |
| 5.0 | 1.591 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-051-999 |
| 10.0 | 3.183 | 960 | 96 | 29 | 29.75 | 26.57 | 2 | 10 | 60 | 16 | 11.5 | 10.0 | 15 | 9 | 30 | M6 | 11.5 | 13.5 | 0.038 | 5.6 | A52-100-100 |
| 10.0 | 3.183 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-101-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting. Fp is the max cumulative pitch error for the corresponding rack length. Dimensions are in mm and are subject to change - consult factory.

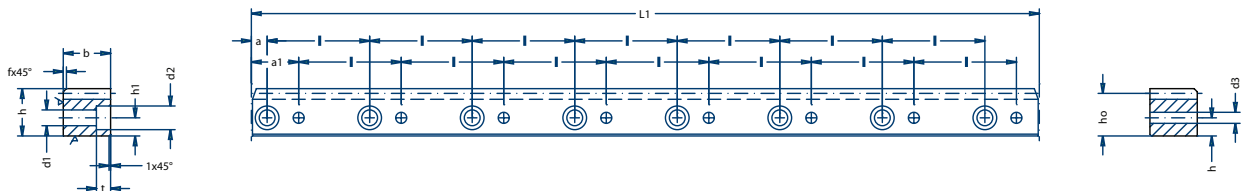
RACKS

WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH
MACHINED FOR LINEAR RAILS MOUNTED 90° FROM TOOTH SIDE



SERIES A54

Case Hardened & Ground Teeth
Tooth Quality DIN 6 h 23 (~AGMA12)
20° Pressure Angle



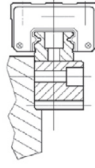
| Circular Pitch, p | Module | L1 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. | |
|-------------------|--------|-----------------------------|-------|----|-------|-------|---|----|----|-------|------|-----|------|-----|----|-----|-----|----------------|----------|-------------|
| 5.0 | 1.591 | 960 | 192 | 19 | 19.50 | 17.91 | 1 | 10 | 60 | 16 | 7.5 | 4.5 | 7.5 | 5.3 | 30 | 4.5 | 2.7 | A54-050-100 | | |
| 5.0 | 1.591 | 960 | 192 | 24 | 24.50 | 22.91 | 1 | 10 | 60 | 16 | 10.0 | 6.0 | 9.5 | 8.5 | 30 | 6.0 | 4.2 | A54-050-100-24 | | |
| 5.0 | 1.591 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A52-051-999 |
| 10.0 | 3.183 | 960 | 96 | 29 | 29.75 | 26.57 | 2 | 10 | 60 | 16 | 11.5 | 7.0 | 11.0 | 9.0 | 30 | 7.0 | 5.6 | A54-100-100 | | |
| 10.0 | 3.183 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | A52-101-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting. Fp is the max cumulative pitch error for the corresponding rack length. Dimensions are in mm and are subject to change - consult factory.

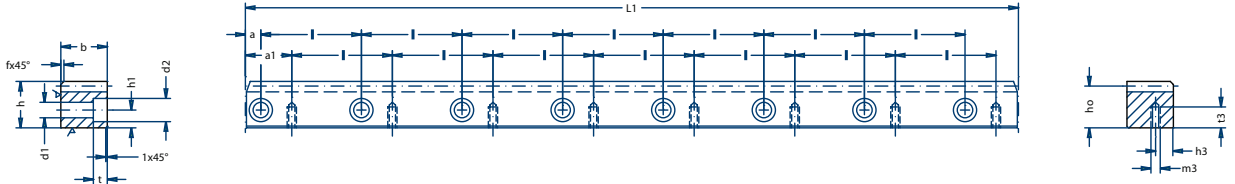
MODULAR RACK & PINION SYSTEM

SERIES A72

Soft Teeth
Tooth Quality DIN 9 h 27 (~AGMA 9)
20° Pressure Angle



RACKS
WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH
MACHINED FOR LINEAR RAILS MOUNTED 180° FROM TOOTH SIDE



| Circular Pitch, p | Module | L1 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | m3 | h3 | t3 | Fp | kg. | Part no. |
|-------------------|--------|-----------------------------|-------|----|-------|-------|---|----|----|-------|------|------|----|---|----|----|------|------|------|-----|----------------|
| 5.0 | 1.591 | 1920 | 384 | 20 | 19.50 | 17.91 | 1 | 10 | 60 | 32 | 7.5 | 5.8 | 10 | 6 | 30 | M4 | 7.5 | 8.0 | 5.4 | | A72-050-200 |
| 5.0 | 1.591 | 1920 | 384 | 25 | 24.50 | 22.91 | 1 | 10 | 60 | 32 | 10.0 | 7.0 | 11 | 7 | 30 | M5 | 10.0 | 11.0 | 8.4 | | A72-050-200-25 |
| 5.0 | 1.591 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-051-999 |
| 10.0 | 3.183 | 1920 | 192 | 30 | 29.75 | 26.57 | 2 | 10 | 60 | 32 | 11.5 | 10.0 | 15 | 9 | 30 | M6 | 11.5 | 13.5 | 11.2 | | A72-100-200 |
| 10.0 | 3.183 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-101-999 |

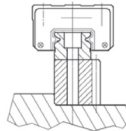
Material AISI 1045 (C45) with tensile strength = 650 N/mm^2 (95,000 PSI). Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

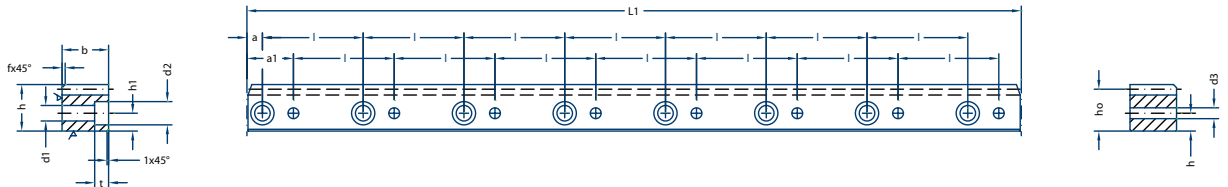
Dimensions are in mm and are subject to change - consult factory.

SERIES A74

Soft Teeth
Tooth Quality DIN 9 h 27 (~AGMA 9)
20° Pressure Angle



RACKS
WITH CIRCULAR PITCH STRAIGHT (SPUR) TEETH
MACHINED FOR LINEAR RAILS MOUNTED 90° FROM TOOTH SIDE



| Circular Pitch, p | Module | L1 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. | | |
|-------------------|--------|-----------------------------|-------|----|-------|-------|---|----|----|-------|------|-----|------|-----|----|-----|------|-----|----------------|--|-------------|
| 5.0 | 1.591 | 1920 | 384 | 20 | 19.50 | 17.91 | 1 | 10 | 60 | 32 | 7.5 | 4.5 | 7.5 | 5.3 | 30 | 4.5 | 5.4 | | A74-050-200 | | |
| 5.0 | 1.591 | 1920 | 384 | 25 | 24.50 | 22.91 | 1 | 10 | 60 | 32 | 10.0 | 6.0 | 9.5 | 8.5 | 30 | 6.0 | 8.4 | | A74-050-200-25 | | |
| 5.0 | 1.591 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-051-999 |
| 10.0 | 3.183 | 1920 | 192 | 30 | 29.75 | 26.57 | 2 | 10 | 60 | 32 | 11.5 | 7.0 | 11.0 | 9.0 | 30 | 7.0 | 11.2 | | A74-100-200 | | |
| 10.0 | 3.183 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A52-101-999 |

Material AISI 1045 (C45) with tensile strength = 650 N/mm^2 (95,000 PSI). Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

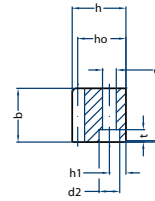
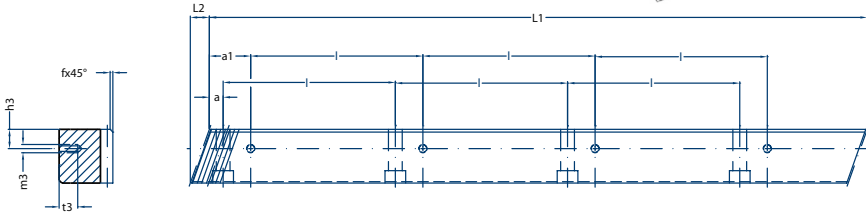
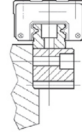
Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

RACKS

WITH RH HELICAL TEETH

MACHINED FOR LINEAR RAILS MOUNTED 180° FROM TOOTH SIDE



SERIES A15

Case Hardened & Ground Teeth
19°31'42" R.H. Helix Angle
Tooth Quality DIN 6 h 23 (~AGMA12)
20° Pressure Angle

| Module | L1 | L2 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | m3 | h3 | t3 | Fp | mass kg. | Part no. |
|---------------------------------|-----|-------|-------|----|-------|-------|---|----|-----|-------|------|------|------|----|----|-----|------|------|-------|----------|----------------|
| 2.0 | 960 | 6.70 | 144 | 19 | 19.50 | 17.50 | 1 | 10 | 60 | 16 | 7.5 | 5.8 | 10.0 | 6 | 30 | M4 | 7.5 | 8.0 | 0.036 | 2.7 | A15-020-100 |
| 2.0 | 960 | 8.50 | 144 | 24 | 24.50 | 22.50 | 1 | 10 | 60 | 16 | 10.0 | 7.0 | 11.0 | 7 | 30 | M5 | 10.0 | 11.0 | 0.036 | 4.2 | A15-020-100-24 |
| 2.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 960 | 10.30 | 96 | 29 | 29.75 | 26.75 | 2 | 10 | 60 | 16 | 11.5 | 10 | 15.0 | 9 | 30 | M6 | 11.5 | 13.5 | 0.036 | 5.6 | A15-030-100 |
| 3.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 960 | 13.83 | 72 | 39 | 39.75 | 35.75 | 2 | 20 | 80 | 12 | 14.0 | 12.0 | 18.0 | 12 | 40 | M8 | 14.0 | 16.0 | 0.040 | 10.5 | A15-040-100 |
| 4.0 | 960 | 13.83 | 72 | 39 | 48.75 | 44.75 | 2 | 20 | 80 | 12 | 17.0 | 12.0 | 18.0 | 12 | 40 | M8 | 17.0 | 16.0 | 0.040 | 13 | A15-040-100-1 |
| 4.0 | 840 | 17.38 | 63 | 49 | 58.00 | 54.00 | 2 | 30 | 105 | 8 | 22.5 | 14.0 | 20.0 | 13 | 60 | M12 | 22.5 | 25.0 | 0.040 | 17.3 | A15-040-100-49 |
| 4.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | | A11-041-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

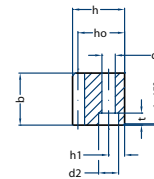
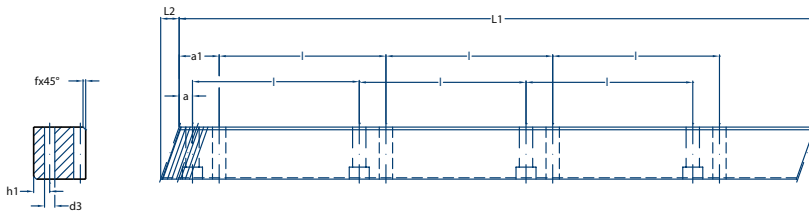
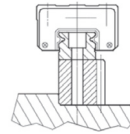
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

RACKS

WITH RH HELICAL TEETH

MACHINED FOR LINEAR RAILS MOUNTED 90° FROM TOOTH SIDE



SERIES A17

Case Hardened & Ground Teeth
19°31'42" R.H. Helix Angle
Tooth Quality DIN 6 h 23 (~AGMA12)
20° Pressure Angle

| Module | L1 | L2 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. | |
|---------------------------------|-----|-------|-------|----|-------|-------|---|----|-----|-------|------|------|------|------|----|------|-------|------|----------------|---------------|
| 2.0 | 480 | 6.70 | 72 | 19 | 19.50 | 17.50 | 1 | 10 | 60 | 8 | 7.5 | 4.5 | 7.5 | 5.3 | 30 | 4.5 | | 1.3 | A17-020-050 | |
| 2.0 | 960 | 6.70 | 144 | 19 | 19.50 | 17.50 | 1 | 10 | 60 | 16 | 7.5 | 4.5 | 7.5 | 5.3 | 30 | 4.5 | 0.036 | 2.7 | A17-020-100 | |
| 2.0 | 480 | 8.50 | 72 | 24 | 24.50 | 22.50 | 1 | 10 | 60 | 8 | 10.0 | 6.0 | 9.5 | 8.5 | 30 | 6.0 | | 2.1 | A17-020-050-24 | |
| 2.0 | 960 | 8.50 | 144 | 24 | 24.50 | 22.50 | 1 | 10 | 60 | 16 | 10.0 | 6.0 | 9.5 | 8.5 | 30 | 6.0 | 0.036 | 4.2 | A17-020-100-24 | |
| 2.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 480 | 10.30 | 48 | 29 | 29.75 | 26.75 | 2 | 10 | 60 | 8 | 11.5 | 7.0 | 11.0 | 9.0 | 30 | 7.0 | | 2.8 | A17-030-050 | |
| 3.0 | 960 | 10.30 | 96 | 29 | 29.75 | 26.75 | 2 | 10 | 60 | 16 | 11.5 | 7.0 | 11.0 | 9.0 | 30 | 7.0 | 0.036 | 5.6 | A17-030-100 | |
| 3.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 480 | 13.83 | 36 | 39 | 39.75 | 35.75 | 2 | 20 | 80 | 6 | 14.0 | 10.0 | 15.0 | 9.0 | 40 | 10.0 | | 5.2 | A17-040-050 | |
| 4.0 | 960 | 13.83 | 72 | 39 | 39.75 | 35.75 | 2 | 20 | 80 | 12 | 14.0 | 10.0 | 15.0 | 9.0 | 40 | 10.0 | 0.040 | 10.5 | A17-040-100 | |
| 4.0 | 480 | 13.83 | 36 | 39 | 48.75 | 44.75 | 2 | 20 | 80 | 6 | 17.0 | 10.0 | 15.0 | 9.0 | 40 | 10.0 | | 6.5 | A17-040-050-1 | |
| 4.0 | 960 | 13.83 | 72 | 39 | 48.75 | 44.75 | 2 | 20 | 80 | 12 | 17.0 | 10.0 | 15.0 | 9.0 | 40 | 10.0 | 0.040 | 13 | A17-040-100-1 | |
| 4.0 | 840 | 17.38 | 63 | 49 | 58.00 | 54.00 | 2 | 30 | 105 | 8 | 22.5 | 14.0 | 20.0 | 13.0 | 60 | 14.0 | | 17.3 | A17-040-100-49 | |
| 4.0 Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-041-999-W |

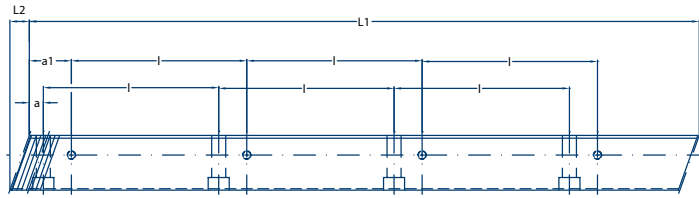
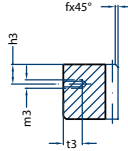
Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Teeth induction hardened to 50-55 Rc; ground on all sides after hardening. Only teeth are hardened allowing subsequent drilling and pinning of rack. Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length. Dimensions are in mm and are subject to change - consult factory.

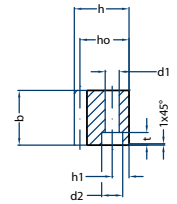
MODULAR RACK & PINION SYSTEM

SERIES A33

Soft Teeth
Tooth Quality DIN 9 h 27 (-AGMA 9)
19°31'42" R.H. Helix Angle
20° Pressure Angle



MACHINED FOR LINEAR RAILS MOUNTED 180° FROM TOOTH SIDE

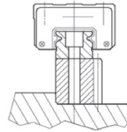


| Module | L1 | L2 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | m3 | h3 | t3 | Fp | kg. | Part no. |
|--------|-----------------------------|------|-------|----|-------|-------|---|----|----|-------|------|-----|----|----|----|----|------|------|------|-----|----------------|
| 2.0 | 1920 | 7.1 | 288 | 20 | 19.5 | 17.5 | 1 | 10 | 60 | 32 | 7.5 | 5.8 | 10 | 6 | 30 | M4 | 7.5 | 8 | 5.4 | | A33-020-200 |
| 2.0 | 1920 | 8.9 | 288 | 25 | 24.5 | 22.5 | 1 | 10 | 60 | 32 | 10 | 7 | 11 | 7 | 30 | M5 | 10 | 11 | 8.4 | | A33-020-200-25 |
| 2.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 1920 | 10.6 | 192 | 30 | 29.75 | 26.75 | 2 | 10 | 60 | 32 | 11.5 | 10 | 15 | 9 | 30 | M6 | 11.5 | 13.5 | 11.2 | | A33-030-200 |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 1920 | 14.2 | 144 | 40 | 39.75 | 35.75 | 2 | 20 | 80 | 24 | 14 | 12 | 18 | 12 | 40 | M8 | 14 | 16 | 21.5 | | A33-040-200 |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | | A11-041-999-W |

Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Rack ends are machined for continuous mounting.

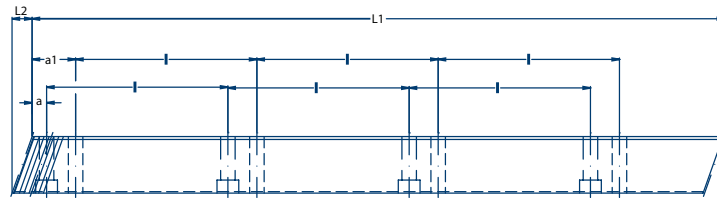
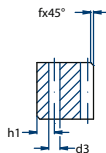
Fp is the max cumulative pitch error for the corresponding rack length.

Dimensions are in mm and are subject to change - consult factory.

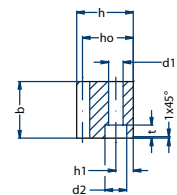


SERIES A35

Soft Teeth
Tooth Quality DIN 9 h 27 (-AGMA 9)
19°31'42" R.H. Helix Angle
20° Pressure Angle



MACHINED FOR LINEAR RAILS MOUNTED 90° FROM TOOTH SIDE



| Module | L1 | L2 | teeth | b | h | ho | f | a | l | holes | h1 | d1 | d2 | t | a1 | d3 | Fp | kg. | Part no. | |
|--------|-----------------------------|------|-------|----|-------|-------|---|----|----|-------|------|-----|-----|-----|----|-----|------|-----|----------------|---------------|
| 2.0 | 1920 | 7.1 | 288 | 20 | 19.5 | 17.5 | 1 | 10 | 60 | 32 | 7.5 | 4.5 | 7.5 | 5.3 | 30 | 4.5 | 5.4 | | A35-020-200 | |
| 2.0 | 1920 | 8.9 | 288 | 25 | 24.5 | 22.5 | 1 | 10 | 60 | 32 | 10 | 6 | 9.5 | 8.5 | 30 | 6 | 8.4 | | A35-020-200-25 | |
| 2.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-021-999-W |
| 3.0 | 1920 | 10.6 | 192 | 30 | 29.75 | 26.75 | 2 | 10 | 60 | 32 | 11.5 | 7 | 11 | 9 | 30 | 7 | 11.2 | | A35-030-200 | |
| 3.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-031-999-W |
| 4.0 | 1920 | 14.2 | 144 | 40 | 39.75 | 35.75 | 2 | 20 | 80 | 24 | 14 | 10 | 15 | 9 | 40 | 10 | 21.5 | | A35-040-200 | |
| 4.0 | Companion Rack for Assembly | | | | | | | | | | | | | | | | | | | A11-041-999-W |

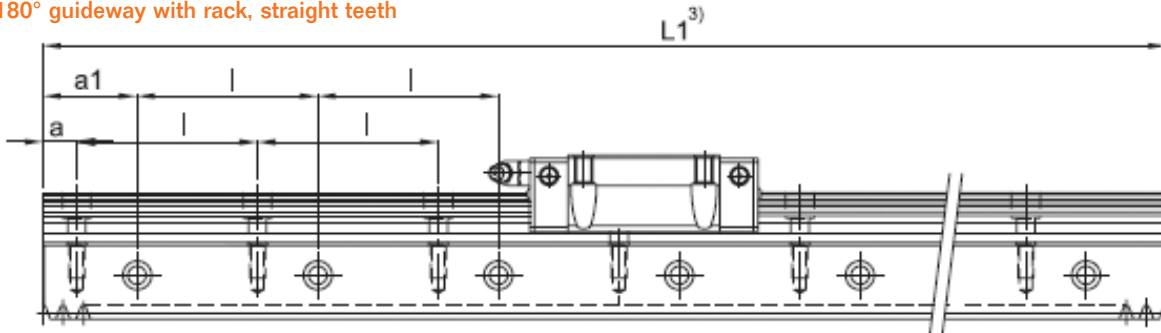
Material AISI 1045 (C45) with tensile strength = 650 N/mm² (95,000 PSI). Rack ends are machined for continuous mounting.

Fp is the max cumulative pitch error for the corresponding rack length.

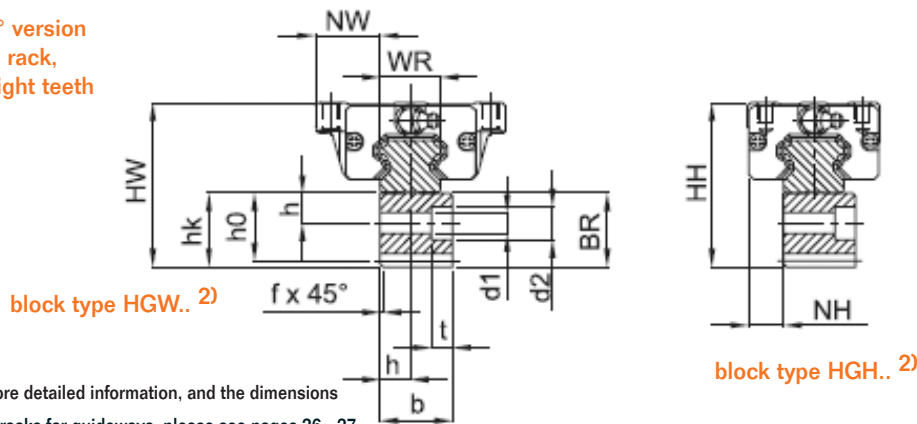
Dimensions are in mm and are subject to change - consult factory.

LINEAR GUIDEWAY WITH RACK Z SERIES

180° guideway with rack, straight teeth



180° version with rack, straight teeth



block type HGW.. ²⁾

block type HGH.. ²⁾

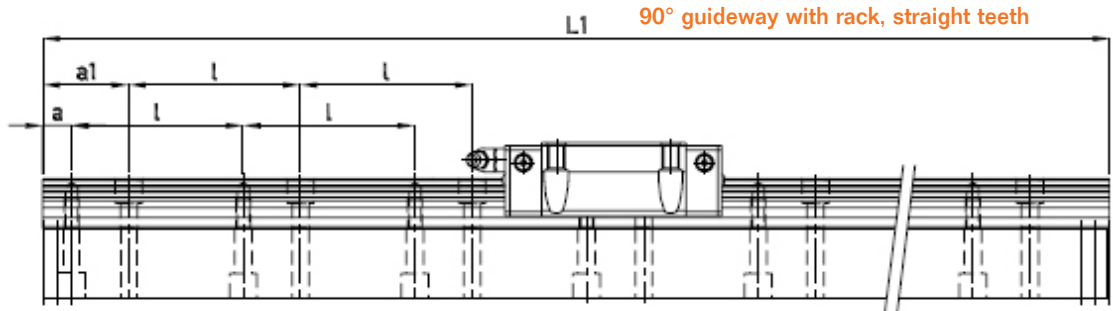
For more detailed information, and the dimensions of our racks for guideways, please see pages 26 - 27.

| Part no. | tooth quality ¹⁾ | design | GT f/300 ⁴⁾ | pitch | L1 ³⁾ | b | hk | h0 | f | a | a1 | rack |
|----------|-----------------------------|--------|------------------------|--------|------------------|----|-------|-------|---|----|----|----------------|
| Z2HGR15R | 2 | 180° | 0.022 | p = 5 | 960 | 19 | 19.50 | 17.91 | 1 | 10 | 30 | A52-050-100 |
| Z4HGR15R | 4 | 180° | 0.059 | p = 5 | 1920 | 20 | 19.50 | 17.91 | 1 | 10 | 30 | A72-050-200 |
| Z2HGR20R | 2 | 180° | 0.022 | p = 5 | 960 | 24 | 24.50 | 22.91 | 1 | 10 | 30 | A52-050-100-24 |
| Z4HGR20R | 4 | 180° | 0.059 | p = 5 | 1920 | 25 | 24.50 | 22.91 | 1 | 10 | 30 | A72-050-200-25 |
| Z2HGR25R | 2 | 180° | 0.024 | p = 10 | 960 | 29 | 29.75 | 26.57 | 2 | 10 | 30 | A52-100-100 |
| Z4HGR25R | 4 | 180° | 0.065 | p = 10 | 1920 | 30 | 29.75 | 26.57 | 2 | 10 | 30 | A72-100-200 |

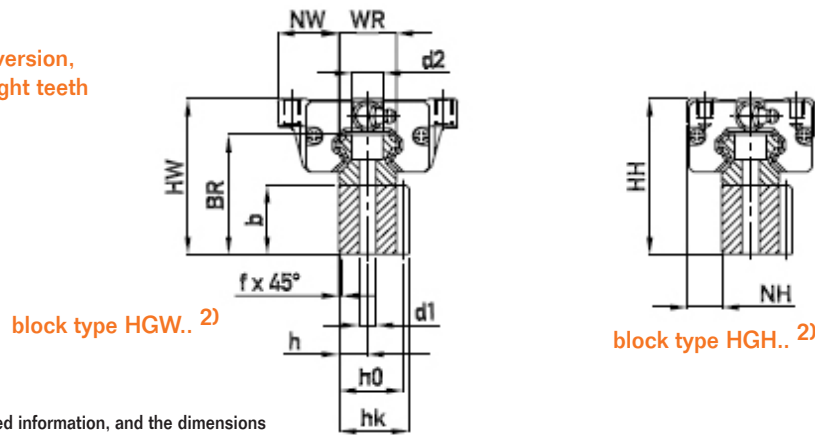
| Part no. | l | h | d1 | d2 | t | BR | WR | NW | HW | NH | HH |
|----------|----|------|------|----|---|-------|----|------|-------|------|-------|
| Z2HGR15R | 60 | 7.5 | 5.8 | 10 | 6 | 34.50 | 15 | 16.0 | 43.50 | 9.5 | 47.50 |
| Z4HGR15R | 60 | 7.5 | 5.8 | 10 | 6 | 34.50 | 15 | 16.0 | 43.50 | 9.5 | 47.50 |
| Z2HGR20R | 60 | 10.0 | 7.0 | 11 | 7 | 42.00 | 20 | 21.5 | 54.50 | 12.0 | 54.50 |
| Z4HGR20R | 60 | 10.0 | 7.0 | 11 | 7 | 42.00 | 20 | 21.5 | 54.50 | 12.0 | 54.50 |
| Z2HGR25R | 60 | 11.5 | 10.0 | 15 | 9 | 51.75 | 23 | 23.5 | 65.75 | 12.5 | 69.75 |
| Z4HGR25R | 60 | 11.5 | 10.0 | 15 | 9 | 51.75 | 23 | 23.5 | 65.75 | 12.5 | 69.75 |

- 1) 1 = helical, ground, hardened (6h23)
2 = straight teeth, ground, hardened (6h23)
3 = helical, milled, soft (9h27)
4 = straight teeth, milled, soft (9h27)
- 2) design and dimensions of the blocks acc. to HG series
- 3) racks with great length are delivered in several parts. To bring them into the correct pitch position, a mounting piece can be delivered.
- 4) maximum pitch error of the rack; rack length 300 mm.

LINEAR GUIDEWAY WITH RACK Z SERIES



90° version,
straight teeth



block type HGW.. 2)

block type HGH.. 2)

For more detailed information, and the dimensions of our racks for guideways, please see pages 26 - 27.

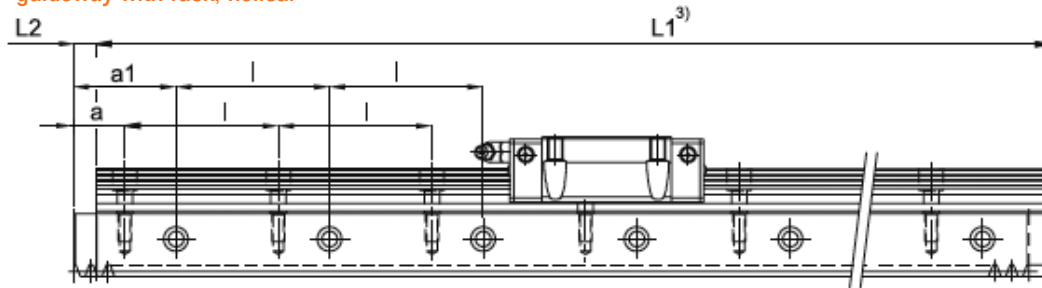
| Part no. | tooth quality 1) | design | GT f/300 4) | pitch | L1 ³⁾ | b | hk | h0 | f | a | a1 | rack |
|----------|------------------|--------|-------------|--------|------------------|----|-------|-------|---|----|----|----------------|
| Z2HGR15Z | 2 | 90° | 0.022 | p = 5 | 960 | 19 | 19.50 | 17.91 | 1 | 10 | 30 | A54-050-100 |
| Z4HGR15Z | 4 | 90° | 0.059 | p = 5 | 1920 | 20 | 19.50 | 17.91 | 1 | 10 | 30 | A74-050-200 |
| Z2HGR20Z | 2 | 90° | 0.022 | p = 5 | 960 | 24 | 24.50 | 22.91 | 1 | 10 | 30 | A54-050-100-24 |
| Z4HGR20Z | 4 | 90° | 0.059 | p = 5 | 1920 | 25 | 24.50 | 22.91 | 1 | 10 | 30 | A74-050-200-25 |
| Z2HGR25Z | 2 | 90° | 0.024 | p = 10 | 960 | 29 | 29.75 | 26.57 | 2 | 10 | 30 | A54-100-100 |
| Z4HGR25Z | 4 | 180° | 0.065 | p = 10 | 1920 | 30 | 29.75 | 26.57 | 2 | 10 | 30 | A74-100-200 |

| Part no. | l | h | d1 | d2 | t | BR | WR | NW | HW | NH | HH |
|----------|----|------|-----|------|-----|------|----|------|----|------|----|
| Z2HGR15Z | 60 | 7.5 | 4.5 | 7.5 | 5.3 | 34.0 | 15 | 16.0 | 43 | 9.5 | 47 |
| Z4HGR15Z | 60 | 7.5 | 4.5 | 7.5 | 5.3 | 35.0 | 15 | 16.0 | 44 | 9.5 | 48 |
| Z2HGR20Z | 60 | 10.0 | 6.0 | 9.5 | 8.5 | 41.5 | 20 | 21.5 | 54 | 12.0 | 54 |
| Z4HGR20Z | 60 | 10.0 | 6.0 | 9.5 | 8.5 | 42.5 | 20 | 21.5 | 55 | 12.0 | 55 |
| Z2HGR25Z | 60 | 11.5 | 7.0 | 11.0 | 9.0 | 51.0 | 23 | 23.5 | 65 | 12.5 | 69 |
| Z4HGR25Z | 60 | 11.5 | 7.0 | 11.0 | 9.0 | 52.0 | 23 | 23.5 | 66 | 12.5 | 70 |

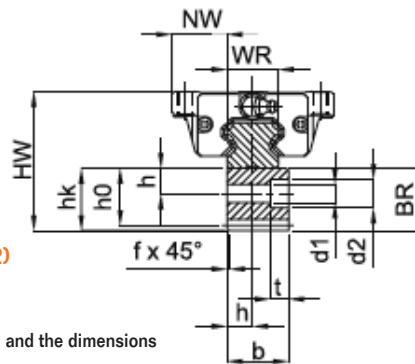
- 1) 1 = helical, ground, hardened (6h23)
2 = straight teeth, ground, hardened (6h23)
3 = helical, milled, soft (9h27)
4 = straight teeth, milled, soft (9h27)
- 2) design and dimensions of the blocks acc. to HG series
- 3) racks with great length are delivered in several parts. To bring them into the correct pitch position, a mounting piece can be delivered.
- 4) maximum pitch error of the rack; rack length 300 mm.

LINEAR GUIDEWAY WITH RACK Z SERIES

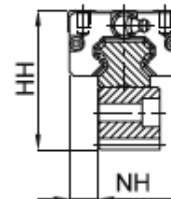
180° guideway with rack, helical



180° version, helical, right hand 19°31'42"



block type HGW.. 2)



block type HGH.. 2)

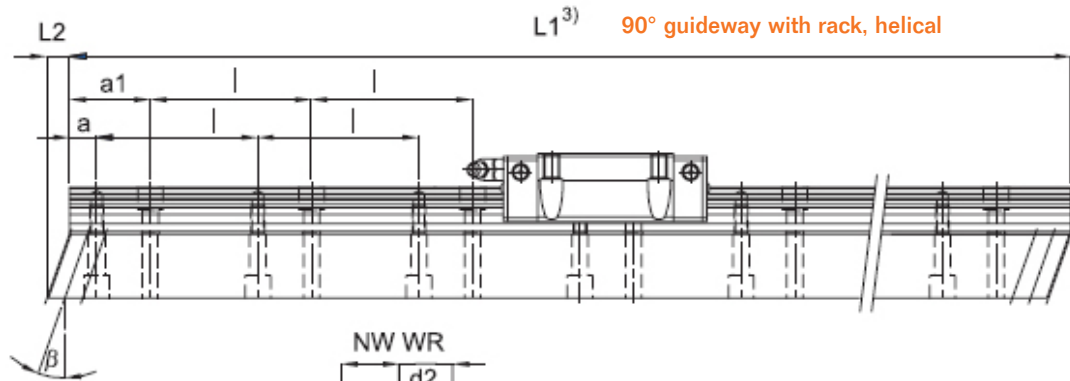
For more detailed information, and the dimensions of our racks for guideways, please see pages 28 - 29.

| Part no. | tooth quality 1) | design | GT f/300 4) | module | L1 ³⁾ | L2 | b | hk | h0 | f | a | rack |
|----------|------------------|--------|-------------|--------|------------------|------|----|-------|-------|---|----|----------------|
| Z1HGR15R | 1 | 180° | 0.022 | 2 | 960 | 6.7 | 19 | 19.50 | 17.50 | 1 | 10 | A15-020-100 |
| Z3HGR15R | 3 | 180° | 0.061 | 2 | 1920 | 7.1 | 20 | 19.50 | 17.50 | 1 | 10 | A33-020-200 |
| Z1HGR20R | 1 | 180° | 0.022 | 2 | 960 | 8.5 | 24 | 24.50 | 22.50 | 1 | 10 | A15-020-100-24 |
| Z3HGR20R | 3 | 180° | 0.061 | 2 | 1920 | 8.9 | 25 | 24.50 | 22.50 | 1 | 10 | A33-020-200-25 |
| Z1HGR25R | 1 | 180° | 0.024 | 3 | 960 | 10.3 | 29 | 29.75 | 26.75 | 2 | 10 | A15-030-100 |
| Z3HGR25R | 3 | 180° | 0.065 | 3 | 1920 | 10.6 | 30 | 29.75 | 26.75 | 2 | 10 | A33-030-200 |
| Z1HGR30R | 1 | 180° | 0.025 | 4 | 960 | 13.8 | 39 | 39.75 | 35.75 | 2 | 20 | A15-040-100 |
| Z3HGR30R | 3 | 180° | 0.068 | 4 | 1920 | 14.2 | 40 | 39.75 | 35.75 | 2 | 20 | A33-040-200 |
| Z1HGR35R | 1 | 180° | 0.025 | 4 | 960 | 13.8 | 39 | 48.75 | 44.75 | 2 | 20 | A17-040-100-1 |
| Z1HGR45R | 1 | 180° | 0.025 | 4 | 840 | 17.4 | 49 | 58.00 | 54.00 | 2 | 30 | A17-040-100-49 |

| Part no. | a1 | l | h | d1 | d2 | t | BR | WR | NW | HW | NH | HH |
|----------|----|-----|------|------|----|----|-------|----|------|--------|------|--------|
| Z1HGR15R | 30 | 60 | 7.5 | 5.8 | 10 | 6 | 34.50 | 15 | 16.0 | 43.50 | 9.5 | 47.50 |
| Z3HGR15R | 30 | 60 | 7.5 | 5.8 | 10 | 6 | 34.50 | 15 | 16.0 | 43.50 | 9.5 | 47.50 |
| Z1HGR20R | 30 | 60 | 10.0 | 7.0 | 11 | 7 | 42.00 | 20 | 21.5 | 54.50 | 12.0 | 54.50 |
| Z3HGR20R | 30 | 60 | 10.0 | 7.0 | 11 | 7 | 42.00 | 20 | 21.5 | 54.50 | 12.0 | 54.50 |
| Z1HGR25R | 30 | 60 | 11.5 | 10.0 | 15 | 9 | 51.75 | 23 | 23.5 | 65.75 | 12.5 | 69.75 |
| Z3HGR25R | 30 | 60 | 11.5 | 10.0 | 15 | 9 | 51.75 | 23 | 23.5 | 65.75 | 12.5 | 69.75 |
| Z1HGR30R | 40 | 80 | 14.0 | 12.0 | 18 | 12 | 65.75 | 28 | 31.0 | 81.75 | 16.0 | 84.75 |
| Z3HGR30R | 40 | 80 | 14.0 | 12.0 | 18 | 12 | 65.75 | 28 | 31.0 | 81.75 | 16.0 | 84.75 |
| Z1HGR35R | 40 | 80 | 17.0 | 12.0 | 18 | 12 | 77.75 | 34 | 33.0 | 96.75 | 18.0 | 103.75 |
| Z1HGR45R | 60 | 105 | 22.5 | 14.0 | 20 | 13 | 96.00 | 45 | 37.5 | 118.00 | 20.5 | 128.00 |

- 1) 1 = helical, ground, hardened (6h23)
2 = straight teeth, ground, hardened (6h23)
3 = helical, milled, soft (9h27)
4 = straight teeth, milled, soft (9h27)
- 2) design and dimensions of the blocks acc. to HG series
- 3) racks with great length are delivered in several parts. To bring them into the correct pitch position, a mounting piece can be delivered.
- 4) maximum pitch error of the rack; rack length 300 mm.

LINEAR GUIDEWAY WITH RACK Z SERIES



90° version, helical, right hand 19°31'42"

block type HGW.. 2)

block type HGH.. 2)

For more detailed information, and the dimensions of our racks for guideways, please see pages 28 - 29.

| Part no. | tooth quality 1) | design | GT f/300 4) | module | L1 ³⁾ | L2 | b | hk | h0 | f | a | rack |
|----------|------------------|--------|-------------|--------|------------------|------|----|-------|-------|---|----|----------------|
| Z1HGR15Z | 1 | 90° | 0.022 | 2 | 960 | 6.7 | 19 | 19.50 | 17.50 | 1 | 10 | A17-020-100 |
| Z3HGR15Z | 3 | 90° | 0.061 | 2 | 1920 | 7.1 | 20 | 19.50 | 17.50 | 1 | 10 | A35-020-200 |
| Z1HGR20Z | 1 | 90° | 0.022 | 2 | 960 | 8.5 | 24 | 24.50 | 22.50 | 1 | 10 | A17-020-100-24 |
| Z3HGR20Z | 3 | 90° | 0.061 | 2 | 1920 | 8.9 | 25 | 24.50 | 22.50 | 1 | 10 | A35-020-200-25 |
| Z1HGR25Z | 1 | 90° | 0.024 | 3 | 960 | 10.3 | 29 | 29.75 | 26.75 | 2 | 10 | A17-030-100 |
| Z3HGR25Z | 3 | 90° | 0.065 | 3 | 1920 | 10.6 | 30 | 29.75 | 26.75 | 2 | 10 | A35-030-200 |
| Z1HGR30Z | 1 | 90° | 0.025 | 4 | 960 | 13.8 | 39 | 39.75 | 35.75 | 2 | 20 | A17-040-100 |
| Z3HGR30Z | 3 | 90° | 0.068 | 4 | 1920 | 14.2 | 40 | 39.75 | 35.75 | 2 | 20 | A35-040-200 |
| Z1HGR35Z | 1 | 90° | 0.025 | 4 | 960 | 13.8 | 39 | 48.75 | 44.75 | 2 | 20 | A17-040-100-1 |
| Z1HGR45Z | 1 | 90° | 0.025 | 4 | 840 | 17.4 | 49 | 58.00 | 54.00 | 2 | 30 | A17-040-100-49 |

| Part no. | a1 | l | h | d1 | d2 | t | BR | WR | NW | HW | NH | HH |
|----------|----|-----|------|------|------|------|------|----|------|-----|------|-----|
| Z1HGR15Z | 30 | 60 | 7.5 | 4.5 | 7.5 | 5.3 | 34.0 | 15 | 16.0 | 43 | 9.5 | 47 |
| Z3HGR15Z | 30 | 60 | 7.5 | 4.5 | 7.5 | 5.3 | 35.0 | 15 | 16.0 | 44 | 9.5 | 48 |
| Z1HGR20Z | 30 | 60 | 10.0 | 6.0 | 9.5 | 8.5 | 41.5 | 20 | 21.5 | 54 | 12.0 | 54 |
| Z3HGR20Z | 30 | 60 | 10.0 | 6.0 | 9.5 | 8.5 | 42.5 | 20 | 21.5 | 55 | 12.0 | 55 |
| Z1HGR25Z | 30 | 60 | 11.5 | 7.0 | 11.0 | 9.0 | 51.0 | 23 | 23.5 | 65 | 12.5 | 69 |
| Z3HGR25Z | 30 | 60 | 11.5 | 7.0 | 11.0 | 9.0 | 52.0 | 23 | 23.5 | 66 | 12.5 | 70 |
| Z1HGR30Z | 40 | 80 | 14.0 | 10.0 | 15.0 | 9.0 | 65.0 | 28 | 31.0 | 81 | 16.0 | 84 |
| Z3HGR30Z | 40 | 80 | 14.0 | 10.0 | 15.0 | 9.0 | 66.0 | 28 | 31.0 | 82 | 16.0 | 85 |
| Z1HGR35Z | 40 | 80 | 17.0 | 10.0 | 15.0 | 9.0 | 68.0 | 34 | 33.0 | 87 | 18.0 | 94 |
| Z1HGR45Z | 60 | 105 | 22.5 | 14.0 | 20.0 | 13.0 | 87.0 | 45 | 37.5 | 109 | 20.5 | 119 |

- 1) 1 = helical, ground, hardened (6h23)
2 = straight teeth, ground, hardened (6h23)
3 = helical, milled, soft (9h27)
4 = straight teeth, milled, soft (9h27)
- 2) design and dimensions of the blocks acc. to HG series
- 3) racks with great length are delivered in several parts. To bring them into the correct pitch position, a mounting piece can be delivered.
- 4) maximum pitch error of the rack; rack length 300 mm.

PINION CAPABILITIES



Standard Range:

The index on the next page provides an overview of our Standard range of straight (spur) and helical tooth pinions. Pinions in the standard range are usually in stock allowing for short delivery times. The standard pinions are available in 5 styles, master gear, plain bore

Custom Pinions:

In addition to the standard range, Andantex can provide Straight or Helical pinions with internal or external teeth to customer designs:

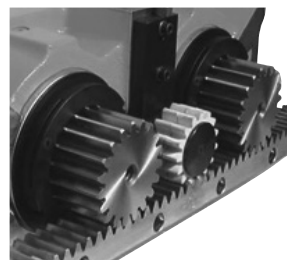
- Precision milled teeth in modules 0.5-24 and diameters up to 5000 mm (200 in.)

(soft bore allows customer to rework to required diameter), bored and keyed, flange mount to ISO 9409-1 and pinion shafts in modules 1 – 10 (diametral pitch (d.p.) = 25.4 – 2.54) with quality from AGMA 8 to AGMA 12.


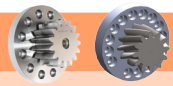



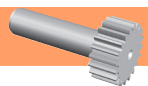
- Shaped or hobbled teeth in modules 0.5 - 10 (d.p. = 50.8 – 2.54) with pitch diameters up to 800 mm (31.5 in.) and widths up to 180 mm (7 in.)
- Ground teeth in modules 1 – 10 (d.p. = 25.4 – 2.54) with pitch diameter up to 2000 mm (79 in.)
- Material hardened or plated
- Stainless Steel
- Plastic



The standard range is completed by the innovative PDP split pinion for eliminating backlash between rack & pinion.



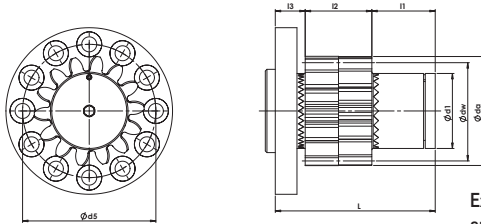
RANGE OF PINIONS

| Part Numbers | Style | Module | Heat | Quality Treatment | Page Level |
|--|-----------------|---|-------------------|-------------------|------------|
|  Pinions - PDP (Preloaded Double Pinion) | | | | | |
| 113-____-____ | Straight (spur) | 2, 3, 4, 5 | Hardened & Ground | 6 e 25 (~AGMA 11) | 40 |
| 123-____-____ | Helical | 2, 3, 4, 5 | Hardened & Ground | 6 e 25 (~AGMA 11) | 40 |
|  Pinions - Flange mounted per ISO 9409-1 | | | | | |
| 112-____-____ | Straight Spur | 2, 3, 4, 5 | Hardened & Ground | 6 e 25 (~AGMA 12) | 42 |
| 122-____-____ | Helical | 2, 3, 4, 5 | Hardened & Ground | 6 e 25 (~AGMA 12) | 42 |
|  Pinions - Master Gear | | | | | |
| 117-____-____ | Straight (spur) | 2, 3, 4, 5, 6 | Hardened & Ground | 6 e 25 (~AGMA 12) | 45 |
| 127-____-____ | Helical | 2, 3, 4, 5, 6 | Hardened & Ground | 6 e 25 (~AGMA 12) | 47 |
|  Pinions - Plain Bore | | | | | |
| 254 0__ | Straight (spur) | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 6 f 24 (~AGMA 12) | 49 |
| 254 5__ | Helical | 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 6 f 24 (~AGMA 12) | 49 |
| 154 ____ | Straight (spur) | 2, 5, 7.5, 10, 12.5, 16, 20, 25 Circular Pitch | Hardened & Ground | 6 f 24 (~AGMA 12) | 49 |
|  Pinions - Bored & Keyed | | | | | |
| 113-____-____ | Straight (spur) | 2, 3, 4 | Hardened & Ground | 7 e 25 (~AGMA 11) | 50 |
| 123-____-____ | Helical | 2, 3, 4 | Hardened & Ground | 7 e 25 (~AGMA 11) | 52 |
| 154 ____ | Straight (spur) | 2, 5, 7.5, 10, 12.5, 16, 20, 25 Circular Pitch | Hardened & Ground | 6 f 24 (~AGMA 11) | 54 |
| 14 ____ | Straight (spur) | 1.5, 2, 2.5, 3, 4, 5, 6 | Hardened & Ground | 6 f 24 (~AGMA 11) | 55 |
| 14 ____ | Helical | 1.5, 2, 2.5, 3, 4, 5, 6, 8 | Hardened & Ground | 6 f 24 (~AGMA 11) | 56 |
|  Pinions - Shaft | | | | | |
| 201 ____ | Straight (spur) | 1, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10 | Hardened & Ground | 6 f 24 (~AGMA 12) | 57 |
| 4 ____ | Straight (spur) | 2, 3.33, 5, 7.5, 10, 12.5, 16, 20 Circular Pitch | Hardened & Ground | 6 f 24 (~AGMA 12) | 57 |
| 211____ | Helical | 1.5, 2, 2.5, 3, 4, 5, 6, 8 | Hardened & Ground | 6 f 24 (~AGMA 12) | 58 |

* Note all AGMA quality grades in this catalog are based on AGMA standard 2000-A88. The new AGMA quality numbers defined in AGMA 2015-1-A01 are similar to the DIN numbers shown.

NEW! PRELOADED DOUBLE PINION WITH STRAIGHT & HELICAL TEETH - VERSION 2013

Our new Preloaded Double Pinion enables a back-lash-free drive in connection with a rack. A flange acc. to ISO 9409-1 connects the Preloaded Double Pinion with a gearbox. The Preloaded Double Pinion is available as either helical or straight teeth type. Unique hirth couplings are used to preload the pinion and connect it to the flange. In addition to our standard range shown below, we offer customized Preloaded Double Pinions as well. Parameters such as module or number of teeth can be chosen to suit customers' requirements.



Example of flange hole pattern - for types and dimensions see page A 4.

MODULE 2-5

Straight (Spur) teeth or Helical,
Pressure angle $\alpha=20^\circ$
L.H. Helix angle $\beta=19^\circ 31' 42''$
Material STEEL AISI 5115 DIN 1.7131 (16MnCr5)
Case hardened & ground teeth
Gear Quality 6e25 (-AGMA 11)

Straight Teeth

| Module | No. teeth | β | x | d_1 | d_w | d_a | d_5 | L | l_1 | l_2 | l_3 | Flange Type | Part No. |
|--------|-----------|-----------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------------|-------------|
| 2 | 22 | 0° | 0.500 | 36 | 46 | 50 | 63 | 63 | 23 | 25 | 15 | 1 | 113-020-122 |
| 3 | 15 | 0° | 0.167 | 36 | 46 | 52 | 63 | 68 | 23 | 30 | 15 | 1 | 113-030-115 |
| 4 | 14 | 0° | 0.250 | 45 | 58 | 66 | 80 | 96 | 38 | 40 | 18 | 2 | 113-040-114 |
| 5 | 15 | 0° | 0.500 | 65 | 80 | 90 | 125 | 113 | 38 | 50 | 25 | 3 | 113-050-115 |

Helical Teeth

| Module | No. teeth | β | x | d_1 | d_w | d_a | d_5 | L | l_1 | l_2 | l_3 | Flange Type | Part No. |
|--------|-----------|---------------------|-------|-------|-------|-------|-------|-----|-------|-------|-------|-------------|-------------|
| 2 | 22 | $19^\circ 31' 42''$ | 0.330 | 36 | 48 | 52 | 63 | 63 | 23 | 25 | 15 | 1 | 123-020-122 |
| 3 | 14 | $19^\circ 31' 42''$ | 0.239 | 36 | 46 | 52 | 63 | 68 | 23 | 30 | 15 | 1 | 123-030-114 |
| 4 | 13 | $19^\circ 31' 42''$ | 0.353 | 45 | 58 | 66 | 80 | 96 | 38 | 40 | 18 | 2 | 123-040-113 |
| 5 | 14 | $19^\circ 31' 42''$ | 0.573 | 65 | 80 | 90 | 125 | 113 | 38 | 50 | 25 | 3 | 123-050-114 |

x - addendum modification. Due to different preload options, the length l_1 and therefore the overall length L may vary by ± 1.5 mm.

Load tables:
Values determined under following conditions:
speed: 2.5 m/s; KA = 1,25; 20.000h; grease

Straight Teeth

| Module | No. teeth | x | Max. Torque [Nm] | | Speed [r.p.m.] | Flange |
|--------|-----------|-------|------------------|-------------------|----------------|------------------|
| | | | Without preload | With max. preload | | |
| 2 | 22 | 0.500 | 92 | 46 | 1061 | ISO 9409-1 - 63 |
| 3 | 15 | 0.167 | 109 | 55 | 1061 | ISO 9409-1 - 63 |
| 4 | 14 | 0.250 | 237 | 119 | 853 | ISO 9409-1 - 80 |
| 5 | 15 | 0.500 | 594 | 297 | 637 | ISO 9409-1 - 125 |

Helical Teeth

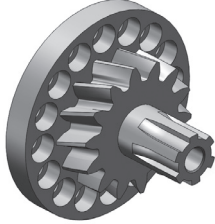
| Module | No. Teeth | x | Max. Torque [Nm] | | Speed [r.p.m.] | Flange |
|--------|-----------|-------|------------------|-------------------|----------------|------------------|
| | | | Without preload | With max. preload | | |
| 2 | 22 | 0.330 | 132 | 66 | 1071 | ISO 9409-1 - 63 |
| 3 | 14 | 0.239 | 147 | 74 | 1071 | ISO 9409-1 - 63 |
| 4 | 13 | 0.353 | 305 | 153 | 865 | ISO 9409-1 - 80 |
| 5 | 14 | 0.573 | 623 | 312 | 643 | ISO 9409-1 - 125 |

Dimensions are in mm and subject to change – consult factory.

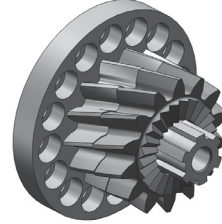
Assembly Instructions

NEW! Preloaded Double Pinion (PDP)

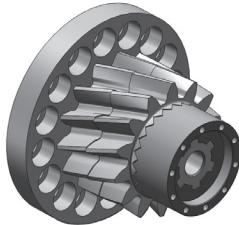
1. Assembly flange to the gearbox



2. Install the PDP on the shaft

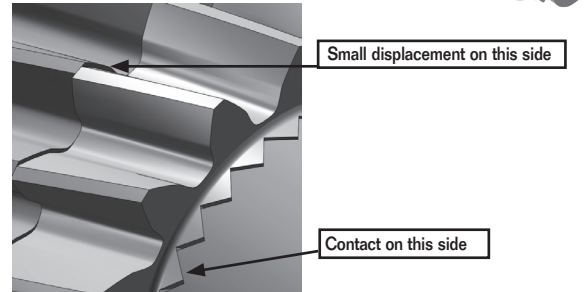


3. Install the pressure plate of the Hirth-Coupling

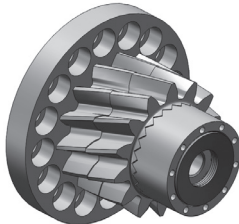


CAUTION: THE DISPLACEMENT AND CONTACT MUST BE AS SHOWN BEFORE PRELOADING TO AVOID DAMAGING PDP

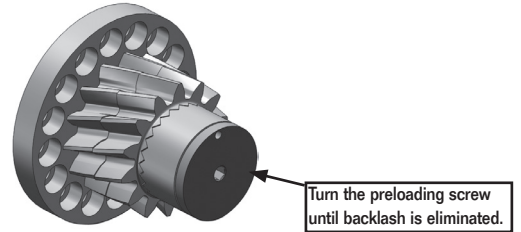
4. Choose the correct position



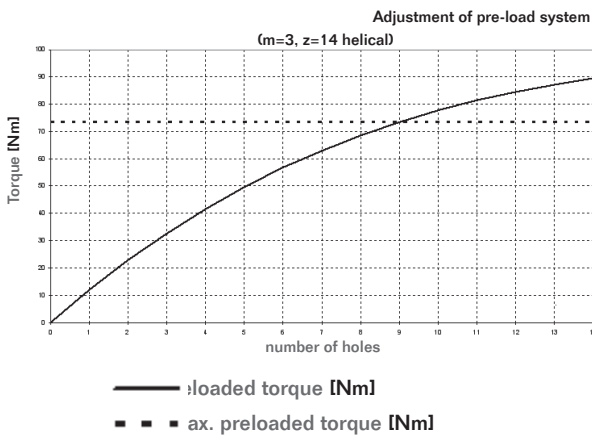
5. Install the disc springs



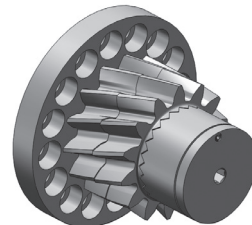
6. Insert the preloading screw and preload until backlash is eliminated



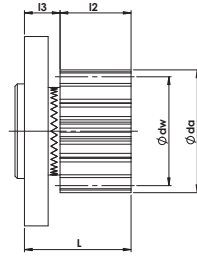
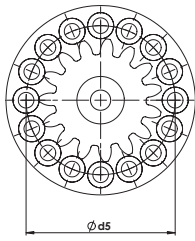
7. Use the diagram and turn the number of holes required for preload



8. Insert the locking set screw



NEW! FLANGE PINION



MODULES 2 - 5

Straight (Spur) teeth or Helical,
 Pressure angle $\phi=20^\circ$
 L.H. Helix angle $\beta=19^\circ 31' 42''$
 Material STEEL AISI 5115 DIN 1.7131 (16MnCr5)
 Case Hardened & Ground Teeth 58-62 HRc
 Gear Quality 6e24 (~AGMA 11)

Straight Teeth

| Module | No. Teeth | β | x | d_w | d_a | d_5 | L | l_2 | l_3 | Flange Type | Part No. |
|--------|-----------|-----------|-------|-------|-------|-------|----|-------|-------|-------------|-------------|
| 2 | 22 | 0° | 0.500 | 46 | 50 | 63 | 40 | 25 | 15 | 1 | 112-120-022 |
| 3 | 15 | 0° | 0.167 | 46 | 52 | 63 | 45 | 30 | 15 | 1 | 112-130-015 |
| 3 | 19 | 0° | 0.500 | 60 | 66 | 80 | 58 | 30 | 18 | 2 | 112-230-019 |
| 4 | 14 | 0° | 0.250 | 58 | 66 | 80 | 58 | 40 | 18 | 2 | 112-240-014 |
| 4 | 20 | 0° | 0.250 | 82 | 90 | 125 | 65 | 40 | 25 | 3 | 112-340-020 |
| 5 | 15 | 0° | 0.500 | 80 | 90 | 125 | 75 | 50 | 25 | 3 | 112-350-015 |

Helical Teeth

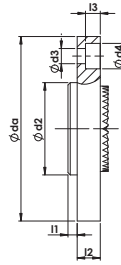
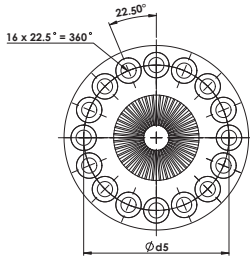
| Module | No. teeth | β | x | d_w | d_a | d_5 | L | l_2 | l_3 | Flange Type | Part No. |
|--------|-----------|---------------------|-------|-------|-------|-------|----|-------|-------|-------------|-------------|
| 2 | 22 | $19^\circ 31' 42''$ | 0.330 | 48 | 52 | 63 | 40 | 25 | 15 | 1 | 122-120-022 |
| 3 | 14 | $19^\circ 31' 42''$ | 0.239 | 46 | 52 | 63 | 45 | 30 | 15 | 1 | 122-130-014 |
| 3 | 18 | $19^\circ 31' 42''$ | 0.450 | 60 | 66 | 80 | 58 | 30 | 18 | 2 | 122-230-018 |
| 4 | 13 | $19^\circ 31' 42''$ | 0.353 | 58 | 66 | 80 | 58 | 40 | 18 | 2 | 122-240-013 |
| 4 | 19 | $19^\circ 31' 42''$ | 0.170 | 82 | 90 | 125 | 65 | 40 | 25 | 3 | 122-340-019 |
| 5 | 14 | $19^\circ 31' 42''$ | 0.573 | 80 | 90 | 125 | 75 | 50 | 25 | 3 | 122-350-014 |

x - addendum modification.

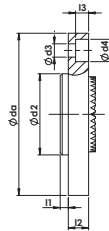
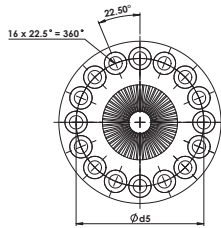
In addition to our standard range shown above, we offer customized Flange Pinions as well. Parameters such as module or number of teeth can be chosen to suit customers' requirements.



FLANGE DIMENSIONS Use for Preloaded Double Pinion & Flange Pinion



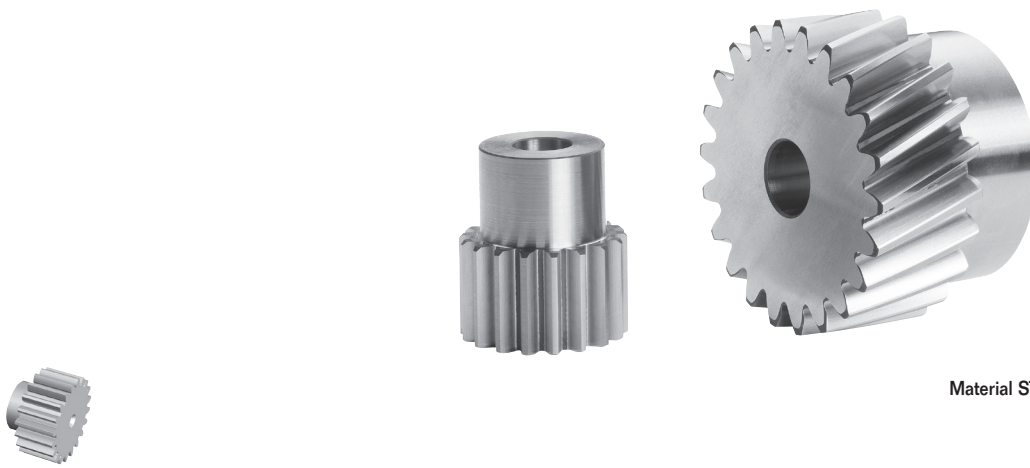
| Flange Type | d_a | d_2 | d_3 | d_4 | d_5 | l_1 | l_2 | l_3 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | 80 | 40 | 6.6 | 11 | 63 | 4 | 10 | 6.4 |



| Flange Type | d_a | d_2 | d_3 | d_4 | d_5 | l_1 | l_2 | l_3 |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2 | 100 | 50 | 9 | 15 | 80 | 6 | 13 | 8.6 |
| 3 | 160 | 80 | 11 | 18 | 125 | 6 | 20 | 10.6 |



Master-Gears



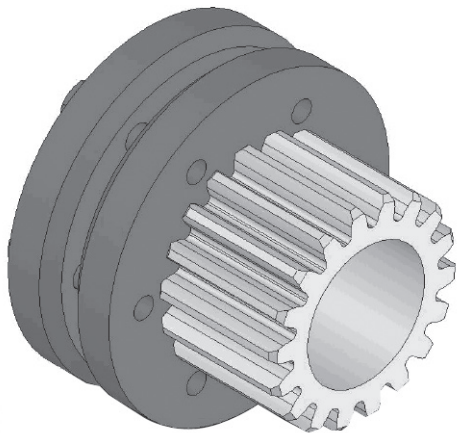
Straight (Spur) Teeth or Helical
Pressure angle $\alpha=20^\circ$
L.H. Helix angle $\beta=19^\circ 31'42''$
Material STEEL AISI 5115 DIN 1.7131 (16MnCr5)
Teeth Induction hardened & ground
Gear Quality 6e25 (~AGMA 11)

Module 2-6 product range

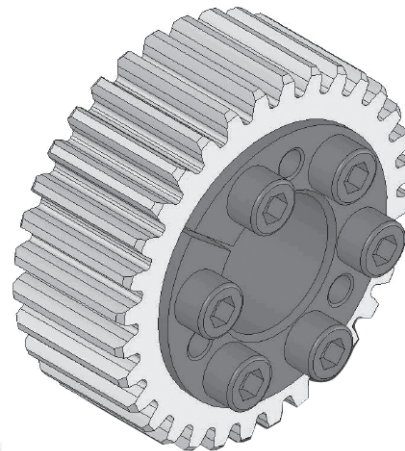
The teeth of the master-gears are case-hardened and ground. The hub and the bore will be machined according to the operating range. Thereby the delivery time is shorter and the spectrum of applications will be enlarged.

Examples

with shrink discs



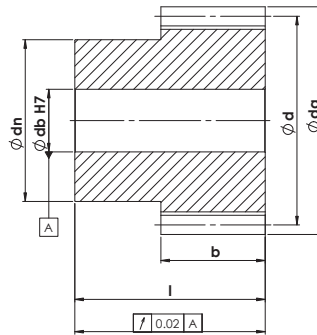
with locking assemblies



MODULAR RACK & PINION SYSTEM

MASTER-GEARS Ground, Straight (Spur) Teeth

Straight (Spur) Teeth
Pressure angle $\phi=20^\circ$
Material AISI 5115 (16MnCr5)
Carburized and teeth induction hardened
Quality 6e25 (-AGMA 11)



Module 2.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|------|----------------|-------------------|----|----------------|----|-------------|
| 18 | 36.0 | 40.0 | 18 | 25 | 30 | 47 | 117-020-018 |
| 20 | 40.0 | 44.0 | 18 | 25 | 30 | 47 | 117-020-020 |
| 22 | 44.0 | 48.0 | 18 | 25 | 36 | 47 | 117-020-022 |
| 25 | 50.0 | 54.0 | 18 | 25 | 44 | 53 | 117-020-025 |
| 28 | 56.0 | 60.0 | 18 | 25 | 50 | 53 | 117-020-028 |
| 30 | 60.0 | 64.0 | 24 | 25 | 54 | 53 | 117-020-030 |
| 32 | 64.0 | 68.0 | 24 | 25 | 55 | 53 | 117-020-032 |
| 36 | 72.0 | 76.0 | 24 | 25 | 65 | 53 | 117-020-036 |
| 40 | 80.0 | 84.0 | 24 | 25 | 68 | 53 | 117-020-040 |

Module 3.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|-------|----------------|-------------------|----|----------------|----|-------------|
| 18 | 54.0 | 60.0 | 24 | 30 | 45 | 45 | 117-030-018 |
| 20 | 60.0 | 66.0 | 24 | 30 | 48 | 48 | 117-030-020 |
| 22 | 66.0 | 72.0 | 24 | 30 | 55 | 55 | 117-030-022 |
| 25 | 75.0 | 81.0 | 24 | 30 | 62 | 62 | 117-030-025 |
| 28 | 84.0 | 90.0 | 24 | 30 | 68 | 68 | 117-030-028 |
| 30 | 90.0 | 96.0 | 24 | 30 | 68 | 68 | 117-030-030 |
| 32 | 96.0 | 102.0 | 24 | 30 | 68 | 68 | 117-030-032 |
| 36 | 108.0 | 114.0 | 24 | 30 | 68 | 68 | 117-030-036 |

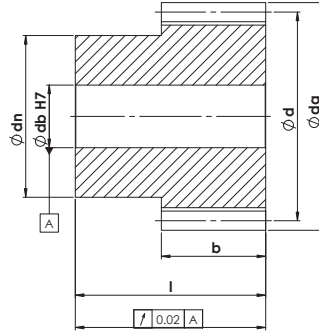
Dimensions are in mm and subject to change – consult factory.

MODULAR RACK & PINION SYSTEM

MASTER-GEARS

Ground, Straight (Spur) Teeth

Straight (Spur) Teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Carburized and teeth induction hardened
 Quality 6e25 (~AGMA 11)



Module 4.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|-------|----------------|-------------------|----|----------------|----|-------------|
| 18 | 72.0 | 80.0 | 24 | 40 | 62 | 73 | 117-040-018 |
| 20 | 80.0 | 88.0 | 24 | 40 | 62 | 73 | 117-040-020 |
| 22 | 88.0 | 96.0 | 24 | 40 | 68 | 73 | 117-040-022 |
| 25 | 100.0 | 108.0 | 24 | 40 | 80 | 74 | 117-040-025 |
| 28 | 112.0 | 120.0 | 24 | 40 | 80 | 74 | 117-040-028 |
| 30 | 120.0 | 128.0 | 30 | 40 | 80 | 74 | 117-040-030 |
| 32 | 128.0 | 136.0 | 30 | 40 | 110 | 74 | 117-040-032 |
| 36 | 144.0 | 152.0 | 30 | 40 | 110 | 74 | 117-040-036 |

Module 5.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|-------|----------------|-------------------|----|----------------|-----|-------------|
| 22 | 110.0 | 120.0 | 24 | 50 | 90 | 91 | 117-050-022 |
| 25 | 125.0 | 135.0 | 24 | 50 | 110 | 101 | 117-050-025 |
| 28 | 140.0 | 150.0 | 24 | 50 | 110 | 101 | 117-050-028 |
| 30 | 150.0 | 160.0 | 30 | 50 | 110 | 101 | 117-050-030 |
| 32 | 160.0 | 170.0 | 30 | 50 | 110 | 101 | 117-050-032 |
| 36 | 180.0 | 190.0 | 30 | 50 | 110 | 101 | 117-050-036 |

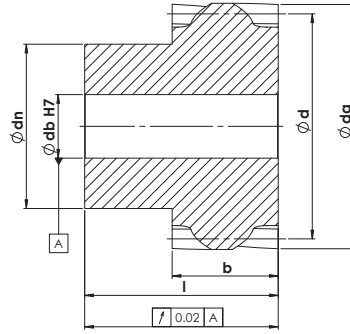
Module 6.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|-------|----------------|-------------------|----|----------------|-----|-------------|
| 20 | 120.0 | 132.0 | 30 | 60 | 100 | 140 | 117-060-020 |
| 25 | 150.0 | 162.0 | 30 | 60 | 130 | 140 | 117-060-025 |
| 28 | 168.0 | 180.0 | 30 | 60 | 130 | 140 | 117-060-028 |
| 30 | 180.0 | 192.0 | 30 | 60 | 140 | 140 | 117-060-030 |

Dimensions are in mm and subject to change – consult factory.

MODULAR RACK & PINION SYSTEM

Helical, left hand
 Helix angle $19^{\circ} 31' 42''$
 Pressure angle $\phi=20^{\circ}$
 Material AISI 5115 (16MnCr5)
 Carburized and teeth induction hardened
 Quality 6e25 (~AGMA 11)



MASTER-GEARS

Ground, Helical Teeth



Module 2.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|-------|----------------|-------------------|----|----------------|----|-------------|
| 18 | 38.2 | 42.20 | 18 | 25 | 30 | 47 | 127-020-018 |
| 20 | 42.44 | 46.44 | 18 | 25 | 30 | 47 | 127-020-020 |
| 22 | 46.69 | 50.69 | 18 | 25 | 36 | 47 | 127-020-022 |
| 25 | 53.05 | 57.05 | 18 | 25 | 44 | 53 | 127-020-025 |
| 28 | 59.42 | 63.42 | 18 | 25 | 50 | 53 | 127-020-028 |
| 30 | 63.66 | 67.66 | 24 | 25 | 54 | 53 | 127-020-030 |
| 32 | 67.91 | 71.91 | 24 | 25 | 55 | 53 | 127-020-032 |
| 36 | 76.39 | 80.39 | 24 | 25 | 65 | 53 | 127-020-036 |
| 40 | 84.88 | 88.88 | 24 | 25 | 68 | 53 | 127-020-040 |

Module 3.0

| No. teeth | d | d _a | d _b H7 | b | d _n | l | Part No. |
|-----------|--------|----------------|-------------------|----|----------------|----|-------------|
| 18 | 57.30 | 63.30 | 24 | 30 | 45 | 52 | 127-030-018 |
| 20 | 63.66 | 69.66 | 24 | 30 | 48 | 52 | 127-030-020 |
| 22 | 70.03 | 76.03 | 24 | 30 | 62 | 52 | 127-030-022 |
| 25 | 79.58 | 85.58 | 24 | 30 | 62 | 58 | 127-030-025 |
| 28 | 89.13 | 95.13 | 24 | 30 | 68 | 58 | 127-030-028 |
| 30 | 95.49 | 101.49 | 24 | 30 | 68 | 58 | 127-030-030 |
| 32 | 101.86 | 107.86 | 24 | 30 | 68 | 58 | 127-030-032 |
| 36 | 114.59 | 120.59 | 24 | 30 | 68 | 58 | 127-030-036 |

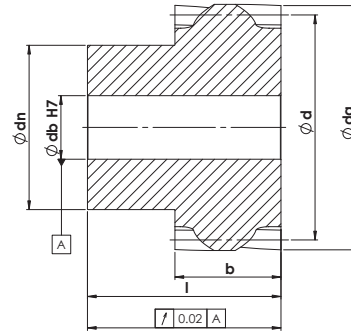
Dimensions are in mm and subject to change – consult factory.

MODULAR RACK & PINION SYSTEM

MASTER-GEARS

Ground, Helical Teeth

Helical, left hand
 Helix angle $19^{\circ} 31' 42''$
 Pressure angle $\phi=20^{\circ}$
 Material AISI 5115 (16MnCr5)
 Carburized and teeth induction hardened
 Quality 6e25 (~AGMA 11)



Module 4.0

| No. teeth | d | da | db ^{H7} | b | dn | l | Part No. |
|-----------|--------|--------|------------------|----|-----|----|-------------|
| 18 | 76.39 | 84.39 | 24 | 40 | 62 | 73 | 127-040-018 |
| 20 | 84.88 | 92.88 | 24 | 40 | 62 | 73 | 127-040-020 |
| 22 | 93.37 | 101.37 | 24 | 40 | 68 | 73 | 127-040-022 |
| 25 | 106.10 | 114.10 | 24 | 40 | 80 | 74 | 127-040-025 |
| 28 | 118.84 | 126.84 | 24 | 40 | 80 | 74 | 127-040-028 |
| 30 | 127.32 | 135.32 | 30 | 40 | 80 | 74 | 127-040-030 |
| 32 | 135.81 | 143.81 | 30 | 40 | 110 | 74 | 127-040-032 |
| 36 | 152.79 | 160.79 | 30 | 40 | 110 | 74 | 127-040-036 |

Module 5.0

| No. teeth | d | da | db ^{H7} | b | dn | l | Part No. |
|-----------|--------|--------|------------------|----|-----|-----|-------------|
| 22 | 116.71 | 126.71 | 24 | 50 | 90 | 91 | 127-050-022 |
| 25 | 132.63 | 142.63 | 24 | 50 | 110 | 101 | 127-050-025 |
| 28 | 148.54 | 158.54 | 24 | 50 | 110 | 101 | 127-050-028 |
| 30 | 159.16 | 169.16 | 30 | 50 | 110 | 101 | 127-050-030 |
| 32 | 169.77 | 179.77 | 30 | 50 | 110 | 101 | 127-050-032 |
| 36 | 190.99 | 200.99 | 30 | 50 | 110 | 101 | 127-050-036 |

Module 6.0

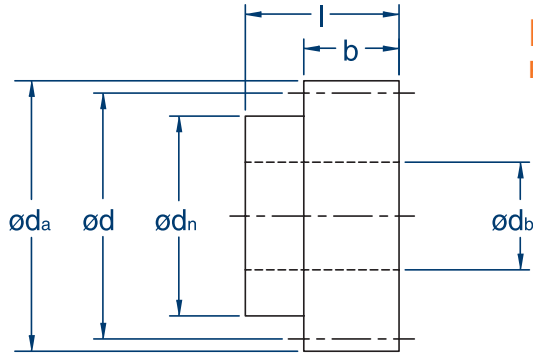
| No. teeth | d | da | db ^{H7} | b | dn | l | Part No. |
|-----------|-------|-------|------------------|----|-----|-----|-------------|
| 20 | 127.3 | 139.0 | 30 | 60 | 100 | 140 | 127-060-020 |
| 25 | 159.2 | 171.2 | 30 | 60 | 130 | 140 | 127-060-025 |
| 28 | 178.3 | 190.0 | 30 | 60 | 130 | 140 | 127-060-028 |
| 30 | 191.0 | 203.0 | 30 | 60 | 140 | 140 | 127-060-030 |

Dimensions are in mm and subject to change – consult factory.

MODULAR RACK & PINION SYSTEM

MODULE 1.5 - 10.0

Straight (Spur) Teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case hardened, 60HRC, ground & crowned teeth
 Quality 6f24 (~AGMA 11)



PINIONS

PLAIN BORE (CAN BE REWORKED)



| No. teeth | Module | d | da | db H7 | dn | b | l | Part No. |
|-----------|--------|-------|-----|-------|-------|-----|-----|----------|
| 20 | 1.5 | 30.0 | 33 | 10.0 | 25.0 | 20 | 28 | 254 012 |
| 20 | 2.0 | 40.0 | 44 | 15.0 | 34.5 | 20 | 30 | 254 022 |
| 20 | 2.5 | 50.0 | 55 | 15.0 | 40.0 | 25 | 37 | 254 032 |
| 20 | 3.0 | 60.0 | 66 | 15.0 | 40.0 | 30 | 44 | 254 042 |
| 20 | 4.0 | 80.0 | 88 | 30.0 | 65.0 | 40 | 59 | 254 052 |
| 20 | 5.0 | 100.0 | 110 | 40.0 | 85.0 | 50 | 70 | 254 062 |
| 20 | 6.0 | 120.0 | 132 | 50.0 | 104.0 | 60 | 100 | 254 072 |
| 20 | 8.0 | 160.0 | 176 | 50.0 | 120.0 | 80 | 130 | 254 082 |
| 20 | 10.0 | 200.0 | 220 | 50.0 | 150.0 | 100 | 150 | 254 092 |

MODULE 1.5 - 10.0

Helical teeth, left hand
 Pressure angle $\phi=20^\circ$
 Helix angle $\beta=19^\circ 31'42''$
 Material AISI 5115 (16MnCr5)
 Case hardened, 60HRC, ground & crowned teeth
 Quality 6f24 (~AGMA 11)



| No. teeth | Module | d | da | db H7 | dn | b | l | Part No. |
|-----------|--------|--------|--------|-------|-------|-----|-----|----------|
| 20 | 1.5 | 31.83 | 34.83 | 10.0 | 25.0 | 20 | 28 | 254 512 |
| 20 | 2.0 | 42.44 | 46.44 | 15.0 | 35.0 | 20 | 30 | 254 522 |
| 20 | 2.5 | 53.05 | 58.05 | 15.0 | 40.0 | 25 | 37 | 254 532 |
| 20 | 3.0 | 63.66 | 69.66 | 15.0 | 40.0 | 30 | 44 | 254 542 |
| 20 | 4.0 | 84.88 | 92.88 | 30.0 | 65.0 | 40 | 59 | 254 552 |
| 20 | 5.0 | 106.10 | 116.10 | 40.0 | 85.0 | 50 | 70 | 254 562 |
| 20 | 6.0 | 127.22 | 139.30 | 50.0 | 105.0 | 60 | 100 | 254 572 |
| 20 | 8.0 | 169.76 | 185.70 | 50.0 | 120.0 | 80 | 130 | 254 582 |
| 20 | 10.0 | 212.21 | 232.20 | 50.0 | 150.0 | 100 | 150 | 254 592 |

CIRCULAR PITCH 2.0-25.0

Straight (Spur) Teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case hardened, 60 HRC, ground & crowned teeth
 Quality 6f24 (~AGMA 11)

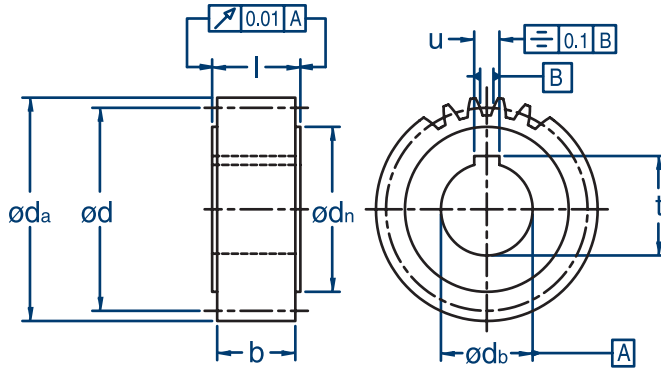


| No. teeth | Pitch | d | da | db H7 | dn | b | l | Part No. |
|-----------|-------|--------|-------|-------|-------|------|-----|----------|
| 25 | 2.0 | 15.92 | 17.2 | 5.0 | 10.0 | 9.5 | 15 | 154 020* |
| 20 | 5.0 | 31.83 | 35.0 | 10.0 | 25.0 | 14.5 | 23 | 154 050 |
| 20 | 7.5 | 47.75 | 52.5 | 15.0 | 40.0 | 19.5 | 30 | 154 075 |
| 20 | 10.0 | 63.66 | 70.0 | 15.0 | 50.0 | 29.5 | 43 | 154 100 |
| 20 | 12.5 | 79.58 | 87.5 | 30.0 | 65.0 | 40.0 | 60 | 154 125 |
| 20 | 16.0 | 101.86 | 112.1 | 40.0 | 85.0 | 50.0 | 90 | 154 160 |
| 20 | 20.0 | 127.32 | 140.1 | 50.0 | 105.0 | 60.0 | 105 | 154 201 |
| 20 | 25.0 | 159.15 | 175.1 | 50.0 | 135.0 | 80.0 | 105 | 154 251 |

* Material: Nitralloy 135 (EGT 100) nitrided.
 Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

PINIONS BORED & KEYED



MODULE 2.0

Straight (Spur) Teeth
Pressure angle $\phi=20^\circ$
Material AISI 5115 (16MnCr5)
Case Hardened & Ground Teeth
Quality 7e25 (~AGMA 10)



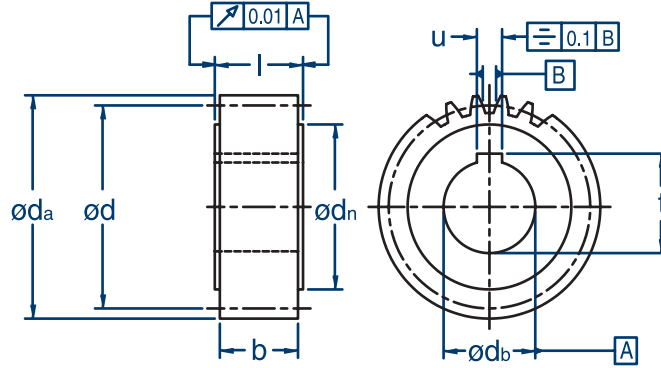
| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|-------|-------|-------|----|----|----|----|------|-------------|
| 16 | 32.0 | 36.0 | 15 | 25 | 28 | 30 | 5 | 17.3 | 113-120-516 |
| 18 | 36.0 | 40.0 | 20 | 25 | 28 | 30 | 6 | 22.8 | 113-220-018 |
| 20 | 40.0 | 44.0 | 20 | 30 | 28 | 30 | 6 | 22.8 | 113-220-020 |
| 22 | 44.0 | 48.0 | 15 | 25 | 28 | 30 | 5 | 17.3 | 113-120-522 |
| 22 | 44.0 | 48.0 | 20 | 30 | 28 | 30 | 6 | 22.8 | 113-220-022 |
| 22 | 44.0 | 48.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-522 |
| 25 | 50.0 | 54.0 | 20 | 30 | 28 | 30 | 6 | 22.8 | 113-220-025 |
| 25 | 50.0 | 54.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-525 |
| 25 | 50.0 | 54.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-320-025 |
| 28 | 56.0 | 60.0 | 20 | 30 | 28 | 30 | 6 | 22.8 | 113-220-028 |
| 28 | 56.0 | 60.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-528 |
| 28 | 56.0 | 60.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-320-028 |
| 28 | 56.0 | 60.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-528 |
| 32 | 64.0 | 68.0 | 20 | 30 | 28 | 30 | 6 | 22.8 | 113-220-032 |
| 32 | 64.0 | 68.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-532 |
| 32 | 64.0 | 68.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-320-032 |
| 32 | 64.0 | 68.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-532 |
| 36 | 72.0 | 76.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-536 |
| 36 | 72.0 | 76.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-320-036 |
| 36 | 72.0 | 76.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-536 |
| 36 | 72.0 | 76.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-420-536 |
| 40 | 80.0 | 84.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-220-540 |
| 40 | 80.0 | 84.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-320-040 |
| 40 | 80.0 | 84.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-540 |
| 40 | 80.0 | 84.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-420-540 |
| 45 | 90.0 | 94.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-545 |
| 45 | 90.0 | 94.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-420-545 |
| 50 | 100.0 | 104.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-320-550 |
| 50 | 100.0 | 104.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-420-550 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

MODULE 3.0

Straight (Spur) Teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case Hardened & Ground Teeth
 Quality 7e25 (~AGMA 10)



PINIONS BORED & KEYPED

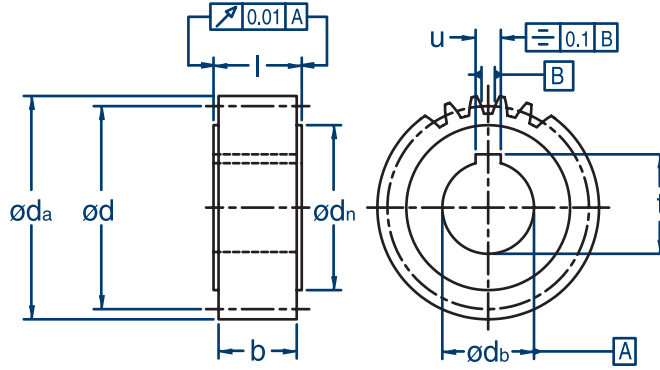
| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|-------|-------|-------|----|----|----|----|------|-------------|
| 18 | 54.0 | 60.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-518 |
| 20 | 60.0 | 66.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-520 |
| 20 | 60.0 | 66.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-330-020 |
| 20 | 60.0 | 66.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-520 |
| 22 | 66.0 | 72.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-522 |
| 22 | 66.0 | 72.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-330-022 |
| 22 | 66.0 | 72.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-522 |
| 25 | 75.0 | 81.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-525 |
| 25 | 75.0 | 81.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-330-025 |
| 25 | 75.0 | 81.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-525 |
| 25 | 75.0 | 81.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-430-525 |
| 28 | 84.0 | 90.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-528 |
| 28 | 84.0 | 90.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-330-028 |
| 28 | 84.0 | 90.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-528 |
| 28 | 84.0 | 90.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-430-528 |
| 32 | 96.0 | 102.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 113-230-532 |
| 32 | 96.0 | 102.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 113-330-032 |
| 32 | 96.0 | 102.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-532 |
| 32 | 96.0 | 102.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-430-532 |
| 36 | 108.0 | 114.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-536 |
| 36 | 108.0 | 114.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-430-536 |
| 40 | 120.0 | 126.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 113-330-540 |
| 40 | 120.0 | 126.0 | 45 | 58 | 28 | 30 | 14 | 48.8 | 113-430-540 |



Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

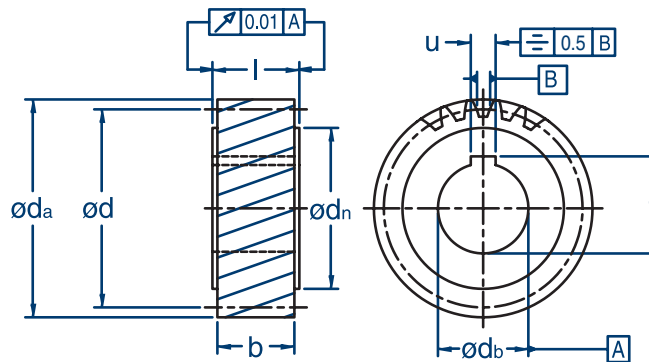
PINIONS BORED & KEYS



MODULE 4.0

Straight (Spur) teeth
Pressure angle $\phi=20^\circ$
Material AISI 5115 (16MnCr5)
Case Hardened & Ground Teeth
Quality 7e25 (~AGMA 10)

| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|-------|-------|-------|----|----|----|----|------|-------------|
| 20 | 80.0 | 88.0 | 35 | 52 | 40 | 50 | 10 | 38.3 | 113-340-520 |
| 20 | 80.0 | 88.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-520 |
| 22 | 88.0 | 96.0 | 35 | 52 | 40 | 50 | 10 | 38.3 | 113-340-522 |
| 22 | 88.0 | 96.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-522 |
| 25 | 100.0 | 108.0 | 35 | 52 | 40 | 50 | 10 | 38.3 | 113-340-525 |
| 25 | 100.0 | 108.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-525 |
| 28 | 112.0 | 120.0 | 35 | 52 | 40 | 50 | 10 | 38.3 | 113-340-528 |
| 28 | 112.0 | 120.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-528 |
| 32 | 128.0 | 136.0 | 35 | 52 | 40 | 50 | 10 | 38.3 | 113-340-532 |
| 32 | 128.0 | 136.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-532 |
| 40 | 160.0 | 168.0 | 45 | 65 | 40 | 50 | 14 | 48.8 | 113-440-540 |
| 40 | 160.0 | 168.0 | 60 | 80 | 40 | 50 | 18 | 64.3 | 113-640-040 |



MODULE 2.0

Helical Teeth, Left Hand
Teeth pressure angle $\phi=20^\circ$
Helix angle $\beta=19^\circ 31'42''$
Material AISI 5115 (16MnCr5)
Case hardened, ground teeth
Quality 7e25 (~AGMA 10)

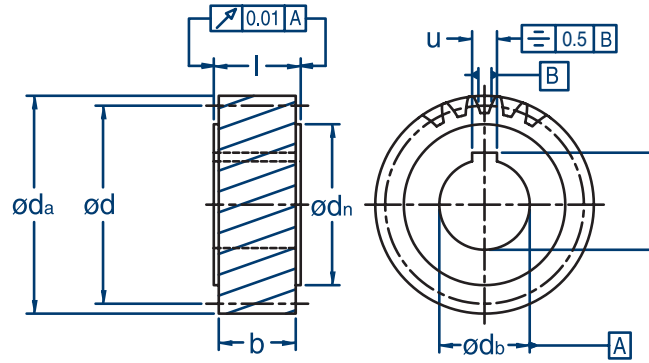
| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|-------|------|-------|----|----|----|----|------|-------------|
| 20 | 42.44 | 46.4 | 20 | 30 | 28 | 30 | 6 | 22.8 | 123-220-020 |
| 25 | 53.05 | 57.1 | 20 | 30 | 28 | 30 | 6 | 22.8 | 123-220-025 |
| 25 | 53.05 | 57.1 | 25 | 36 | 28 | 30 | 8 | 28.3 | 123-220-525 |
| 28 | 59.42 | 63.4 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-320-528 |
| 30 | 63.66 | 67.7 | 25 | 36 | 28 | 30 | 8 | 28.3 | 123-220-530 |
| 30 | 63.66 | 67.7 | 30 | 45 | 28 | 30 | 8 | 33.3 | 123-320-030 |
| 32 | 67.91 | 71.9 | 20 | 30 | 28 | 30 | 6 | 22.8 | 123-220-032 |
| 32 | 67.91 | 71.9 | 25 | 36 | 28 | 30 | 8 | 28.3 | 123-220-532 |
| 32 | 67.91 | 71.9 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-320-532 |
| 36 | 76.39 | 80.4 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-320-536 |
| 40 | 84.88 | 88.9 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-320-540 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

MODULE 3.0

Helical teeth, Left Hand
pressure angle $\phi=20^\circ$
Helix angle $\beta=19^\circ 31'42''$
Material AISI 5115 (16MnCr5)
Case Hardened & Ground Teeth
Quality 7e25 (~AGMA 10)

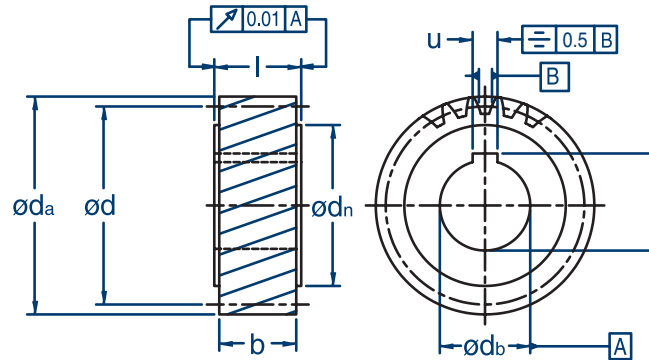


PINIONS BORED & KEYPED

| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|-------|------|-------|----|----|----|----|------|-------------|
| 20 | 63.66 | 69.7 | 30 | 45 | 28 | 30 | 8 | 33.3 | 123-330-020 |
| 20 | 63.66 | 69.7 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-330-520 |
| 22 | 70.03 | 76.0 | 25 | 36 | 28 | 30 | 8 | 28.3 | 123-230-522 |
| 22 | 70.03 | 76.0 | 30 | 45 | 28 | 30 | 8 | 33.3 | 123-330-022 |
| 22 | 70.03 | 76.0 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-330-522 |
| 25 | 79.58 | 85.6 | 25 | 36 | 28 | 30 | 8 | 28.3 | 123-230-525 |
| 25 | 79.58 | 85.6 | 30 | 45 | 28 | 30 | 8 | 33.3 | 123-330-025 |
| 25 | 79.58 | 85.6 | 35 | 48 | 28 | 30 | 10 | 38.3 | 123-330-525 |

MODULE 4.0

Helical teeth, Left Hand
pressure angle $\phi=20^\circ$
Helix angle $\beta=19^\circ 31'42''$
Material AISI 5115 (16MnCr5)
Case Hardened & Ground Teeth
Quality 7e25 (~AGMA 10)



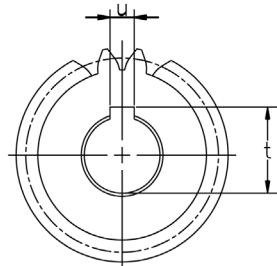
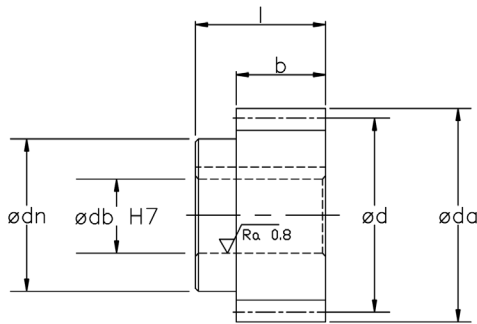
| No. teeth | d | da | db H6 | dn | b | l | u | t | Part No. |
|-----------|--------|-------|-------|----|----|----|----|------|-------------|
| 15 | 63.66 | 71.7 | 35 | 48 | 40 | 50 | 10 | 38.3 | 123-340-515 |
| 20 | 84.88 | 92.9 | 35 | 48 | 40 | 50 | 10 | 38.3 | 123-340-520 |
| 20 | 84.88 | 92.9 | 45 | 58 | 40 | 50 | 14 | 48.8 | 123-440-520 |
| 22 | 93.37 | 101.4 | 35 | 52 | 40 | 50 | 10 | 38.3 | 123-340-522 |
| 22 | 93.37 | 101.4 | 45 | 65 | 40 | 50 | 14 | 48.8 | 123-440-522 |
| 25 | 106.10 | 114.1 | 35 | 48 | 40 | 50 | 10 | 38.3 | 123-340-525 |
| 25 | 106.10 | 114.1 | 45 | 58 | 40 | 50 | 14 | 48.8 | 123-440-525 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

PINIONS BORED & KEYED

CIRCULAR PITCH P=2, 5, 7.5, 10, 12.5, 16, 20, & 25



Straight (Spur) teeth
Pressure angle $\phi=20^\circ$
Material AISI 5115 (16MnCr5)
Case hardened, 60 HRc,
Ground & Crowned teeth
Quality 6f24 (-AGMA 11)



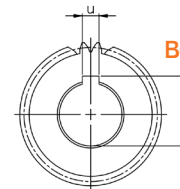
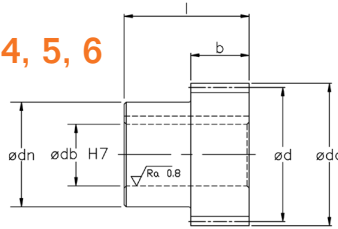
| No. teeth | pitch | Module | d | da | db H7 | dn | b | l | u | t | Part No. |
|-----------|-------|--------|---------|--------|-------|-----|------|-----|----|------|----------|
| 25 | 2.0 | 0.637 | 15.915 | 17.19 | 6 | 10 | 9.5 | 15 | 2 | 7.0 | 154021 |
| 25 | 2.0 | 0.637 | 15.915 | 17.19 | 7 | 10 | 9.5 | 15 | 2 | 8.0 | 154022 |
| 20 | 5.0 | 1.592 | 31.831 | 35.01 | 11 | 25 | 14.5 | 23 | 4 | 12.8 | 154051 |
| 20 | 5.0 | 1.592 | 31.831 | 35.01 | 14 | 25 | 14.5 | 23 | 5 | 16.3 | 154052 |
| 20 | 5.0 | 1.592 | 31.831 | 35.01 | 16 | 25 | 14.5 | 23 | 5 | 18.3 | 154053 |
| 20 | 7.5 | 2.387 | 47.746 | 52.52 | 22 | 40 | 19.5 | 30 | 6 | 24.8 | 154076 |
| 20 | 7.5 | 2.387 | 47.746 | 52.52 | 25 | 40 | 19.5 | 30 | 8 | 28.3 | 154077 |
| 20 | 7.5 | 2.387 | 47.746 | 52.52 | 30 | 40 | 19.5 | 30 | 8 | 33.3 | 154078 |
| 20 | 10.0 | 3.183 | 63.662 | 70.03 | 22 | 50 | 29.5 | 43 | 6 | 24.8 | 154101 |
| 20 | 10.0 | 3.183 | 63.662 | 70.03 | 25 | 50 | 29.5 | 43 | 8 | 28.3 | 154102 |
| 20 | 10.0 | 3.183 | 63.662 | 70.03 | 32 | 50 | 29.5 | 43 | 10 | 35.3 | 154103 |
| 20 | 12.5 | 3.979 | 79.557 | 87.54 | 32 | 65 | 40.0 | 60 | 10 | 35.3 | 154127 |
| 20 | 12.5 | 3.979 | 79.557 | 87.54 | 35 | 65 | 40.0 | 60 | 10 | 38.3 | 154128 |
| 20 | 12.5 | 3.979 | 79.557 | 87.54 | 40 | 65 | 40.0 | 60 | 12 | 43.3 | 154129 |
| 20 | 16.0 | 5.093 | 101.859 | 112.05 | 40 | 85 | 50.0 | 90 | 12 | 43.3 | 154161 |
| 20 | 16.0 | 5.093 | 101.859 | 112.05 | 45 | 85 | 50.0 | 90 | 14 | 48.8 | 154162 |
| 20 | 16.0 | 5.093 | 101.859 | 112.05 | 55 | 85 | 50.0 | 90 | 16 | 59.3 | 154163 |
| 20 | 20.0 | 6.366 | 127.324 | 140.06 | 55 | 105 | 60.0 | 105 | 16 | 59.3 | 154202 |
| 20 | 20.0 | 6.366 | 127.324 | 140.06 | 75 | 105 | 60.0 | 105 | 20 | 79.9 | 154203 |
| 20 | 20.0 | 6.366 | 127.324 | 140.06 | 85 | 105 | 60.0 | 105 | 22 | 90.4 | 154204 |
| 20 | 25.0 | 7.958 | 159.155 | 175.07 | 55 | 135 | 80.0 | 105 | 16 | 59.3 | 154252 |
| 20 | 25.0 | 7.958 | 159.155 | 175.07 | 75 | 135 | 80.0 | 105 | 20 | 79.9 | 154253 |
| 20 | 25.0 | 7.958 | 159.155 | 175.07 | 85 | 135 | 80.0 | 105 | 22 | 90.4 | 154254 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

MODULES 1.5, 2, 2.5, 3, 4, 5, 6

Straight (Spur) teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case Hardened, 60HRc, Ground & Crowned Teeth
 Quality 6f24 (~AGMA 11)



PINIONS BORED & KEYED

| No. teeth | Module | d | da | db H7 | dn | b | l | u | t | Part No. |
|-----------|--------|-------|-------|-------|-----|----|-----|----|------|----------|
| 25 | 1.5 | 37.5 | 40.5 | 16 | 30 | 20 | 46 | 5 | 18.3 | 141501 |
| 32 | 1.5 | 48.0 | 51.0 | 22 | 36 | 20 | 48 | 6 | 24.8 | 141502 |
| 40 | 1.5 | 60.0 | 63.0 | 22 | 36 | 20 | 48 | 6 | 24.8 | 141503 |
| 25 | 2.0 | 50.0 | 54.0 | 16 | 30 | 28 | 54 | 5 | 18.3 | 142001 |
| 25 | 2.0 | 50.0 | 54.0 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142002 |
| 28 | 2.0 | 56.0 | 60.0 | 30 | 50 | 28 | 60 | 8 | 33.3 | 142003 |
| 32 | 2.0 | 64.0 | 68.0 | 16 | 30 | 28 | 54 | 5 | 18.3 | 142004 |
| 32 | 2.0 | 64.0 | 68.0 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142005 |
| 32 | 2.0 | 64.0 | 68.0 | 30 | 50 | 28 | 60 | 8 | 33.3 | 142006 |
| 32 | 2.0 | 64.0 | 68.0 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142007 |
| 36 | 2.0 | 72.0 | 76.0 | 40 | 62 | 28 | 65 | 12 | 43.3 | 142008 |
| 40 | 2.0 | 80.0 | 84.0 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142009 |
| 40 | 2.0 | 80.0 | 84.0 | 40 | 62 | 28 | 65 | 12 | 43.3 | 142010 |
| 40 | 2.0 | 80.0 | 84.0 | 45 | 68 | 28 | 65 | 14 | 48.8 | 142011 |
| 50 | 2.0 | 100.0 | 104.0 | 45 | 68 | 28 | 65 | 14 | 48.8 | 142012 |
| 22 | 2.5 | 55.0 | 60.0 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142501 |
| 28 | 2.5 | 70.0 | 75.0 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142502 |
| 36 | 2.5 | 90.0 | 95.0 | 40 | 62 | 28 | 65 | 12 | 43.3 | 142503 |
| 22 | 3.0 | 66.0 | 72.0 | 22 | 36 | 28 | 56 | 6 | 24.8 | 143001 |
| 22 | 3.0 | 66.0 | 72.0 | 25 | 44 | 28 | 60 | 8 | 28.3 | 143002 |
| 22 | 3.0 | 66.0 | 72.0 | 30 | 50 | 28 | 60 | 8 | 33.3 | 143003 |
| 22 | 3.0 | 66.0 | 72.0 | 32 | 55 | 28 | 65 | 10 | 35.3 | 143004 |
| 22 | 3.0 | 66.0 | 72.0 | 35 | 55 | 28 | 65 | 10 | 38.3 | 143005 |
| 25 | 3.0 | 75.0 | 81.0 | 40 | 62 | 28 | 65 | 12 | 43.3 | 143006 |
| 28 | 3.0 | 84.0 | 90.0 | 22 | 36 | 28 | 56 | 6 | 24.8 | 143007 |
| 28 | 3.0 | 84.0 | 90.0 | 25 | 44 | 28 | 60 | 8 | 28.3 | 143008 |
| 28 | 3.0 | 84.0 | 90.0 | 30 | 50 | 28 | 60 | 8 | 33.3 | 143009 |
| 28 | 3.0 | 84.0 | 90.0 | 32 | 55 | 28 | 65 | 10 | 35.3 | 143010 |
| 28 | 3.0 | 84.0 | 90.0 | 35 | 55 | 28 | 65 | 10 | 38.3 | 143011 |
| 28 | 3.0 | 84.0 | 90.0 | 45 | 68 | 28 | 65 | 14 | 48.8 | 143012 |
| 32 | 3.0 | 96.0 | 102.0 | 40 | 62 | 28 | 65 | 12 | 43.3 | 143013 |
| 36 | 3.0 | 108.0 | 114.0 | 45 | 68 | 28 | 65 | 14 | 48.8 | 143014 |
| 20 | 4.0 | 80.0 | 88.0 | 32 | 55 | 40 | 75 | 10 | 35.3 | 144001 |
| 20 | 4.0 | 80.0 | 88.0 | 35 | 55 | 40 | 75 | 10 | 38.3 | 144002 |
| 20 | 4.0 | 80.0 | 88.0 | 40 | 62 | 40 | 75 | 12 | 43.3 | 144003 |
| 22 | 4.0 | 88.0 | 96.0 | 45 | 68 | 40 | 75 | 14 | 48.8 | 144004 |
| 25 | 4.0 | 100.0 | 108.0 | 32 | 55 | 40 | 75 | 10 | 35.3 | 144005 |
| 25 | 4.0 | 100.0 | 108.0 | 35 | 55 | 40 | 75 | 10 | 38.3 | 144006 |
| 25 | 4.0 | 100.0 | 108.0 | 40 | 62 | 40 | 75 | 12 | 43.3 | 144007 |
| 25 | 4.0 | 100.0 | 108.0 | 55 | 80 | 40 | 80 | 16 | 59.3 | 144008 |
| 28 | 4.0 | 112.0 | 120.0 | 45 | 68 | 40 | 75 | 14 | 48.8 | 144009 |
| 32 | 4.0 | 128.0 | 136.0 | 88 | 80 | 40 | 80 | 16 | 59.3 | 144010 |
| 32 | 4.0 | 128.0 | 136.0 | 75 | 110 | 40 | 100 | 20 | 79.9 | 144011 |
| 40 | 4.0 | 160.0 | 168.0 | 75 | 110 | 40 | 100 | 20 | 79.9 | 144012 |
| 21 | 5.0 | 105.0 | 115.0 | 45 | 68 | 50 | 85 | 14 | 48.8 | 145001 |
| 21 | 5.0 | 105.0 | 115.0 | 55 | 80 | 50 | 90 | 16 | 59.3 | 145002 |
| 25 | 5.0 | 125.0 | 135.0 | 45 | 68 | 50 | 85 | 14 | 48.8 | 145003 |
| 25 | 5.0 | 125.0 | 135.0 | 55 | 80 | 50 | 90 | 16 | 59.3 | 145004 |
| 25 | 5.0 | 125.0 | 135.0 | 75 | 110 | 50 | 110 | 20 | 79.9 | 145005 |
| 21 | 6.0 | 126.0 | 138.0 | 55 | 80 | 60 | 100 | 16 | 59.3 | 146001 |
| 21 | 6.0 | 126.0 | 138.0 | 75 | 110 | 60 | 120 | 20 | 79.9 | 146002 |
| 25 | 6.0 | 150.0 | 162.0 | 55 | 80 | 60 | 100 | 16 | 59.3 | 146003 |
| 25 | 6.0 | 150.0 | 162.0 | 75 | 110 | 60 | 120 | 20 | 79.9 | 146004 |

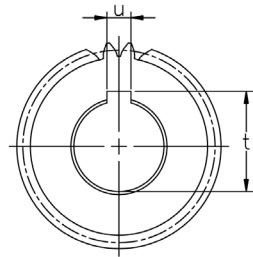
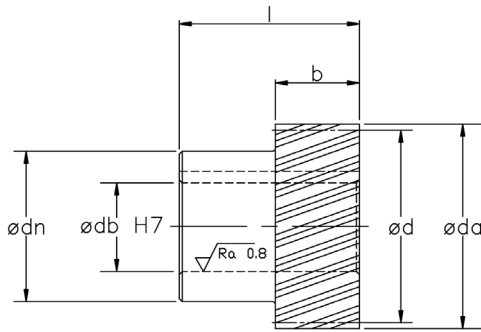


Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

PINIONS BORED & KEYED

MODULES 1.5, 2, 2.5, 3, 4, 5, 6, 8



Helical Teeth, Left Hand
Pressure angle = 20°
Helix Angle = 19 31'42"
Material AISI 5115 (16MnCr5)
Case hardened, 60 HRc,
Ground & Crowned teeth
Quality 6f24 (-AGMA 11)

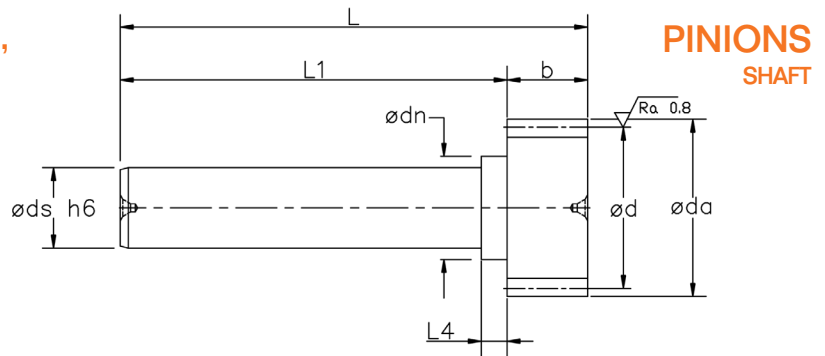
| No. teeth | Module | d | da | db H7 | dn | b | l | u | t | Part No. |
|-----------|--------|---------|--------|-------|-----|----|-----|----|------|----------|
| 21 | 1.5 | 33.423 | 36.42 | 16 | 30 | 20 | 46 | 5 | 18.3 | 141551 |
| 30 | 1.5 | 47.747 | 50.75 | 22 | 36 | 20 | 48 | 6 | 24.8 | 141552 |
| 39 | 1.5 | 62.071 | 65.07 | 22 | 36 | 20 | 48 | 6 | 24.8 | 141553 |
| 21 | 2.0 | 44.563 | 48.56 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142051 |
| 30 | 2.0 | 63.662 | 67.66 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142052 |
| 30 | 2.0 | 63.662 | 67.66 | 30 | 50 | 28 | 60 | 8 | 33.3 | 142053 |
| 30 | 2.0 | 63.662 | 67.66 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142054 |
| 39 | 2.0 | 82.761 | 86.76 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142055 |
| 20 | 2.5 | 53.052 | 58.05 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142551 |
| 25 | 2.5 | 66.315 | 71.31 | 22 | 36 | 28 | 56 | 6 | 24.8 | 142552 |
| 25 | 2.5 | 66.315 | 71.31 | 32 | 55 | 28 | 65 | 10 | 35.3 | 142553 |
| 20 | 3.0 | 63.662 | 69.66 | 22 | 36 | 28 | 56 | 6 | 24.8 | 143051 |
| 20 | 3.0 | 63.662 | 69.66 | 25 | 44 | 28 | 60 | 8 | 28.3 | 143052 |
| 20 | 3.0 | 63.662 | 69.66 | 30 | 50 | 28 | 60 | 8 | 33.3 | 143053 |
| 20 | 3.0 | 63.662 | 69.66 | 32 | 55 | 28 | 65 | 10 | 35.3 | 143054 |
| 25 | 3.0 | 79.578 | 85.58 | 22 | 36 | 28 | 56 | 6 | 24.8 | 143055 |
| 25 | 3.0 | 79.578 | 85.58 | 25 | 44 | 28 | 60 | 8 | 28.3 | 143056 |
| 25 | 3.0 | 79.578 | 85.58 | 30 | 50 | 28 | 60 | 8 | 33.3 | 143057 |
| 25 | 3.0 | 79.578 | 85.58 | 32 | 55 | 28 | 65 | 10 | 35.3 | 143058 |
| 25 | 3.0 | 79.578 | 85.58 | 35 | 55 | 28 | 65 | 10 | 38.3 | 143059 |
| 18 | 4.0 | 76.394 | 84.39 | 32 | 55 | 40 | 75 | 10 | 35.3 | 144051 |
| 21 | 4.0 | 89.127 | 97.13 | 32 | 55 | 40 | 75 | 10 | 35.3 | 144052 |
| 21 | 4.0 | 89.127 | 97.13 | 35 | 55 | 40 | 75 | 10 | 38.3 | 144053 |
| 21 | 4.0 | 89.127 | 97.13 | 40 | 62 | 40 | 75 | 12 | 43.3 | 144054 |
| 21 | 4.0 | 89.127 | 97.13 | 45 | 68 | 40 | 75 | 14 | 48.8 | 144055 |
| 24 | 4.0 | 101.859 | 109.86 | 32 | 55 | 40 | 75 | 10 | 35.3 | 144056 |
| 24 | 4.0 | 101.859 | 109.86 | 35 | 55 | 40 | 75 | 10 | 38.3 | 144057 |
| 24 | 4.0 | 101.859 | 109.86 | 40 | 62 | 40 | 75 | 12 | 43.3 | 144058 |
| 24 | 4.0 | 101.859 | 109.86 | 45 | 68 | 40 | 75 | 14 | 48.8 | 144059 |
| 24 | 4.0 | 101.859 | 109.86 | 55 | 80 | 40 | 80 | 16 | 59.3 | 144060 |
| 18 | 5.0 | 95.493 | 105.49 | 45 | 68 | 50 | 85 | 14 | 48.8 | 145051 |
| 24 | 5.0 | 127.324 | 137.32 | 45 | 68 | 50 | 85 | 14 | 48.8 | 145052 |
| 24 | 5.0 | 127.324 | 137.32 | 55 | 80 | 50 | 90 | 16 | 59.3 | 145053 |
| 24 | 5.0 | 127.324 | 137.32 | 75 | 110 | 50 | 110 | 20 | 79.9 | 145054 |
| 20 | 6.0 | 127.324 | 139.32 | 55 | 80 | 60 | 100 | 16 | 59.3 | 146051 |
| 20 | 6.0 | 127.324 | 139.32 | 75 | 110 | 60 | 120 | 20 | 79.9 | 146052 |
| 25 | 6.0 | 159.155 | 171.16 | 55 | 80 | 60 | 100 | 16 | 59.3 | 146053 |
| 25 | 6.0 | 159.155 | 171.16 | 75 | 110 | 60 | 120 | 20 | 79.9 | 146054 |
| 18 | 8.0 | 152.789 | 168.79 | 75 | 110 | 80 | 140 | 20 | 79.9 | 148051 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

MODULES 1.0, 1.5, 2, 2.5, 3, 4, 5, 6, 8, 10

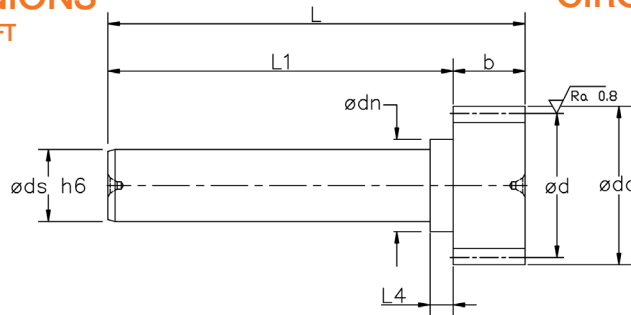
Straight (Spur) teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case hardened, 60 HRC, Ground & Crowned teeth
 Quality 6f24 (~AGMA 11)



| No. teeth | Module | d | da | ds | dn | L | L ₁ | b | L ₄ | Fits Servo | Part No. |
|-----------|--------|-------|-------|----|-----|-----|----------------|-----|----------------|------------|----------|
| 20 | 1.0 | 20.0 | 22.0 | 12 | 16 | 70 | 55 | 15 | 2.5 | HPG 030 | 201020 |
| 25 | 1.0 | 25.0 | 27.0 | 12 | 16 | 70 | 60.5 | 9.5 | 2.5 | HPG 030 | 201025 |
| 16 | 1.5 | 24.9 | 27.9 | 12 | 16 | 90 | 70 | 20 | 4.5 | HPG 030 | 201116 |
| 20 | 1.5 | 30.0 | 33.0 | 20 | 26 | 110 | 90 | 20 | 4.5 | HPG 045 | 201120 |
| 16 | 2.0 | 33.2 | 37.2 | 20 | 26 | 110 | 90 | 20 | 8.0 | HPG 045 | 201216 |
| 20 | 2.0 | 40.0 | 44.0 | 25 | 32 | 140 | 120 | 20 | 8.0 | HPG 060 | 201220 |
| 20 | 2.5 | 50.0 | 55.0 | 25 | 32 | 145 | 120 | 25 | 8.0 | HPG 060 | 201320 |
| 16 | 3.0 | 49.8 | 55.8 | 25 | 32 | 150 | 120 | 30 | 8.0 | HPG 060 | 201416 |
| 20 | 3.0 | 60.0 | 66.0 | 40 | 50 | 190 | 160 | 30 | 12.5 | HPG 090 | 201420 |
| 20 | 4.0 | 80.0 | 88.0 | 40 | 50 | 200 | 160 | 40 | 18.0 | HPG 090 | 201520 |
| 20 | 5.0 | 100.0 | 110.0 | 60 | 85 | 310 | 260 | 50 | 35.0 | HPG 120 | 201620 |
| 20 | 6.0 | 120.0 | 132.0 | 60 | 85 | 320 | 260 | 60 | 35.0 | HPG 120 | 201720 |
| 20 | 8.0 | 160.0 | 176.0 | 60 | 85 | 345 | 260 | 80 | 35.0 | HPG 120 | 201820 |
| 20 | 8.0 | 160.0 | 176.0 | 90 | 105 | 385 | 305 | 80 | 35.0 | HPG 180 | 201821 |
| 16 | 10.0 | 166.0 | 186.0 | 90 | 105 | 410 | 310 | 100 | 40.0 | HPG 180 | 201916 |

PINIONS SHAFT

CIRCULAR PITCH 2.0, 3.33, 5.0, 7.5, 10.0, 12.5, 16.0, 20.0



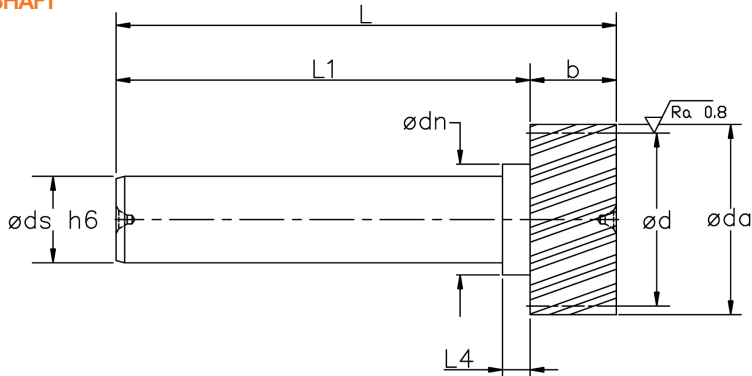
Straight (Spur) teeth
 Pressure angle $\phi=20^\circ$
 Material AISI 5115 (16MnCr5)
 Case hardened, 60 HRC, Ground & Crowned teeth
 Quality 6f24 (~AGMA 11)

| No. teeth | Pitch | d | da | ds | dn | L | L ₁ | b | L ₄ | Fits Servo | Part No. |
|-----------|-------|--------|-------|----|-----|-----|----------------|------|----------------|------------|----------|
| 30 | 2.0 | 19.10 | 20.4 | 12 | 17 | 70 | 60.5 | 9.5 | 2.5 | HPG 030 | 403040 |
| 20 | 3.3 | 21.221 | 23.3 | 12 | 16 | 70 | 60.5 | 9.5 | 2.5 | HPG 030 | 403042 |
| 20 | 5.0 | 31.83 | 35.0 | 12 | 20 | 90 | 78.5 | 11.5 | 4.5 | HPG 030 | 403041 |
| 20 | 5.0 | 31.83 | 35.0 | 20 | 26 | 90 | 78.5 | 11.5 | 4.5 | HPG 045 | 404540 |
| 20 | 5.0 | 31.83 | 35.0 | 20 | 26 | 90 | 75.5 | 14.5 | 11.5 | HPG 045 | 404541 |
| 20 | 7.5 | 47.75 | 52.5 | 20 | 25 | 108 | 88.5 | 19.5 | 8.0 | HPG 045 | 404542 |
| 20 | 7.5 | 47.75 | 52.5 | 25 | 32 | 108 | 88.5 | 19.5 | 8.0 | HPG 060 | 406040 |
| 20 | 10.0 | 63.66 | 70.0 | 25 | 32 | 162 | 132.5 | 29.5 | 12.5 | HPG 060 | 406041 |
| 14 | 10.0 | 46.47 | 52.5 | 25 | 32 | 162 | 132.5 | 29.5 | 12.5 | HPG 060 | 406042 |
| 20 | 10.0 | 63.66 | 70.0 | 40 | 50 | 162 | 132.5 | 29.5 | 12.5 | HPG 090 | 409040 |
| 20 | 12.5 | 79.58 | 87.5 | 40 | 50 | 239 | 199.0 | 40.0 | 20.0 | HPG 090 | 409041 |
| 14 | 12.5 | 58.09 | 66.0 | 40 | 45 | 196 | 156.0 | 40.0 | 18.0 | HPG 090 | 903547 |
| 26 | 12.5 | 103.45 | 111.4 | 60 | 85 | 277 | 237.0 | 40.0 | 18.0 | HPG 120 | 412041 |
| 20 | 16.0 | 101.86 | 112.1 | 60 | 85 | 302 | 252.0 | 50.0 | 40.0 | HPG 120 | 412044 |
| 20 | 20.0 | 127.32 | 140.1 | 60 | 85 | 302 | 242.0 | 60.0 | 55.0 | HPG 120 | 412043 |
| 20 | 20.0 | 127.32 | 140.1 | 90 | 105 | 350 | 290.0 | 60.0 | 20.0 | HPG 180 | 418040 |

Dimensions are in mm and are subject to change - consult factory.

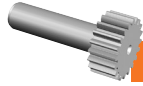
MODULAR RACK & PINION SYSTEM

PINIONS SHAFT



MODULES 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 6.0, 8.0, 10.0

Helical Teeth, Left hand
Helix Angle = 19° 31' 42"
Pressure angle $\phi=20^\circ$
Material AISI 5115 (16MnCr5)
Case Hardened, 60HRC, Ground & Crowned Teeth
Quality 6F24 (-AGMA 11)



| No. teeth | Module | d | da | ds | dn | L | L ₁ | b | L ₄ | Fits Servo | Part No. |
|-----------|--------|--------|--------|----|-------|-------|----------------|-----|----------------|------------|----------|
| 16 | 1.5 | 26.36 | 29.36 | 12 | 16.0 | 90.0 | 70.0 | 20 | 4.5 | HPG 030 | 211116 |
| 20 | 1.5 | 31.83 | 34.83 | 20 | 26.0 | 110.0 | 90.0 | 20 | 4.5 | HPG 045 | 211120 |
| 16 | 2.0 | 35.15 | 39.15 | 20 | 26.0 | 110.0 | 90.0 | 20 | 8.0 | HPG 045 | 211216 |
| 20 | 2.0 | 42.44 | 46.44 | 25 | 32.0 | 140.0 | 120.0 | 20 | 8.0 | HPG 060 | 211220 |
| 20 | 2.5 | 53.05 | 58.05 | 25 | 32.0 | 145.0 | 120.0 | 25 | 8.0 | HPG 060 | 211320 |
| 16 | 3.0 | 52.73 | 58.73 | 25 | 32.0 | 150.0 | 120.0 | 30 | 8.0 | HPG 060 | 211416 |
| 20 | 3.0 | 63.66 | 69.66 | 40 | 50.0 | 190.0 | 160.0 | 30 | 12.5 | HPG 090 | 211420 |
| 20 | 4.0 | 84.88 | 92.88 | 40 | 50.0 | 200.0 | 160.0 | 40 | 18.0 | HPG 090 | 211520 |
| 20 | 4.0 | 84.88 | 92.9 | 60 | 74.0 | 310 | 270.0 | 40 | 14.5 | HPG 120 | 211521 |
| 20 | 5.0 | 106.10 | 116.10 | 60 | 85.0 | 310.0 | 260.0 | 50 | 35.0 | HPG 120 | 211620 |
| 20 | 6.0 | 127.32 | 139.30 | 90 | 105.0 | 350.0 | 290.0 | 60 | 20.0 | HPG 180 | 211720 |
| 20 | 8.0 | 169.76 | 185.70 | 90 | 105.0 | 350.0 | 270.0 | 80 | 35.0 | HPG 180 | 211820 |
| 15 | 10.0 | 165.16 | 185.20 | 90 | 105.0 | 410.0 | 310.0 | 100 | 40.0 | HPG 180 | 211915 |

Dimensions are in mm and are subject to change - consult factory.

MODULAR RACK & PINION SYSTEM

RACK & PINION TORQUE RATINGS

The values shown in the tables below are given for a linear speed of 1.5 m/s, shock free operation, good lubrication (automatic electric lubricator, or manual lubrication once/day), and rigid cantilevered pinion support. Calculations are based on root stress bending fatigue and hertzian stress pit-

ting fatigue and provide a life of 20,000 hours. In all cases pinions are hardened & ground AISI 5115 (16MnCr5) with minimum quality of 7e25.

Module 1.5 (19 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 22.5 | 2 (1) | 3.2 (2) | 7.9 (6) | - | - | - | - | - | - |
| 16 | 24 | 6.4 (5) | - | - | 35 (26) | 25.46 | - | - | - | 41 (30) |
| 20 | 30 | 10 (7) | - | 32 (24) | 55 (41) | 31.83 | - | - | - | 67 (49) |
| 25 | 37.5 | 20 (15) | 30 (22) | 60 (44) | 70 (52) | - | - | - | - | - |
| 30 | - | - | - | - | - | 47.75 | - | - | - | - |
| 32 | 48 | 38 (28) | 53 (39) | 75 (55) | 82 (60) | - | - | - | - | - |

Module 2.0 (24 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 30 | 13.8 (10) | 22 (16) | 29 (21) | - | - | - | - | - | - |
| 16 | 32 | 14 (10) | - | 41 (30) | 77 (57) | 33.95 | - | - | - | 92 (68) |
| 18 | 36 | 23 (17) | 33 (24) | 50 (37) | 86 (63) | - | - | - | - | - |
| 20 | 40 | 28 (21) | 43 (32) | 75 (55) | 119 (88) | 42.44 | 35 (26) | 46 (34) | 130 (96) | 139 (103) |
| 22 | 44 | 33 (24) | 52 (38) | 90 (66) | 131 (97) | 46.68 | - | 59 (44) | 155 (114) | - |
| 25 | 50 | 48 (35) | 68 (50) | 128 (94) | 171 (126) | 53.05 | 60 (44) | 73 (54) | 180 (133) | 196 (145) |
| 28 | 56 | 64 (47) | 82 (60) | 140 (103) | 192 (142) | 59.41 | 80 (59) | 88 (65) | 197 (145) | 220 (162) |
| 30 | 60 | 74 (55) | 100 (74) | 152 (112) | 195 (144) | 63.66 | 92 (68) | 105 (77) | 213 (157) | 238 (176) |
| 32 | 64 | 83 (61) | 116 (86) | 163 (120) | 205 (151) | 67.91 | 105 (77) | 120 (89) | 228 (168) | 250 (184) |
| 36 | 72 | 119 (88) | 140 (103) | 173 (128) | 224 (165) | 76.39 | 130 (96) | 150 (111) | 250 (184) | 275 (203) |
| 45 | 90 | - | - | - | 260 (192) | 95.49 | - | - | - | 334 (246) |

Module 2.5 (24 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 37.5 | 15.6 (12) | - | 60 (44) | - | - | - | - | - | - |
| 20 | 50.0 | 45 (33) | - | 150 (111) | 225 (166) | 53.05 | - | - | - | 275 (203) |
| 22 | 55.0 | 60 (44) | - | 180 (133) | 251 (185) | - | - | - | - | - |
| 25 | 62.5 | 95 (70) | - | 256 (189) | - | 66.31 | - | - | - | 343 (253) |
| 28 | 70.0 | 115 (85) | - | 280 (207) | 311 (229) | - | - | - | - | - |
| 36 | 90.0 | 215 (159) | - | 350 (258) | 389 (287) | - | - | - | - | - |
| 40 | 100.0 | 245 (181) | - | 400 (295) | - | - | - | - | - | - |

Module 3.0 (29 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 45 | 40.8 (30) | 63 (46) | 87 (64) | 218 (161) | - | - | - | - | 294 (217) |
| 16 | 49.8 | - | - | - | 302 (223) | 50.93 | - | - | 200 (148) | 346 (255) |
| 18 | 54 | 81 (60) | 121 (89) | 197 (145) | 324 (239) | 57.30 | - | - | - | 434 (320) |
| 19 | 57 | - | - | - | 390 (288) | - | - | - | - | - |
| 20 | 60 | 92 (68) | 138 (102) | 215 (159) | 411 (303) | 63.66 | 102 (75) | 145 (107) | 410 (302) | 467 (344) |
| 22 | 66 | 115 (85) | 170 (125) | 305 (225) | 434 (320) | 70.03 | 128 (94) | 182 (134) | 430 (317) | 511 (374) |
| 25 | 75 | 168 (124) | 235 (173) | 440 (325) | 500 (369) | 79.57 | 188 (139) | 245 (181) | 490 (361) | 605 (446) |
| 28 | 84 | 205 (151) | 285 (210) | 485 (358) | 564 (416) | - | - | 295 (218) | 555 (409) | - |
| 32 | 96 | 290 (214) | - | 510 (376) | 641 (473) | - | - | 415 (306) | 563 (415) | - |
| 35 | 105 | - | - | - | 670 (494) | 111.41 | - | - | - | 750 (553) |
| 36 | 108 | 386 (271) | 512 (378) | 642 (474) | 692 (510) | - | - | 525 (387) | 700 (516) | - |
| 40 | 120 | 450 (332) | 620 (457) | 780 (575) | 850 (627) | 127.32 | - | 640 (472) | 820 (605) | 940 (693) |
| 52 | 156 | - | - | - | 1133 (836) | 165.52 | - | - | - | 1255 (926) |

RACK & PINION TORQUE RATINGS

Module 4.0 (39 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 60 | 130 (96) | 190 (140) | 220 (162) | - | 63.66 | 145 (107) | 205 (151) | 670 (494) | 700 (516) |
| 18 | 72 | 200 (148) | 290 (214) | 450 (332) | - | 76.39 | 224 (165) | 305 (225) | 900 (664) | 1085 (800) |
| 19 | 76 | - | - | - | 915 (675) | - | - | - | - | - |
| 20 | 80 | 250 (184) | 355 (262) | 640 (472) | 963 (710) | 84.88 | 280 (207) | 370 (273) | 975 (719) | 1205 (889) |
| 22 | 88 | 300 (221) | 430 (317) | 890 (656) | 1081 (797) | 93.37 | 335 (247) | 445 (328) | 1100 (811) | 1335 (985) |
| 25 | 100 | 415 (306) | 575 (424) | 1070 (789) | 1257 (927) | 106.10 | 465 (343) | 590 (435) | 1200 (885) | 1520 (1121) |
| 28 | 112 | 505 (372) | 720 (531) | 1220 (900) | 1427 (1053) | 118.84 | - | 735 (542) | 1350 (996) | 1560 (1151) |
| 32 | 128 | 700 (516) | 962 (710) | 1400 (1033) | 1608 (1186) | 135.81 | - | 985 (727) | 1550 (1143) | - |
| 40 | 160 | 1100 (811) | 1550 (1143) | 1710 (1261) | 1885 (1390) | 169.77 | - | 1650 (1217) | 1970 (1453) | 2200 (1623) |
| 45 | - | - | - | - | - | 190.99 | - | - | - | 2700 (1992) |

Module 5.0 (49 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 12 | 60 | 150 (111) | 190 (140) | 280 (207) | - | 63.66 | - | - | - | 1050 (774) |
| 15 | 75 | 260 (192) | 320 (236) | 450 (332) | 1100 (811) | 79.58 | 300 (221) | - | - | 1330 (981) |
| 18 | 90 | 400 (295) | 460 (339) | 905 (668) | - | 95.49 | - | - | - | 2147 (1584) |
| 19 | 95 | 450 (332) | 520 (384) | 1070 (789) | 1773 (1308) | - | - | - | - | - |
| 20 | 100 | 499 (368) | 590 (435) | 1150 (848) | 1866 (1376) | 106.10 | 560 (413) | - | - | 2385 (1759) |
| 25 | 125 | 800 (590) | 920 (679) | 1660 (1224) | 2433 (1795) | - | 900 (664) | - | - | 2950 (2176) |
| 36 | 180 | - | - | - | 2800 (2065) | 190.98 | 1030 (760) | - | - | 3300 (2434) |
| 42 | 210 | - | - | - | - | 222.82 | - | - | - | 3700 (2729) |

Module 6.0 (59 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 90 | 470 (347) | - | 795 (586) | - | 95.49 | - | - | - | 2250 (1660) |
| 18 | - | - | - | - | - | 114.59 | - | - | - | 3724 (2747) |
| 19 | 114 | 625 (461) | - | 1850 (1365) | 3014 (2223) | - | - | - | - | - |
| 20 | 120 | 810.3 (598) | - | 2200 (1623) | 3173 (2340) | 127.32 | 910 (671) | - | - | 4137 (3051) |
| 25 | 150 | 1400 (1033) | - | 2950 (2176) | 4135 (3050) | - | 1570 (1158) | - | - | 5285 (3898) |
| 35 | - | - | - | - | - | 222.82 | - | - | - | 5570 (4108) |

Module 8.0 (79 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 15 | 120 | 1149.5 (848) | - | 1898 (1400) | - | 127.32 | - | - | - | 7281 (5370) |
| 16 | 128 | - | - | - | 5838 (4306) | - | - | - | - | - |
| 20 | 160 | 2101 (1550) | - | 4502 (3321) | 7298 (5383) | 169.77 | - | - | - | 9709 (7161) |
| 25 | 200 | 3398 (2506) | - | 7500 (5532) | - | - | - | - | - | - |

Module 10.0 (99 mm Face Width)

| # of Teeth z | Torque Capacity for Straight Nm(lb.ft.): | | | | | Torque Capacity for Helical Nm(lb.ft.): | | | | |
|--------------|--|---------------|------------------------------|-----------------------------|----------------------------|---|---------------|------------------------------|-----------------------------|----------------------------|
| | d (mm) | Soft Rack A30 | Quenched & Tempered Rack A20 | Induction Hardened Rack A40 | Hardened & Ground Rack A10 | d (mm) | Soft Rack A31 | Quenched & Tempered Rack A21 | Induction Hardened Rack A41 | Hardened & Ground Rack A11 |
| 14 | - | - | - | - | - | 148.54 | - | - | - | 11920 (8792) |
| 15 | 150 | - | - | - | 10286 (7587) | 165.16 | - | - | - | 12773 (9421) |
| 16 | 160 | - | - | - | 10972 (8093) | - | - | - | - | - |
| 20 | 200 | 4000 (2950) | - | 9900 (7302) | 13864 (10226) | 213.21 | - | - | - | 18569 (13696) |

RACK & PINION TORQUE RATINGS

CIRCULAR METRIC PITCH

| # of Teeth z | d (mm) | Torque Capacity for Straight Nm(lb.ft.): | | |
|--|--------|--|-----------------------------|----------------------------|
| | | Soft Rack A70 | Induction Hardened Rack A60 | Hardened & Ground Rack A50 |
| Circular metric pitch 2.0 (9.5 mm Face Width) | | | | |
| 25 | 15.91 | 1.5 (1.1) | - | 2.7 (2) |
| 30 | 19.10 | 2.1 (1.6) | - | 4 (3) |
| Circular metric pitch 5.0 (14.5 mm Face Width) | | | | |
| 20 | 31.83 | 15 (11) | - | 49 (36) |
| Circular metric pitch 7.5 (19.5 mm Face Width) | | | | |
| 20 | 47.75 | 47 (35) | - | 166 (123) |
| Circular metric pitch 10.0 (29.5 mm Face Width) | | | | |
| 20 | 63.66 | 138 (102) | 250 (185) | 470 (347) |
| Circular metric pitch 12.5 (40.0 mm Face Width) | | | | |
| 14 | 58.09 | 90 (67) | 315 (233) | - |
| 20 | 79.58 | 203 (150) | 563 (416) | - |
| Circular metric pitch 16.0 (50.0 mm Face Width) | | | | |
| 20 | 101.86 | - | 1378 (1018) | - |
| Circular metric pitch 20.0 (60.0 mm Face Width) | | | | |
| 20 | 127.32 | - | 2720 (2010) | - |
| Circular metric pitch 25.0 (80.0 mm Face Width) | | | | |
| 20 | 159.15 | - | 6092 (4502) | - |

SELECTION & CALCULATIONS

Rack & Pinion Calculations & Selection

Follow this method to select the correct size rack and pinion:

Start with the type of application: HORIZONTAL translation or VERTICAL lifting

Determine the units: Metric or Imperial

Follow the table below for the calculation procedure:

| Application | HORIZONTAL translation | | VERTICAL lifting | |
|-------------------------------------|---------------------------------|------------------------------------|------------------------------|--------------------------------|
| | APPLICATION PARAMETERS | | | |
| Units | Metric | Imperial | Metric | Imperial |
| Mass to move, M | Kg | W/gc, Lb * s2 / ft. | Kg | W/gc, Lb * s2 / ft. |
| Linear Speed, V | M/s | Ft/s | M/s | Ft/s |
| Acceleration time, ta | s | s | s | s |
| Acceleration due to gravity, g | 9.8 M/s2 | 32.2 Ft/s2 | 9.8 M/s2 | 32.2 Ft/s2 |
| Coefficient of friction, μ | - | - | - | - |
| Pitch circle dia. of pinion, d | mm | in. | mm | in. |
| External Force, F | N | Lbs. | N | Lbs. |
| Service Factor, S.F. * | - | - | - | - |
| | CALCULATED DATA | | | |
| Acceleration, a | $a = V/ta$ M/s2 | $a = V/ta$ Ft/s2 | $a = V/ta$ M/s2 | $a = V/ta$ Ft/s2 |
| Application force at rack, Fr | $Fr = \mu M^*g + M^*a + F$ N | $Fr = \mu M^*g + M^*a + F$ Lbs. | $Fr = M^*g + M^*a + F$ N | $Fr = M^*g + M^*a + F$ Lbs. |
| Application Torque at Pinion, Tp | $Tp = (Fr * d)/2000$ NM | $Tp = (Fr * d)/24$ Lb.Ft. | $Tp = (Fr * d)/2000$ NM | $Tp = (Fr * d)/24$ Lb.Ft. |
| Design Torque, Td | $Td = Tp * S.F.$ NM | $Td = Tp * S.F.$ Lb.Ft. | $Td = Tp * S.F.$ NM | $Td = Tp * S.F.$ Lb.Ft. |
| Max. Rotational speed of pinion, Np | $Np = (V * 19,100)/d$ RPM | $Np = (V * 229.2)/d$ RPM | $Np = (V * 19,100)/d$ RPM | $Np = (V * 229.2)/d$ RPM |

* The service factor, S.F. is selected based on experience with the application. The service factor takes into account shock loading, assembly tolerances, pinion mounting and life required. Service factors range between 1.0 and 4.0.

Rack & Pinion Selection:

- Select the pinion number of teeth
- Select the module and quality level based on the torque ratings, (Trating) in the preceding tables. Insure that: **Trating > Td**
- Check that the quality level selected is suitable for the application requirements by evaluating the cumulative pitch error, Fp for the quality level selected.

SELECTION & CALCULATIONS

Rack & Pinion Properties:

Pinion Description

Metric:

$M = \text{ød}/Z$ (mm)

$\text{ødth} = Z \cdot M / \cos\beta$ (mm)

$\text{ød}w = Z \cdot M / \cos\beta + 2 \cdot x \cdot M$ (mm)

$\text{ød} = \text{Pitch Diameter}$

$Z = \text{Number of teeth}$

Imperial:

$P = Z / \text{ød}$ (1/in.)

$\text{ødth} = Z / P \cdot \cos\beta$ (in.)

$\text{ød}w = Z / P \cdot \cos\beta + 2 \cdot x / P$ (in.)

Rack Description

Metric:

M

$p = \pi \cdot M$ (mm)

$1.25 M$

Imperial:

$p = \pi / P$ (in.)

$1/P$

$1.25/P$

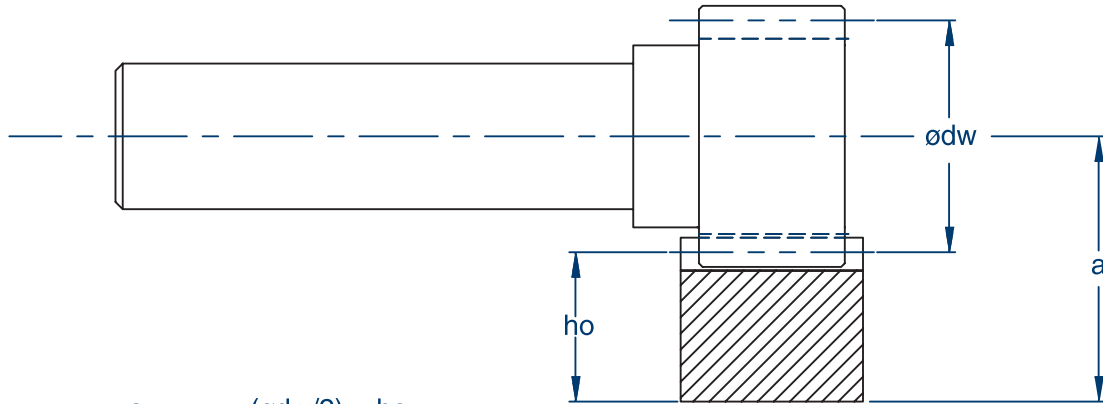
$P = 25.4/M$

Module 2.0 **P= 12.70**

Module 6.0 **P= 4.23**

SELECTION & CALCULATIONS

Theoretical Center Distance Between Pinion and Rack:



- $a = (\text{ødw}/2) + h_o$
- $Z =$ Number of teeth
- $\text{ødw} =$ Working Pitch Diameter
- $h_o =$ distance from back face to pitch line of rack

Nomenclature:

Application Data:

- $W =$ Weight, Lbs.
- $g_c =$ Gravitational Constant = 32.2 Ft/s²

Pinion Data:

- $M =$ Module, mm
- $P =$ Diametral Pitch, 1/in.
- $\text{Ødth} =$ Theoretical Pitch diameter, (mm or in.)
- $\text{Ød} = \text{Ødth} =$ Pitch diameter when $x = 0$ (mm or in.)
- $\text{Ødw} =$ Working Pitch diameter, (mm or in.)
- $x =$ Addendum correction factor

Rack Data:

- $p =$ Circular pitch (mm or in.)

RACK & PINION DRIVE SYSTEM APPLICATION SHEET

COMPANY: _____ CONTACT: _____
 ADDRESS: _____ PHONE: () _____ - _____
 _____ FAX: () _____ - _____
 _____ EMAIL: _____

APPLICATION DESCRIPTION:

Machine Type: Traveling Gantry/Bridge (driven on both sides)
 Traveling Column (driven on one side only)
 Material Being Machined (if any): Steel Aluminum Other: _____
 Operations Being Performed: Contouring Milling Boring
 Machine Description:
 Axis Orientation: Horizontal Vertical

APPLICATION SPECIFICATIONS:

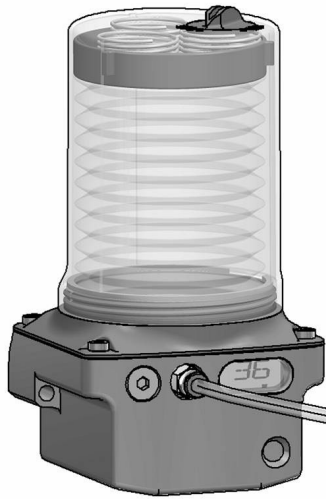
Axis Travel Length: _____ feet or: _____ meters
 Total Weight Being Moved: _____ lb.
 Maximum Axis Speed: _____ inches/minute or: _____ meters/minute
 Maximum Acceleration Rate: _____ in/sec²
 Acceleration Time: _____ seconds
 Axis Friction Factor (): _____
 Additional Cutting Force (if any): _____ lb.
 Axis Duty Cycle: _____ cycles per hour _____ hours per day
 Desired Axis Accuracy: _____
 Drive Motor Mfg./Model (if known): _____ (Send flange & shaft dimensions)
 Drive Motor Base Speed: _____ rpm
 Drive Motor Continuous Torque: _____ in.lb.
 Machine Sales Potential: _____ machines per year

REDUCER SPECIFICATIONS:

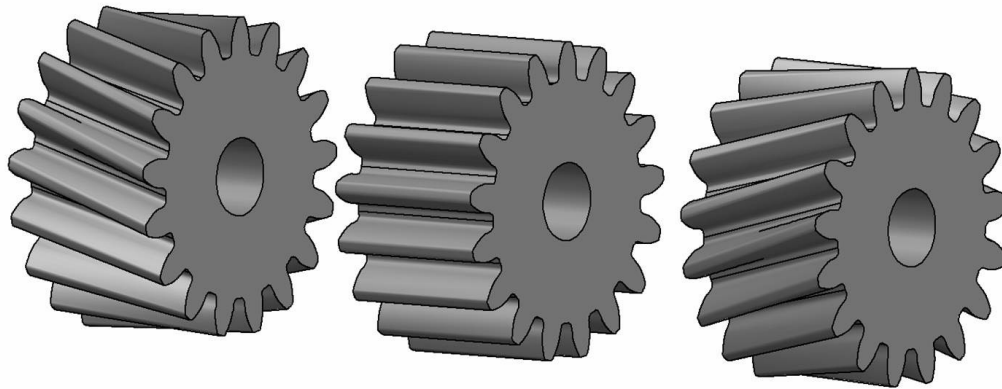
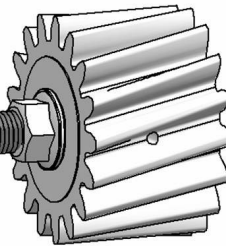
Reducer Style: In-line Right-Angle
 Rack preload required: Yes No
 Preload Style: Split-Pinion Dual-Drive Electrical (Twin-Drive)
 Unit Mounting Orientation: Output Horizontal Output Vertically Down

LUBRICATION OF PINIONS AND RACKS

FlexxPump

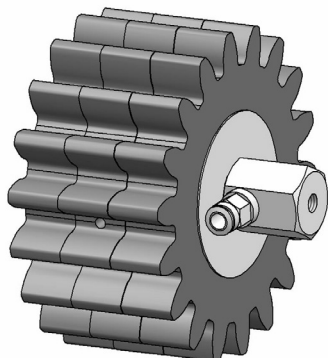


polyurethane pinion

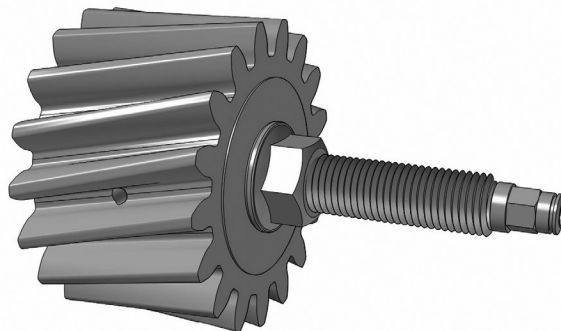


straight and helical teeth module 2 ... 10

mounting axis - right-angled





mounting axis - straight







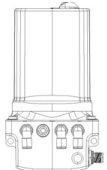
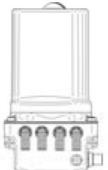




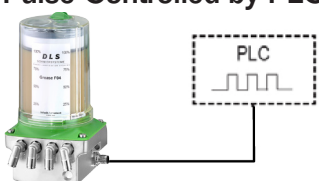

FLEXPUMP 400/500 CONFIGURATIONS

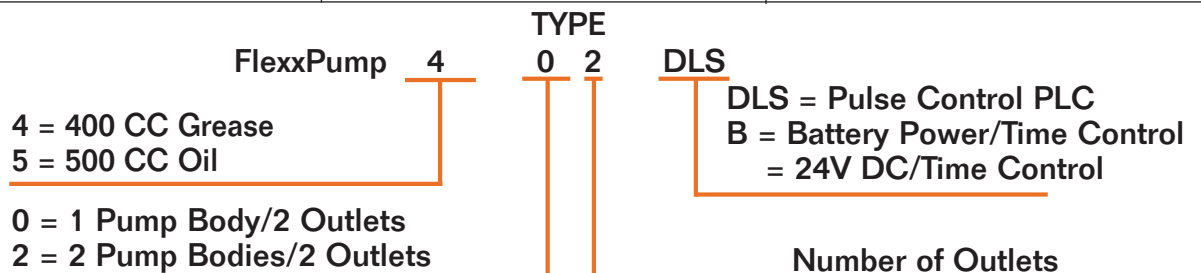
LUBRICANT

| GREASE | OIL |
|---|--|
|  <p>FlexxPump 4xx 400 cc Grease Cartridge</p> |  <p>FlexxPump 5xx 500 cc Oil Reservoir</p> |

Number of Outlets

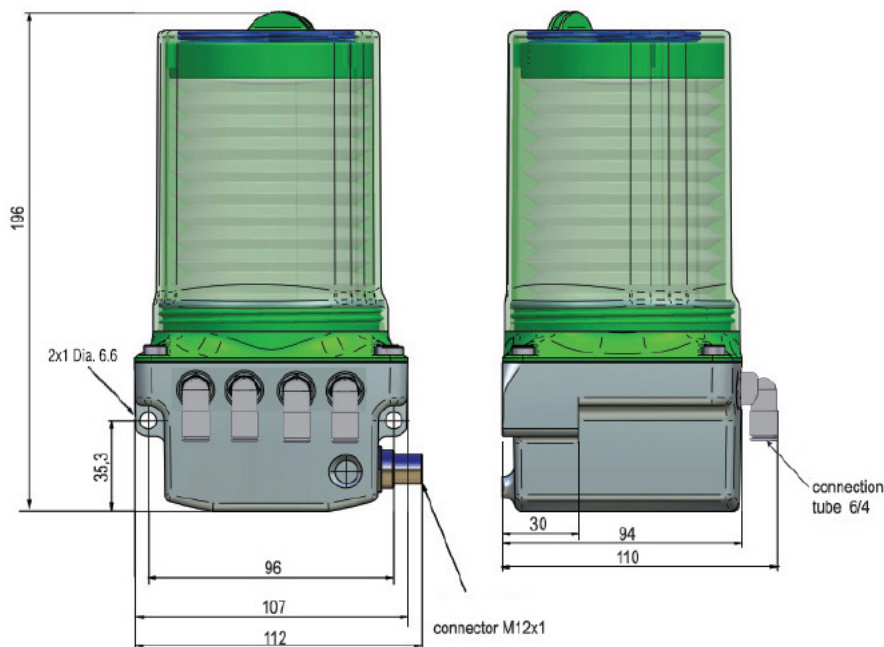
| | | | | | | | |
|--|--|--|--|--|--|--|--|
|  401 |  402 |  403 |  404 |  501 |  502 |  503 |  504 |
|  422 | | | |  522 | | | |

| Operating Power | 24V DC | BATTERY |
|------------------------------|---|---|
| <p>Control Method</p> | <p>DLS Pulse Controlled by PLC</p>  | <p>Time Controlled by on-Board Programming</p> <p>ON-BOARD PROGRAMMING</p>  |



FLEXPUMP 400/500 DLS RELUBRICATION UNIT DIRECT LUBRICATION SYSTEM

DIMENSIONS FlexxPump 400/500 DLS



TECHNICAL DATA FlexxPump 400/500 DLS

| | |
|----------------------------|---|
| Dimensions, Max: | width x height x depth: 112mm x 196mm x 94mm |
| Weight, without lubricant: | 1120g |
| Storage/volume: | 400cm ³ grease in a cartridge (types: 400); 500ml oil (types: 500) |
| Lubricant: | oil or grease up to NLGI. 3 (also containing solid lubricants) |
| Function/principle: | piston pump |
| Delivery rate per pulse: | 0, 15cm ³ |
| Number of outlets: | up to 4; right-angled and pivotable |
| Operating voltage: | 24V DC |
| Operating current: | I _{max} : 350mA; typical: 200mA |
| Fuse: | 500mA (characteristic: delay) |
| Lube-connection: | high pressure tube 6x4 (flexible tube with diameter 6mm outside; 4mm inside) |
| Operating pressure: | max. 70bar (1000 psi) |
| Operating temperature: | -25°C... +70°C (-13F ... +160F) |
| Combination: | possible with progressive systems |
| Pressure monitoring: | intergrated, electronic (monitoring backpressure) |
| Level monitoring: | intergrated, reed-contact |
| electrical connection: | M12x1; 4-pole |
| Protection class: | IP 65 (= suitable for underwater operation up to 1m) |

*Relubrication unit delivered without grease bellows.
Bellows are available as accessories.

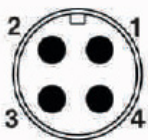
FLEXPUMP 400/500 DLS RELUBRICATION UNIT DIRECT LUBRICATION SYSTEM

| Part Number | Outlets | Pump Bodies | Grease (g) Oil (o) | Type |
|-------------|---------|-------------|-----------------------|-------------------|
| 135-140-210 | 1 | 1 | g | FlexxPump 401 DLS |
| 135-240-210 | 2 | 1 | g | FlexxPump 402 DLS |
| 135-340-210 | 3 | 2 | g | FlexxPump 403 DLS |
| 135-440-210 | 4 | 2 | g | FlexxPump 404 DLS |
| 135-240-212 | 2 | 2 | g | FlexxPump 422 DLS |
| 135-150-210 | 1 | 1 | o | FlexxPump 501 DLS |
| 135-250-210 | 2 | 1 | o | FlexxPump 502 DLS |
| 135-350-210 | 3 | 2 | o | FlexxPump 503 DLS |
| 135-450-210 | 4 | 2 | o | FlexxPump 504 DLS |
| 135-250-212 | 2 | 2 | o | FlexxPump 522 DLS |

Connector PIN assignment M12x1



The FlexxPump uses a four-pin socket to connect a M12x1 plug allowing communication with the machine controller. An external 24VDC power supply is used to switch ON and OFF (voltage of +20 ...up to +30 VDC, supplied to PIN1). When voltage is supplied the lubrication pump is in operating condition. If there are no errors (Pump OK) the input voltage will be transferred to the output signal (PIN 4) indicating all is OK. Once the voltage supply to PIN 1 is stopped (switched OFF), the pump rests and saves the current operating conditions in memory. When the pump is turned back on the saved operating conditions will be continued PIN 4 relays the operating condition.



Connector PIN assignment M 12x1

PIN 1: Input voltage +20...30 VDC, color brown
 PIN 2: Activation of the individual pump outlets (page 7), color white
 PIN 3: Ground (GND), color blue
 PIN 4: Output Signal, color black

Output signal (Pin 4) - high (+20...30VDC) = OK
 - low (0 V) = Error (over current/over pressure/electronic error)
 - 0.5 Hz. pulse (0V low/20..30V high) = empty signal
 - Pump operation: 7-12 sec low signal while pump is operating

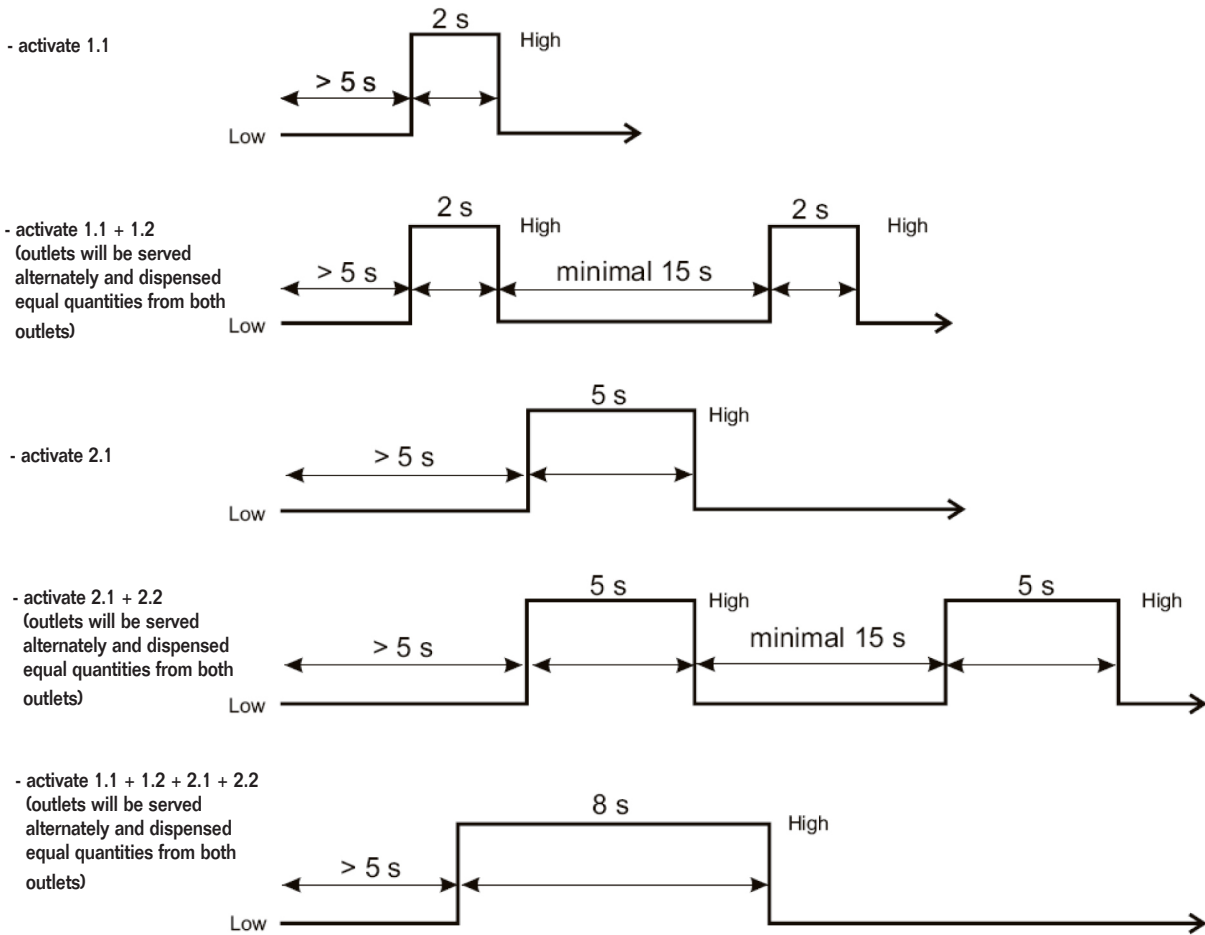
FLEXPUMP 400/500 DLS RELUBRICATION UNIT DIRECT LUBRICATION SYSTEM

Identification of the pump outlets



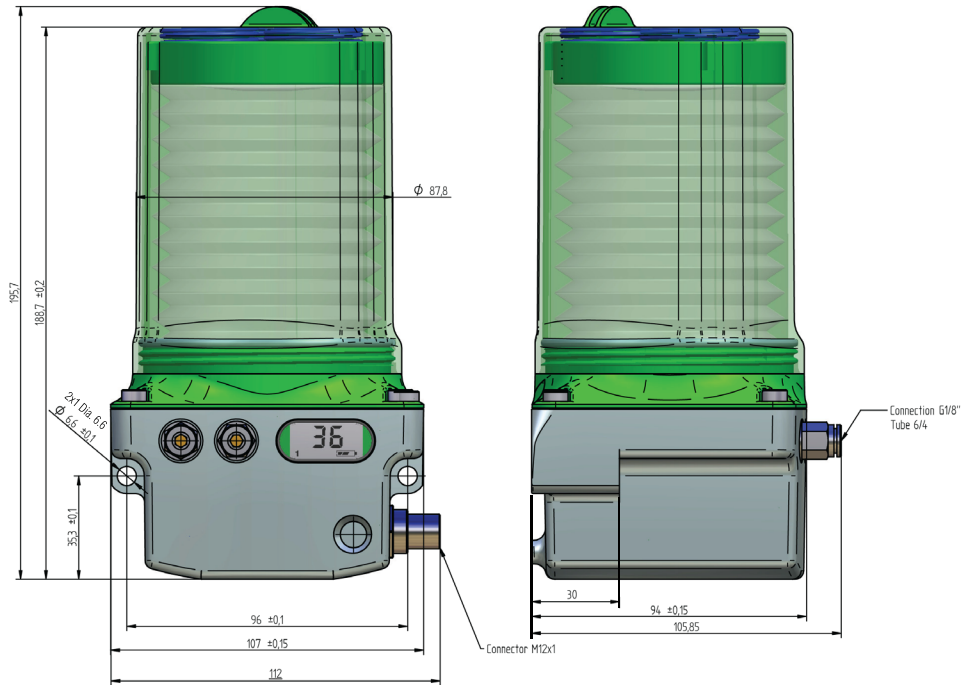
Deliver Rate per pulse signal = 0.15 cc/outlet

Pulse signal to activate the outlets (Indication in seconds, accuracy +/- 10%)
Time between two pulse signals: minimum 15 s



FLEXPUMP 400/500 B RELUBRICATION UNIT

DIMENSIONS FlexxPump 400/500 B



TECHNICAL DATA FlexxPump 400/500 B (Battery)

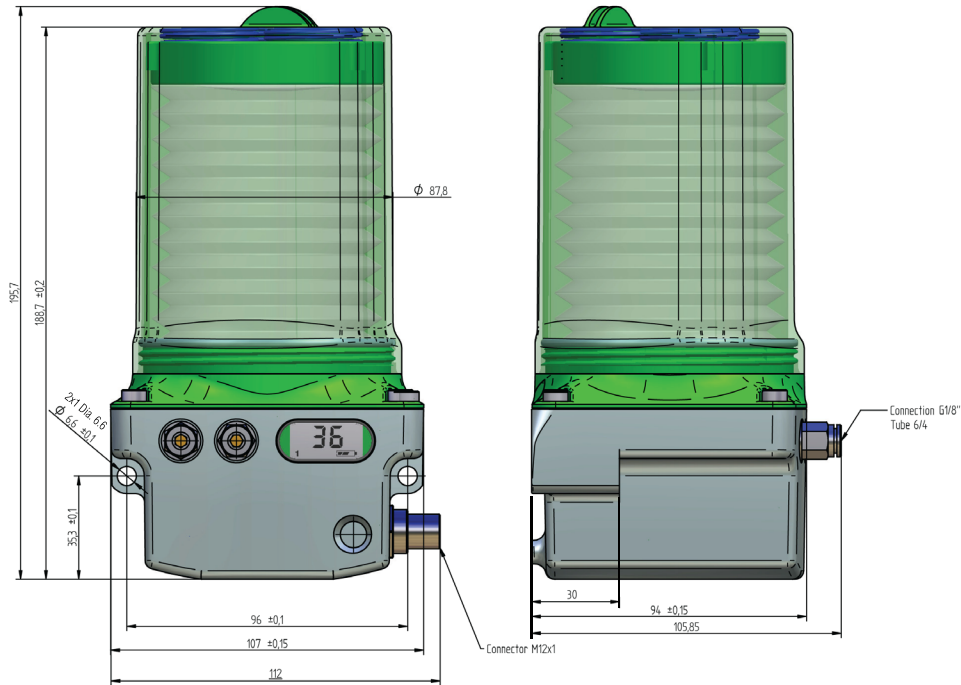
| | |
|----------------------------|--|
| Dimensions, Max: | width x height x depth: 112mm x 196mm x 94mm |
| Weight, without lubricant: | 1120g (2.5 lbs.) |
| Storage/volume: | 400cm ³ grease in cartridge* (types: 4xx); 500ml oil (types: 5xx) |
| Lubricant: | oil or grease up to NLGI 3 (also containing solid lubricants) |
| Function/principle: | piston pump |
| Number of outlets: | 1 or 2 |
| Delivery rate/stroke: | 1 outlet 0.30 cc, 2 outlet 0.15 cc |
| Operating voltage: | 3.6 V. Battery Pack |
| On-Board Programming: | Via LCD display |
| Lube-connection: | high pressure tube 6x4 |
| Operating pressure: | max. 70bar (1000 psi) |
| Operating temperature: | -25°C... +70°C (-13°F ... +160°F) |
| Pressure monitoring: | integrated, electronic (monitoring back pressure) |
| Level monitoring: | integrated, reed-contact |
| Optional PLC connection: | M12x1; 4-pin - for monitoring and on-off only |
| Protection class: | IP 65 |
| Installation position: | grease any; oil upright |
| Error Signal: | OPTICAL Cartridge Empty/over pressure/low battery LED Flashing |
| Housing Material: | Zinc Polyamide |

*Relubrication unit delivered without grease cartridge. Cartridges are available as accessories.

| Part Number | Outlets | Pump Bodies | Grease (g) Oil (o) | Type |
|-------------|---------|-------------|-----------------------|----------------|
| 135-140-000 | 1 | 1 | g | FlexxPump 401B |
| 135-240-000 | 2 | 1 | g | FlexxPump 402B |
| 135-150-000 | 1 | 1 | o | FlexxPump 501B |
| 135-250-000 | 2 | 1 | o | FlexxPump 502B |

FLEXPUMP 400/500 RELUBRICATION UNIT

DIMENSIONS FlexxPump 400/500



TECHNICAL DATA FlexxPump 400/500

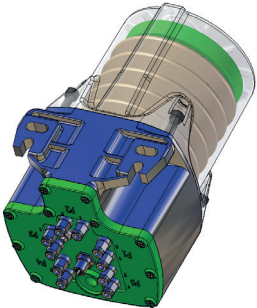
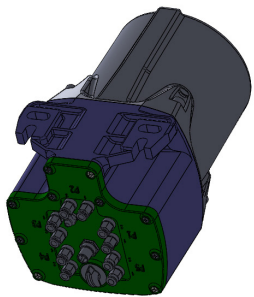
| | |
|----------------------------|--|
| Dimensions, Max: | width x height x depth: 112mm x 196mm x 94mm |
| Weight, without lubricant: | 1120g (2.5 lbs.) |
| Storage/volume: | 400cm ³ grease in cartridge* (types: 4xx); 500ml oil (types: 5xx) |
| Lubricant: | oil or grease up to NLGI 3 (also containing solid lubricants) |
| Function/principle: | piston pump |
| Number of outlets: | 1 or 2 |
| Delivery rate/stroke: | 1 outlet 0.30 cc, 2 outlet 0.15 cc |
| Operating voltage: | 24 V DC |
| On-Board Programming: | Via LCD display |
| Lube-connection: | high pressure tube 6x4 |
| Operating pressure: | max. 70bar (1000 psi) |
| Operating temperature: | -25°C... +70°C (-13°F ... +160°F) |
| Pressure monitoring: | integrated, electronic (monitoring back pressure) |
| Level monitoring: | integrated, reed-contact |
| Optional PLC connection: | M12x1; 4-pin - for monitoring and on-off only |
| Protection class: | IP 65 (= suitable for underwater operation up to 1m) |
| Installation position: | grease any; oil upright |
| Error Signal: | OPTICAL Cartridge Empty/over pressure/low battery LED Flashing |
| Housing Material: | Zinc Polyamide |

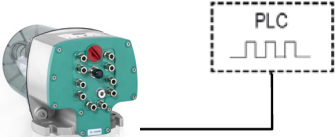

*Relubrication unit delivered without grease cartridge. Cartridges are available as accessories.

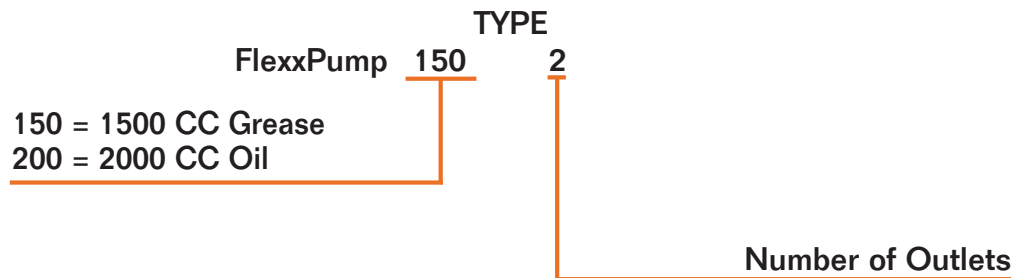
| Part Number | Outlets | Pump Bodies | Grease (g) Oil (o) | Type |
|-------------|---------|-------------|-----------------------|---------------|
| 135-140-100 | 1 | 1 | g | FlexxPump 401 |
| 135-240-100 | 2 | 1 | g | FlexxPump 402 |
| 135-150-100 | 1 | 1 | o | FlexxPump 501 |
| 135-250-100 | 2 | 1 | o | FlexxPump 502 |

FLEXPUMP 1500/2000 CONFIGURATIONS

LUBRICANT

| GREASE | | | | | OIL | | | | |
|---|------|------|------|------|--|------|------|------|------|
|  <p>FlexxPump 150x 1500 cc Grease Bellows</p> | | | | |  <p>FlexxPump 200x 2000 cc Oil Reservoir</p> | | | | |
| Number of Outlets | | | | | | | | | |
| 1502 | 1504 | 1506 | 1508 | 1510 | 2002 | 2004 | 2006 | 2008 | 2010 |

| Operating Power | 24V DC | |
|-----------------|---|--|
| Control Method | <p>DLS Pulse Controlled by PLC</p>  | <p>Time Controlled by on-Board Programming</p>  <p>ON-BOARD PROGRAMMING</p> |



FLEXPUMP 1500/2000 RELUBRICATION UNIT

Time-controlled or pulse-driven relubrication unit

Direct controlled by PLC (incl. error-monitoring)

Piston-pump (1-5 pumpbodies)

Oils and greases up to NLGI 2 including solid particles

2-10 outlets

Different times and/or quantities of lubricant

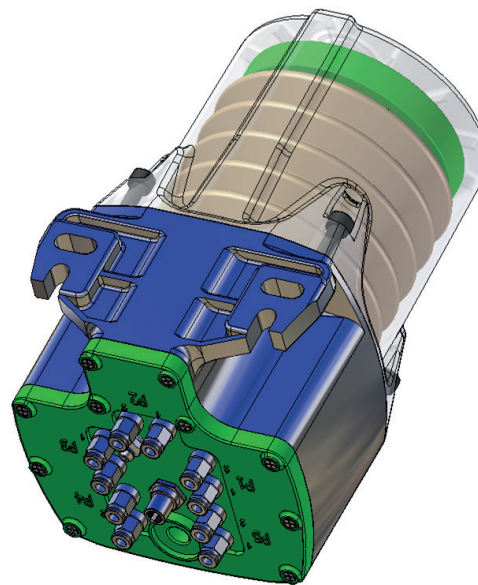
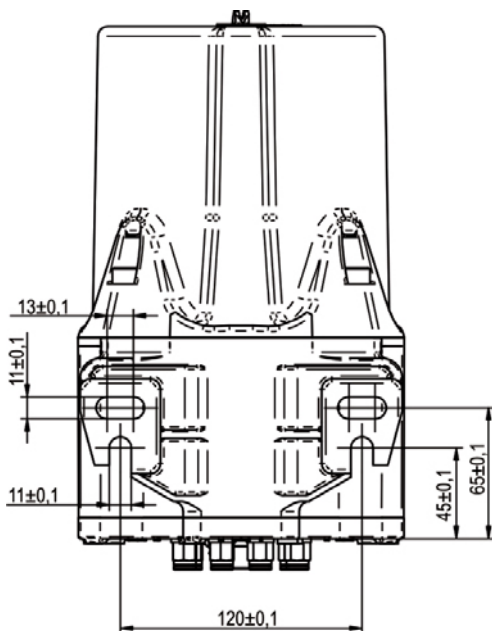
Pressure: max. 70 bar (1000 PSI)

1500 cc grease/2000 cc oil

Low weight and minimum current consumption

Suitable for combined relubrication of:

- open gearing chains
- ball-bearings
- linear bearing blocks
- ball screw nuts



FLEXPUMP 1500/2000 RELUBRICATION UNIT

TECHNICAL DATA FlexxPump 1500/2000

| | |
|------------------------------------|--|
| Dimensions, Max: | width x height x depth: 162mm x 255mm x 165mm |
| Weight, without lubricant: | 4000 g |
| Storage/volume: | grease: 1500cc in bellows, oil: 2000 ml |
| Lubricant: | oil or grease; up to NLGI 2, with solid parts possible |
| Function/principle: | piston pump |
| Number of outlets: | Max. 10 straight |
| Delivered volume per stroke/pulse: | 2 outlets: 2 x 0.15 cm ³ - types: 1502/2002 4 outlets: 4 x 0.15 cm ³ - types: 1504/2004 6 outlets: 6 x 0.15 cm ³ - types: 1506/2006 8 outlets: 8 x 0.15 cm ³ - types: 1508/2008 10 outlets: 10 x 0.15 cm ³ - types: 1510/2010 |
| Operating voltage: | 24 V DC (via cable) |
| Lube-connection: | PA-tube, t=6x4 |
| Operating pressure: | max. 70bar |
| Operating temperature: | -20°C... +70°C (-4°F... +160°F) |
| Pressure monitoring: | integrated, electronic |
| Fill Level monitoring: | integrated, reed-contact |
| Installation position: | grease any; oil upright; |
| Error Signal: | PLC: sophisticated: bellow empty / back pressure / internal error OPTICAL: LCD-display |
| Number of Pump Strokes / 2000 cc: | ~13300 |
| Number of Lubricant Points: | Max. 40 */** |
| Connection Plug: | M12 x 1, 4-pin |
| Current Consumption at 24 V DC: | I _{max} ≤ 350 mA |
| Control: | Integrated: Microelectronical Internal/External: Internal: time-controlled, External: PLC |
| IP Class | IP 54 |
| Material Housing | Aluminum, polyamide |

| Part Number | Grease (g) Oil (o) | Type | Outlets | Pump Bodies | Lubrication Points | Quantities Lubricant |
|-------------|-----------------------|----------------|---------|-------------|--------------------|----------------------|
| 540-202-100 | g | FlexxPump 1502 | 2 | 1 | max. 8 | 1 |
| 540-404-200 | g | FlexxPump 1504 | 4 | 2 | max. 16 | 2 |
| 540-606-300 | g | FlexxPump 1506 | 6 | 3 | max. 24 | 3 |
| 540-808-400 | g | FlexxPump 1508 | 8 | 4 | max. 32 | 4 |
| 541-010-510 | g | FlexxPump 1510 | 10 | 5 | max. 40 | 5 |
| 550-202-100 | o | FlexxPump 2002 | 2 | 1 | max. 8 | 1 |
| 550-404-200 | o | FlexxPump 2004 | 4 | 2 | max. 16 | 2 |
| 550-606-300 | o | FlexxPump 2006 | 6 | 3 | max. 24 | 3 |
| 550-808-400 | o | FlexxPump 2008 | 8 | 4 | max. 32 | 4 |
| 501-010-500 | o | FlexxPump 2010 | 10 | 5 | max. 40 | 5 |

Monitoring and controlled by PLC.

*By using Splitters

**More lubrication points possible by using progressive distributors

LUBRICATION OF PINIONS AND RACKS

Lubrication of open spur gear drives and racks

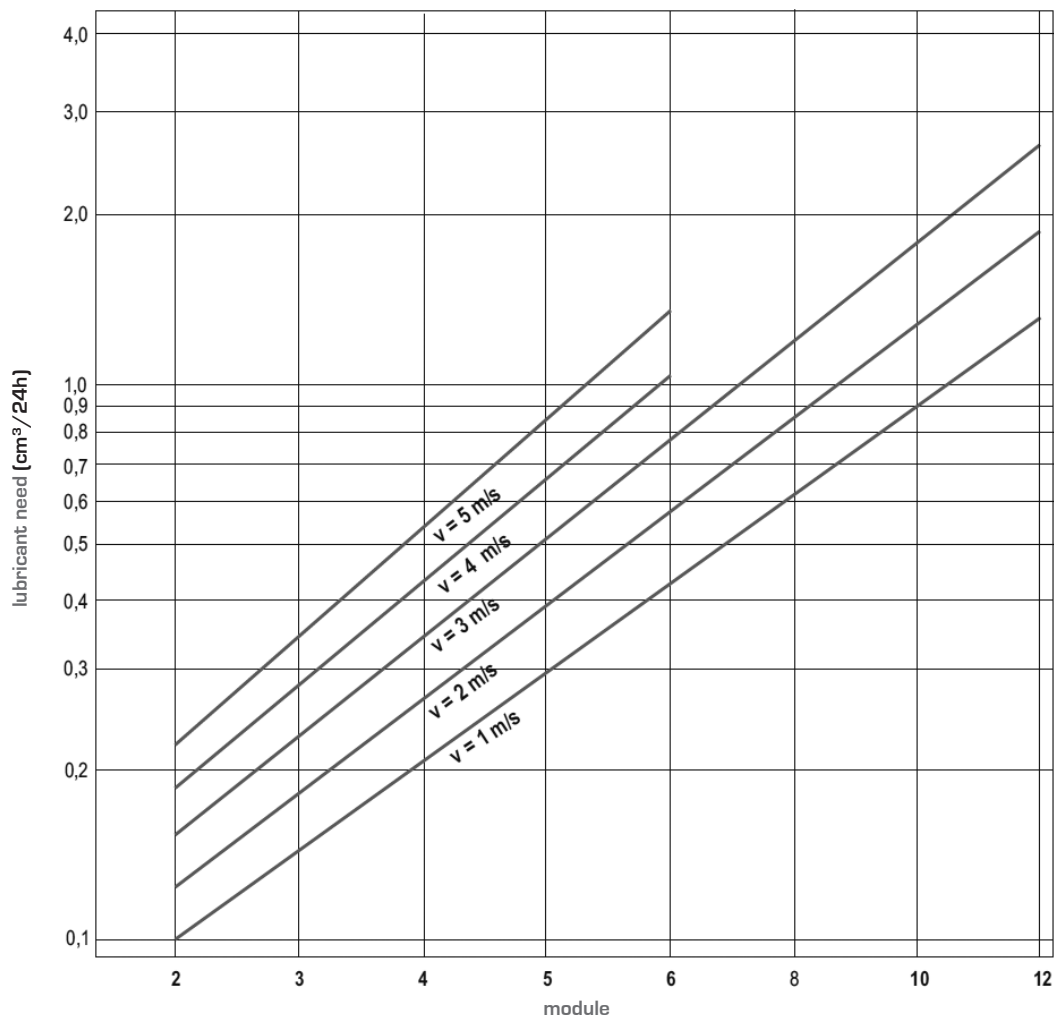
For tooth systems in open drives, an automatic lubrication supply is preferred. Exceptions are possible, in the case of very small modules, slow speed <math><1\text{m/s}</math> and light duty cycles manual lubrication is adequate. Therefore, we offer an adhering grease - F01 - as well as the lubricant F02 (for an application in the food industry (with H1-approval)), and F03 for bearings, racks and pinions.

Automatic relubrication with polyurethane foam pinions

A far better technical solution to relubricate the tooth system is an automatic and continuous spreading of the lubricant with polyurethane foam pinion which are brought into contact with the drive gear or rack. The lubrication pinion does not transmit a torque - it only carries the grease to that part of the tooth system it touches.

The necessary relubrication amounts for different tooth systems with different running conditions is shown in the diagram below. Conditions for the validity of the values shown in the table below are the use of a suitable DLS polyurethane foam pinion and a proper lubricant like DLS F01, F02 or F03.

Lubricant quantities for lubrication with PU Foam Pinions

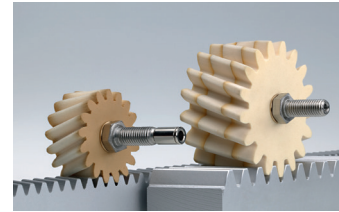


LUBRICATION PINION

Technical specification lubrication pinion

The DLS lubrication pinions are made of an open cellular polyurethane foam (temperature range -30° C...+150° C). Pinions with module 3 and bigger are put together in segments. To choose the correct lubrication pinion it has to be decided by design, if the lubrication pinion should be mounted on the rack or drive pinion.

Using lubrication pinions of an open-cellular polyurethane foam material ensures an optimal supply of the tooth system over long distances. The material stores the lubricant and delivers it in smallest quantities. This lubrication avoids over-lubrication as well as wear (as a consequence of insufficient lubrication).



LUBRICATION PINION - STRAIGHT TEETH

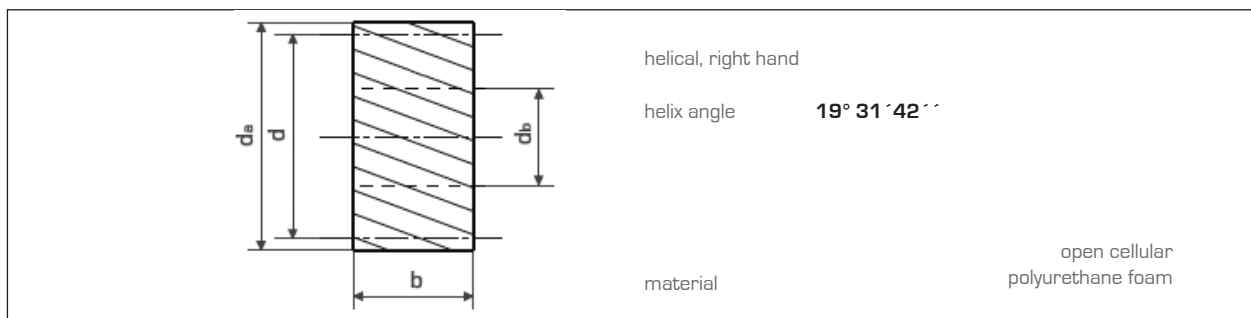


| Part Number | Module | z* | da | d | db | b |
|-------------|--------|----|-------|-------|------|-------|
| 130-015-024 | 1.5 | 24 | 39.0 | 36.0 | 12.0 | 15.0 |
| 130-020-017 | 2.0 | 17 | 38.0 | 34.0 | 12.0 | 20.0 |
| 130-030-017 | 3.0 | 17 | 57.0 | 51.0 | 12.0 | 30.0 |
| 130-040-017 | 4.0 | 17 | 76.0 | 68.0 | 12.0 | 40.0 |
| 130-050-017 | 5.0 | 17 | 95.0 | 85.0 | 20.0 | 50.0 |
| 130-060-017 | 6.0 | 17 | 114.0 | 102.0 | 20.0 | 60.0 |
| 130-080-017 | 8.0 | 17 | 152.0 | 136.0 | 20.0 | 80.0 |
| 130-100-017 | 10.0 | 17 | 190.0 | 170.0 | 20.0 | 100.0 |

*number of teeth

Special design (all parameter disposable): on demand!
Dimensions are in mm and are subject to change - consult factory.

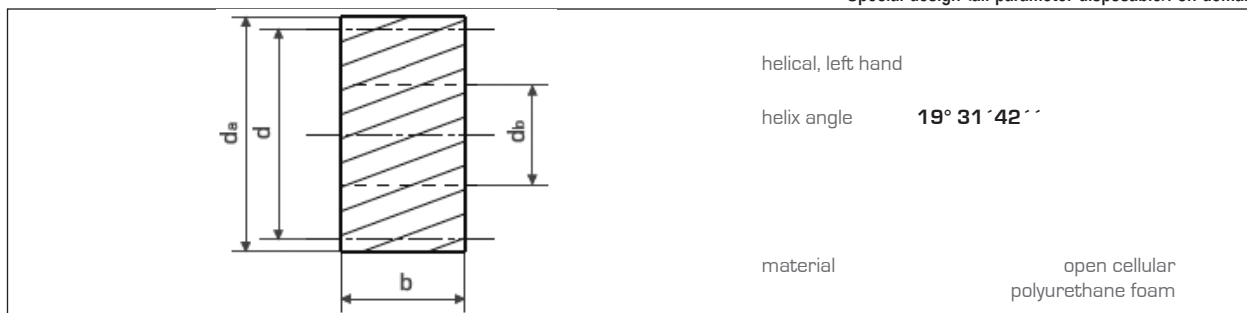
LUBRICATION OF PINIONS AND RACKS



Arrangement with drive pinion

| Part Number | Module | z* | da | d | db | b |
|-------------|--------|----|-------|-------|------|-------|
| 131-015-024 | 1.5 | 24 | 41.2 | 38.2 | 12.0 | 15.0 |
| 131-020-017 | 2.0 | 17 | 40.1 | 36.1 | 12.0 | 20.0 |
| 131-030-017 | 3.0 | 17 | 60.1 | 54.1 | 12.0 | 30.0 |
| 131-040-017 | 4.0 | 17 | 80.2 | 72.2 | 12.0 | 40.0 |
| 131-050-017 | 5.0 | 17 | 100.2 | 90.2 | 20.0 | 50.0 |
| 131-060-017 | 6.0 | 17 | 120.2 | 108.2 | 20.0 | 60.0 |
| 131-080-017 | 8.0 | 17 | 160.3 | 144.2 | 20.0 | 80.0 |
| 131-100-017 | 10.0 | 17 | 200.4 | 180.4 | 20.0 | 100.0 |

Special design (all parameter disposable): on demand!

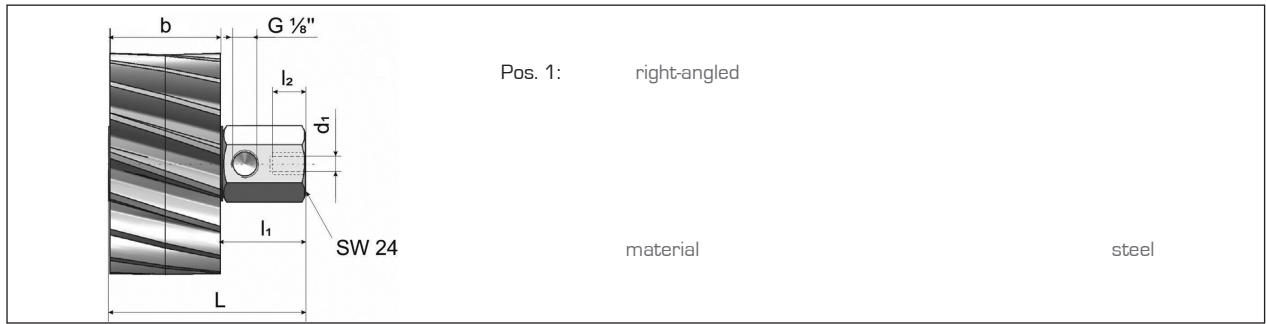


Arrangement with rack

| Part Number | Module | z* | da | d | db | b |
|-------------|--------|----|-------|-------|------|-------|
| 132-015-024 | 1.5 | 24 | 41.2 | 38.2 | 12.0 | 15.0 |
| 132-020-017 | 2.0 | 17 | 40.1 | 36.1 | 12.0 | 20.0 |
| 132-030-017 | 3.0 | 17 | 60.1 | 54.1 | 12.0 | 30.0 |
| 132-040-017 | 4.0 | 17 | 80.2 | 72.2 | 12.0 | 40.0 |
| 132-050-017 | 5.0 | 17 | 100.2 | 90.2 | 20.0 | 50.0 |
| 132-060-017 | 6.0 | 17 | 120.2 | 108.2 | 20.0 | 60.0 |
| 132-080-017 | 8.0 | 17 | 160.3 | 144.3 | 20.0 | 80.0 |
| 132-100-017 | 10.0 | 17 | 200.4 | 180.4 | 20.0 | 100.0 |

Special design (all parameter disposable): on demand!

MOUNTING AXES



| Part Number | Module | L | l ₁ | l ₂ | d ₁ | connection | b | kg |
|-------------|--------|-------|----------------|----------------|----------------|------------|-------|------|
| 133-015-001 | 1.5 | 46.4 | 30.6 | 10.0 | M 8 | G 1/8" | 15.0 | 0.13 |
| 133-020-001 | 2.0 | 51.4 | 30.6 | 10.0 | M 8 | G 1/8" | 20.0 | 0.14 |
| 133-030-001 | 3.0 | 61.4 | 30.6 | 10.0 | M 8 | G 1/8" | 30.0 | 0.17 |
| 133-040-001 | 4.0 | 71.4 | 30.6 | 10.0 | M 8 | G 1/8" | 40.0 | 0.20 |
| 133-050-001 | 5.0 | 81.4 | 30.6 | 10.0 | M 8 | G 1/8" | 50.0 | 0.25 |
| 133-060-001 | 6.0 | 91.4 | 30.6 | 10.0 | M 8 | G 1/8" | 60.0 | 0.45 |
| 133-080-001 | 8.0 | 111.4 | 30.6 | 10.0 | M 8 | G 1/8" | 80.0 | 0.64 |
| 133-100-001 | 10.0 | 131.4 | 30.6 | 10.0 | M 8 | G 1/8" | 100.0 | 0.90 |

Special design (all parameter disposable): on demand!



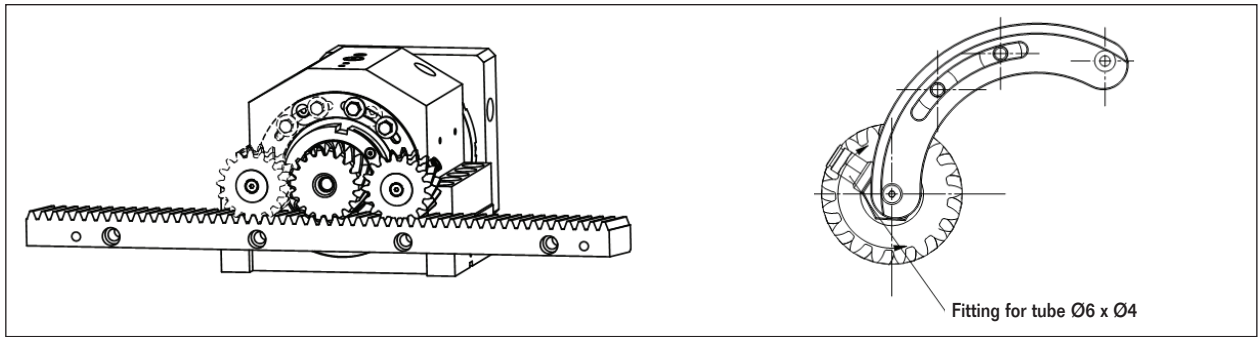
| Part Number | Module | L | l ₁ | d ₁ | SW | connection d ₂ | b | kg* |
|-------------|--------|-------|----------------|----------------|----|---------------------------|-------|------|
| 133-015-002 | 1.5 | 57 | 30.6 | M 10 | 15 | M 6 | 15.0 | 0.07 |
| 133-020-002 | 2.0 | 61.2 | 30.6 | M 10 | 15 | M 6 | 20.0 | 0.08 |
| 133-030-002 | 3.0 | 71.2 | 30.0 | M 10 | 15 | M 6 | 30.0 | 0.11 |
| 133-040-002 | 4.0 | 81.2 | 30.0 | M 10 | 15 | M 6 | 40.0 | 0.14 |
| 133-050-002 | 5.0 | 116.4 | 49.1 | M 16 | 24 | G 1/8" | 50.0 | 0.45 |
| 133-060-002 | 6.0 | 126.4 | 49.1 | M 16 | 24 | G 1/8" | 60.0 | 0.53 |
| 133-080-002 | 8.0 | 146.4 | 49.1 | M 16 | 24 | G 1/8" | 80.0 | 0.61 |
| 133-100-002 | 10.0 | 166.4 | 49.1 | M 16 | 24 | G 1/8" | 100.0 | 0.87 |

Special design (all parameter disposable): on demand!

Dimensions are in mm and are subject to change - consult factory.

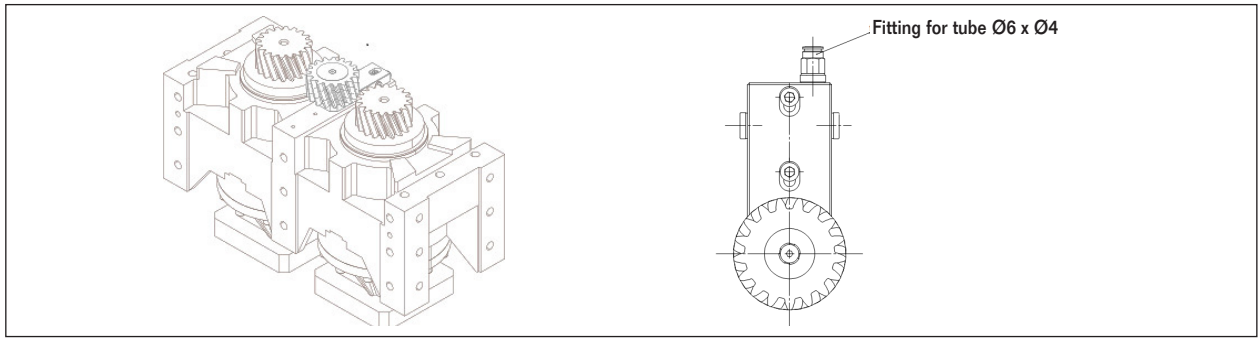
MOUNTING AXES

SFRPX - Lubrication Pinion Support for KRPX



| Part Number | Gearbox | Pinion Support |
|--------------|---------|----------------|
| 20050011-000 | KRPX1 | SFRPX1.3 |
| 20050012-000 | KRPX2 | SFRPX2.4 |
| 20050013-000 | KRPX3 | SFRPX3.5 |
| 20050014-000 | KRPX4 | SFRPX4.6 |
| 20050015-000 | KRPX5 | SFRPX5.8 |

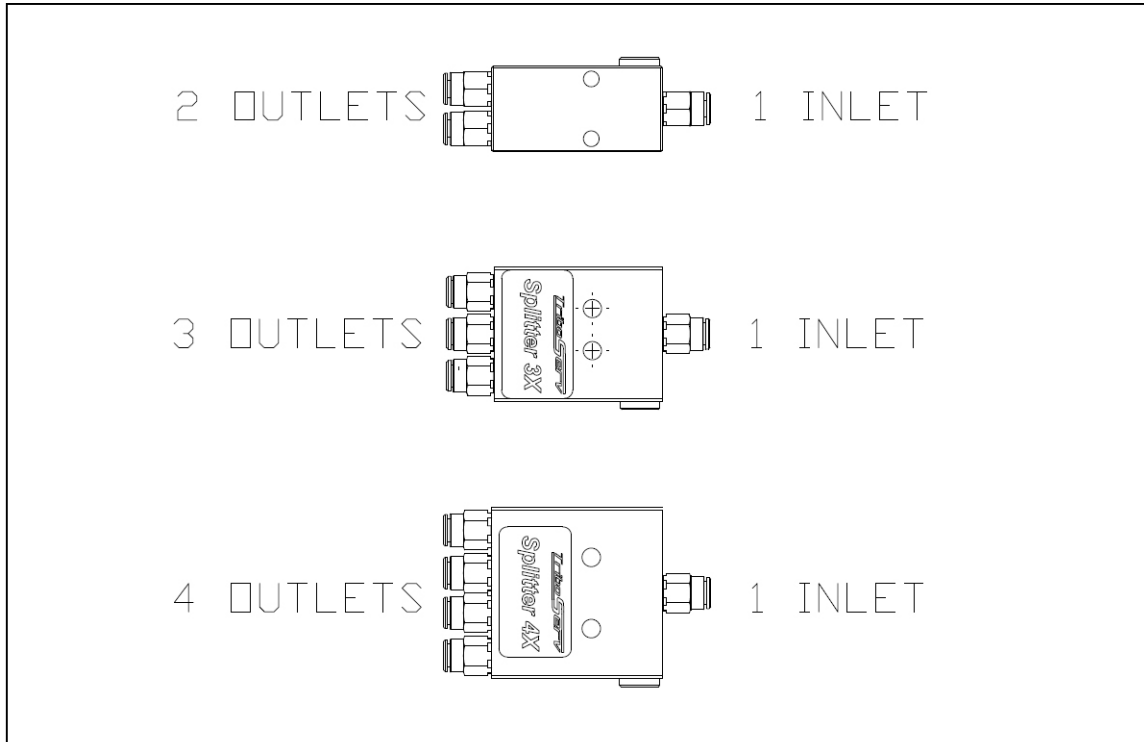
SFRP - Lubrication Pinion Support for DRP



| Part Number | Gearbox | Pinion Support |
|--------------|---------|----------------|
| 20050016-000 | DRP1 | SFRP1.3 |
| 20050017-000 | DRP2 | SFRP2.4 |
| 20050018-000 | DRP3 | SFRP3.5 |
| 20050019-000 | DRP4 | SFRP4.6 |
| 20050020-000 | DRP5 | SFRP5.8 |

Pre-assembled
 Including: fitting, screws for mounting on gearbox and washers
 PU-Lubrication Pinions not included
 3D STEP files available

SPLITTERS FOR RELUBRICATION UNIT FlexxPump



| Part Number | Inlets | Outlets | Grease (g) Oil (o) | Quantity of Lubricant per piston stroke | Type |
|-------------|--------|---------|-----------------------|--|-------------------------------------|
| 134-005-002 | 1 | 2 | g | ~.08 cc | Splitter 1 inlet, 2 outlets, grease |
| 134-005-003 | 1 | 3 | g | ~.05 cc | Splitter 1 inlet, 3 outlets, grease |
| 134-005-004 | 1 | 4 | g | ~.04 cc | Splitter 1 inlet, 4 outlets, grease |
| 134-005-006 | 1 | 2 | o | ~.08 cc | Splitter 1 inlet, 2 outlets, oil |
| 134-005-007 | 1 | 3 | o | ~.05 cc | Splitter 1 inlet, 3 outlets, oil |
| 134-005-008 | 1 | 4 | o | ~.04 cc | Splitter 1 inlet, 4 outlets, oil |

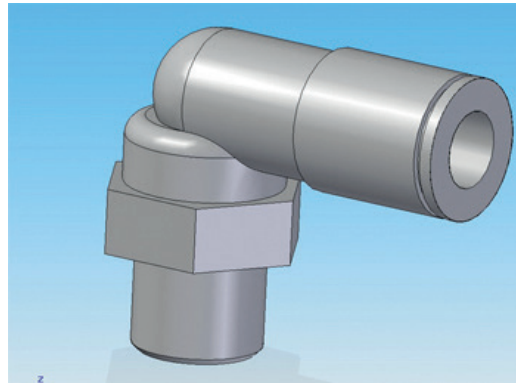
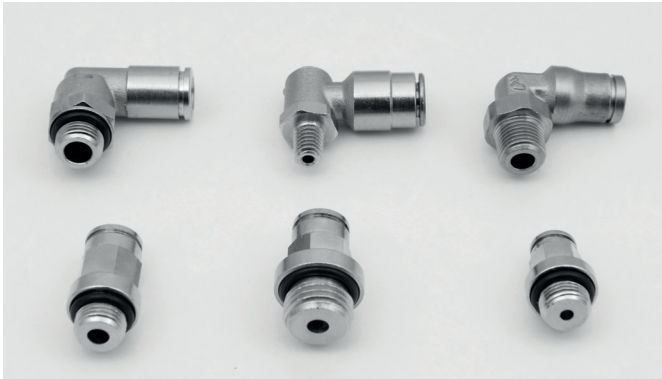
Each outlet of the FlexxPump can be combined with only one splitter. The combination of 2 or more splitters at one pump outlet is not possible. Therefore, the maximum lubrication points that can be serviced by one FlexxPump 404DLS and 4 splitters is 16.

INSTALLATION RECOMMENDATIONS:

The splitters are designed to connect to 6 mm outside diameter tubes. The splitters should be located as close as possible to the FlexxPump outlets.

The length of the tubes between the outlet side of the splitter and the lubrication points should be as close as possible to equal. Pressure differences between the outlets should not exceed 3 bars (43.5 PSI). The amount of lubricant supplied to lubrication points can vary slightly depending on the pressure differences at the outlets.

TUBE CONNECTORS



| Part Number | Description | Version | Thread | tube ØT |
|-----------------|----------------|----------|------------|---------|
| for tube Ø 6 | | | | |
| 134-000-001 | tube connector | straight | M 6 x 1 | 6 |
| 134-000-002 | tube connector | straight | G 1/8 | 6 |
| 134-000-004 | tube connector | straight | G 1/4 | 6 |
| 134-000-005 | tube connector | straight | M 8 x 1 | 6 |
| 134-000-010 | tube connector | straight | M 6 x 0.75 | 6 |
| (*) 134-000-011 | tube connector | straight | M 10 x 1 | 6 |
| (*) 134-000-014 | tube connector | straight | M 6 x 1 | 6 |
| (*) 134-000-015 | tube connector | straight | M 5 x 0.8 | 6 |
| for tube Ø 8 | | | | |
| 134-000-008 | tube connector | straight | G 1/8 | 8 |
| for tube Ø 4 | | | | |
| 134-000-006 | tube connector | straight | M 6 x 1 | 4 |
| (*) 134-000-007 | tube connector | straight | M 3 x 1 | 4 |
| 134-000-009 | tube connector | straight | M 6 x 0.75 | 4 |
| 134-000-012 | tube connector | straight | G 1/8 | 4 |

*changed version

Application:

connection between lubrication points and plastic tubes from Flexpump.

Technical data:

- working pressure max. 80 bar
- working temperature -30° C...+100° C
- fluid oil, grease
- material nickel-plated brass 58, NBR, stainless steel

Features:

- full flow for the fluid
- very simple seal function through integrated O-rings with own seat
- can be inserted and extracted
- all straight connectors with integrated hexagon socket
- all rotary elbow male adaptors can be rotated under pressure

TUBE CONNECTORS

tube-connectors - right-angled

| Part Number | Description | Version | Thread | tube ØT |
|-----------------|----------------|--------------|-----------|---------|
| for tube Ø 6 | | | | |
| 134-001-001 | tube connector | right-angled | M 6 x 1 | 6 |
| 134-001-002 | tube connector | right-angled | G 1/8 | 6 |
| 134-001-006 | tube connector | right-angled | M10 x 1 | 6 |
| 134-001-009 | tube connector | right-angled | G 1/4 | 6 |
| 134-001-010 | tube connector | right-angled | M8 x 1 | 6 |
| 134-001-012 | tube connector | right-angled | M6 x 0.75 | 6 |
| 134-001-013 | tube connector | right-angled | M 5 x 0.8 | 6 |
| 134-001-014 | tube connector | right-angled | M 6 x 1 | 6 |
| 134-001-015 | tube connector | right-angled | PT 1/8 | 6 |
| 134-001-016 | tube connector | right-angled | R 1/8 | 6 |
| (*) 134-001-017 | tube connector | right-angled | M 10x1 | 6 |

for tube Ø 4

| | | | | |
|-----------------|----------------|--------------|------------|---|
| 134-001-007 | tube connector | right-angled | M 6 x 1 | 4 |
| (*) 134-001-008 | tube connector | right-angled | M 3 x 1 | 4 |
| 134-001-011 | tube connector | right-angled | M 6 x 0.75 | 4 |
| 134-001-020 | tube connector | right-angled | M 5 x 0.8 | 4 |



tube to tube connectors

| Part Number | Description | Version | tube ØT1 | tube ØT2 |
|-------------|------------------|--------------|----------|----------|
| 134-000-104 | tube connector | straight | 6 | 6 |
| 134-001-104 | tube connector | right-angled | 6 | 6 |
| 134-000-105 | tube connector | straight | 6 | 8 |
| 134-000-106 | tube connector | straight | 6 | 4 |
| 134-000-108 | Extension | straight | 6 | 8 |
| 134-000-109 | Extension | straight | 4 | 6 |
| 134-002-000 | Y-tube connector | straight | 6 | 6 (2x) |

TUBES



| Part Number | Description |
|-----------------|---------------------------------------|
| 134-003-001 | tube 6x4 - pre-filled with grease F01 |
| 134-003-002 | tube 6x4 - pre-filled with grease F02 |
| 134-003-003 | tube 6x4 - pre-filled with grease F03 |
| (*) 134-003-004 | tube 6x4 - pre-filled with grease F04 |
| (*) 134-003-005 | tube 6x4 - pre-filled with grease F05 |
| 134-004-001 | tube 6x4 - empty |
| 134-004-002 | tube 6x4 - empty - transparent |

* maximum length: 5m

The tubes are sold by meter; maximum length: 10 m.

ACCESSORIES



tube scissor 134-002-002



Replacement battery 134-002-004

| Part Number | Description |
|-------------|---|
| 134-002-002 | tube scissor (metal, exchangeable blades) |
| 134-002-003 | cable M12x1; 5m long, PUR suitable for dragchain for mounting on PLC |
| 134-002-004 | battery for relubrication unit FlexxPump (high performance lithium battery) |
| 134-002-005 | syringe - to fill the oil into the tube |

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Standard grease for open gears

grease F01

- based on lithium/calcium complex with extreme pressure additives, which are combined with the soap structure so that an optimum adhesiveness to the metal surface is possible.
- heat-resistant, good corrosion protection attributes, contains no solid particles.

Operative Ranges:

- developed as special grease for highly loaded open gears.
- due to the high temperature properties usable for a wide range of applications, where high temperatures and high loads exist.

temperature range -30°C to +150°C

| Part Number | Description |
|-------------|--|
| 000-101-105 | cartridge for FlexxPump, pre-filled with 400 cc of grease F01 |
| 000-105-115 | grease-bellow for FlexxPump 1500; pre-filled with 1500cc of grease F01 |
| 000-101-210 | grease F01, 1 kg tin |
| 000-101-220 | grease F01 400 cc, cartridge for grease gun |

LUBRICANTS - GREASE

grease F02

With H1-approval

- synthetic special grease for high temperatures based on synthetic hydrocarbons with a partial special thickener of high metal affinity.
- NSF/H1-registration for incidental food contact.

Quality Attributes:

- water (cold, hot) and steam resistant; high thermal and oxidation stability; for high load; very good wear-protection; high service life and wide temperature range; optimum lubricating effect at low friction values

temperature range -40°C to +140°C

| Part Number | Description |
|-------------|--|
| 000-102-105 | cartridge for FlexxPump, pre-filled with 400 cc of grease F02 |
| 000-102-115 | grease-bellow for FlexxPump 1500; pre-filled with 1500cc of grease F02 |
| 000-102-210 | grease F02, 1 kg tin |
| 000-102-220 | grease F02 400 cc, cartridge for grease gun |

grease F03

Special grease for bearings, linear guideways & ball screws

- short-fibred and homogeneous lithium-saponified universal grease with one mineral oil. It can be used for roller and slide bearing lubrication and is appropriate for medium and high load applications.
- very adhesive; appropriate for short-stroke applications.
- water resistant and protective against corrosion.

Operative Ranges:

- lubrication of linear bearings (recirculating ball bearing guides, roller guides and ballscrews)
- in combination with a lubrication pinion and continuous re-lubrication suitable for open gear lubrication
- very well conveyable in relubrication units

temperature range -20°C to +120°C

| Part Number | Description |
|-------------|--|
| 000-103-105 | cartridge for FlexxPump, pre-filled with 400 cc of grease F03 |
| 000-103-115 | grease-bellow for FlexxPump 1500; pre-filled with 1500cc of grease F03 |
| 000-103-210 | grease F03, 1 kg tin |
| 000-103-220 | grease F03 400 cm ³ , cartridge for grease gun |



LUBRICANTS-GREASE

grease F04

Special grease for bearings

- multipurpose grease based on lithiums-calcium-soap with EP additives
- suitable for bearings with medium loads

Operative Ranges:

- lubrication of bearings and ballscrews
- in combination with a lubrication pinion and continuous re-lubrication suitable for open gear lubrication
- well conveyable in relubrication units and distributors

temperature range -30°C to +130°C

| Part Number | Description |
|-------------|--|
| 000-104-105 | cartridge for FlexxPump, pre-filled with 400 cc of grease F04 |
| 000-104-115 | grease-bellow for FlexxPump 1500; pre-filled with 1500cc of grease F04 |
| 000-104-210 | grease F04, 1 kg tin |
| 000-104-220 | grease F04 400 cm ³ , cartridge for grease gun |

grease F05

Special grease for rack and bearings

- aluminium complex soap and graphite
- based on a high quality mineral oil
- optimum adhesiveness and good corrosion protection

Operative Ranges:

- lubrication of highly loaded racks and pinions
- up to 0°C very good conveyable

temperature range -20°C to +150°C

| Part Number | Description |
|-------------|--|
| 000-105-105 | cartridge for FlexxPump, pre-filled with 400 cc of grease F05 |
| 000-105-115 | grease-bellow for FlexxPump 1500; pre-filled with 1500cc of grease F05 |
| 000-105-210 | grease F05, 1 kg tin |
| 000-105-220 | grease F05 400 cm ³ , cartridge for grease gun |

RACK & PINION INSTALLATION GUIDELINES

The mounting and alignment of rack & pinion drives is critical to the performance and lifetime of the axis. Racks can be mounted in any position. In environments where debris is present (chips, sawdust, etc.) the rack should be mounted with the teeth facing down or covered to minimize contamination. 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. We recommend using the predrilled holes in the rack as a guide for the tapped holes in the mounting surface in order to insure optimum alignment.

The following instructions are meant to be general guidelines on how to achieve an accurate mounting of a rack & pinion drive:

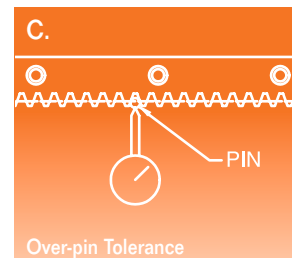
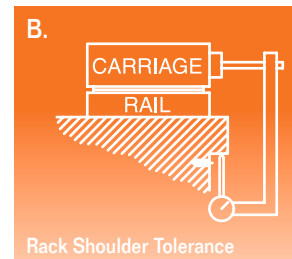
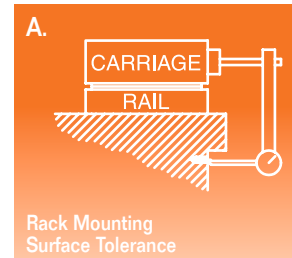
1. Mount and align the linear slides (rails) to the axis base.
2. Measure the location of the rail in relation to the rack mounting surface with a dial indicator (see A.). A shoulder should be provided on the mounting surface to locate the back of the rack (see B.).

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.

3. Attach the first rack segment to the rack mounting surface. Measure the location of the rail in relation to the pitchline of the rack segment with a dial indicator (see diagram C.). To locate the pitchline of the rack, a pin (see table for size) is placed in-between the rack teeth and an over-pin tolerance is measured:

| Rack Module | Pin Size |
|-------------|--------------------|
| 1.5 | Ø3.0 mm (Ø0.118") |
| 2.0 | Ø4.0 mm (Ø0.157") |
| 2.5 | Ø5.0 mm (Ø0.197") |
| 3.0 | Ø6.0 mm (Ø0.236") |
| 4.0 | Ø8.0 mm (Ø0.315") |
| 5.0 | Ø10.0 mm (Ø0.394") |
| 6.0 | Ø12.0 mm (Ø0.472") |
| 8.0 | Ø16.0 mm (Ø0.630") |
| 10.0 | Ø20.0 mm (Ø0.787") |

If the tolerances are found to be high, the rack should be shimmed accordingly and the rack pitchline parallelism should be checked again (step #3).



MODULAR RACK & PINION SYSTEM

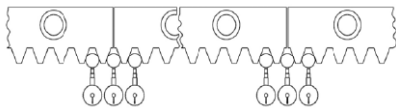
Once the desired tolerance is reached, attach the rack to the machine frame using Class 12.9 socket head capscrews tightened to the torque values shown in the table below:

| Rack Module | 1.5, 2.0, 2.5 | 3.0, 4.0 | 5.0 | 6.0 | 8.0 | 10.0 |
|--------------------------------|---------------|----------|-----------|-----------|-----------|-------------|
| Ø d1 (Through hole) mm | 7 | 10 | 14 | 18 | 22 | 33 |
| Ø d2 (Counterbore) mm | 11 | 15 | 20 | 26 | 33 | 48 |
| Screw Size | M6 | M8 | M12 | M16 | M20 | M3 |
| Tightening Torque NM (LB. Ft.) | 16 (12) | 39 (29) | 135 (100) | 330 (240) | 640 (470) | 2205 (1625) |

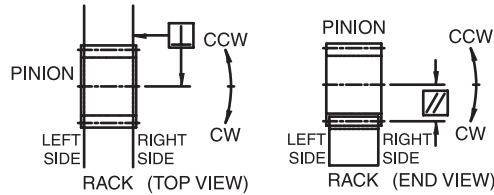
4. Attach the next rack segment to the rack mounting surface. A companion rack should be used to properly space the teeth in between rack segments.



Once again measure the parallelism between the rail and the rack pitch line (as in step # 3). Take special care to measure the parallelism with three pins at the interface of two rack segments:



5. Mount the pinion/gearbox to the rail carriage. Make sure the pinion engages the total face width of the rack. Check 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.



Pinion not perpendicular

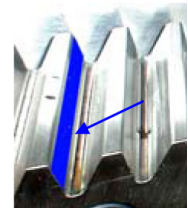
Pinion not parallel

6. Measure the linear backlash between the rack & pinion along the entire axis travel length. A general guide for minimum backlash is shown below:

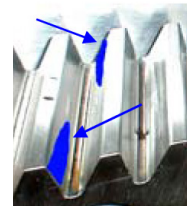
| Rack Quality | Minimum Backlash |
|---------------------|------------------|
| Induction Hardened | 0.20 mm (0.008") |
| Quenched & Tempered | 0.10 mm (0.004") |
| Hardened & Ground | 0.05 mm (0.002") |

7. Run the pinion/gearbox through the entire rack travel length to check for any problems, such as binding or excessive noise. If either is found, return to step #3.

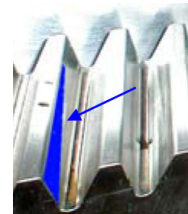
8. Drill dowel pin holes into the rack mounting surface using the pilot holes in racks. Place dowel pins in the holes (two for each rack segment).



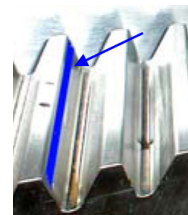
Correct Mesh



Pinion not perpendicular



Pinion not parallel



Incorrect center distance



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