# Worm gear sets

**Catalogue worm gear sets and customised worm gear sets**

Advanced production methods combined with years of experience in manufacturing gears and providing customers with sound advice have made Framo Morat's worm gear sets a byword for quality. In recent decades Framo Morat worm gear sets have won appreciable market shares both in Germany and abroad. Besides our catalogue worm gear sets (made to the Framo Morat standard), which we keep in stock in moderate quantities, we also manufacture customised worm gear sets in compliance with customer specifications. Our catalogue worm gear sets are generally available in a wide range of centre distances and transmission ratios directly from stock. Our factory can calculate and manufacture centre distances and transmission ratios deviating from the Framo Morat standard, although it will not always be possible to use available gear cutting tools.
The worm gear sets are usually right-handed but can be produced left-handed on request. Depending on the transmission ratio, tooling will have to be procured first.

**Pressure Angle**

Due to the manufacturing process, the teeth have a K flank shape. The pressure angle is generally 15° and therefore deviates from the DIN standard of 20°. A pressure angle of 15° allows more favourable radial force component conditions. This reduces the bending stress of the worm shaft and the pushing away of the associated worm gear, reducing the noise and increasing the service life. The efficiency differences due to the modification of the pressure angle are negligible.

**Metric conversion table**

Our standard worm gear sets are primarily designed in metric scales. The catalog data can be converted into 'English measures' by using the following conversion table:

| Metric units | Factor | English units |
|---|---|---|
| Torque (Nm) | x 8.85 | in.lb. |
| Distance (mm) | x 0.03937 | in. |

**ISO-tolerances**

The worm gear drawings show ISO-tolerances like $Ø32^{H7}$. If you are not familiar with ISO-tolerances please call Framo Morat or the local distributor to get the precise dimensions.

**Construction materials**

The worms are made of case hardened steel with ground bore and worm profile. The worm gears are made of a special alloy (copper-zinc alloy with additives of aluminum, silicon and manganese). Chemically this alloy belongs to the material group of CuZn40Al2 DIN 17660 (new according to EN: CuZn37Mn3Al2PbSi-S40) but is treated for better sliding characteristics. The chemical resistance is very high due to aluminum additives.

Mechanical characteristics:
- High corrosion resistance
- High mechanical strength:
  - Tensile strength $R_m$: 560 N/mm²
  - Strain limit $R_{P0,2}$: 290 N/mm²
  - Strain at failure $A_5$: 15%
  - Hardness HB2,5/62,5: 140-170
  - Shearing strength: 470 N/mm²
  - Alternating stress: 170 N/mm² ($20x10^6$ cycles)
- Good gliding characteristics
- High wear resistance

**Plastic worm gears**

Plastic worm gears are suitable for low sliding speeds (< 1.5 m/s) and medium tooth pressure due to their bad thermal conductivity. Worms have to be hardened and ground.
Plastic worm gears are suitable for 50% torque of bronze worm gears.

| Mechanical characteristics: | POM | PA 66 |
|---|---|---|
| Tensile strength $R_m$ with 23°C: | 70 N/mm² | 50 N/mm² |
| Tensile strength $R_m$ with 70°C: | 48 N/mm² | 35 N/mm² |
| Temperature range: | -50 .... +100°C | -40 .... +100°C |





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The thermal expansion coefficient is appr. 4 times higher than with bronze. Therefore the backlash shouldn't be too small. At the limit temperature of 100°C the mechanical values drop to 40% of the nominal values. The case temperature shouldn't exceed 50°C, which means the temperature of the gears must not exceed 70°C.

Market offers a variety of different bronze for worm gears. Some of them are described here. "Soft" bronze is good for higher speed, "hard" bronze' is good for lower speed. "Soft" bronze worm gears can be paired with unhardened steel worms but that means reductions in torque and life time. "Hard" bronze worm gears can only be paired with hardened steel worms.

***Cu Sn 12 DIN 1705***

Comparatively soft material with good wear resistance, suitable for high sliding speeds.

| | *G-CuSn12* | *GZ-CuSn12* | *GC-CuSn12* |
|---|---|---|---|
| Tensile strength $R_m$: | 260 N/mm$^2$ | 280 N/mm$^2$ | 280 N/mm$^2$ |
| Strain limit $R_{p0,2}$: | 140 N/mm$^2$ | 150 N/mm$^2$ | 140 N/mm$^2$ |
| Strain at failure $A_5$: | 12 % | 5 % | 8 % |
| Hardness HB10: | 80 | 95 | 90 |

***Cu Sn 12 Ni DIN 1705***

Comparatively soft material with very good wear resistance, suitable for very high sliding speeds.

| | *G-CuSn12Ni* | *GZ-CuSn12Ni* | *GC-CuSn12Ni* |
|---|---|---|---|
| Tensile strength $R_m$: | 280 N/mm$^2$ | 300 N/mm$^2$ | 300 N/mm$^2$ |
| Strain limit $R_{p0,2}$: | 160 N/mm$^2$ | 180 N/mm$^2$ | 170 N/mm$^2$ |
| Strain at failure $A_5$: | 14 % | 8 % | 10 % |
| Hardness HB10: | 90 | 100 | 90 |

G = dead mold casting
GZ = centrifugal casting
GC = continuous casting

***CuAl10Fe3 Mn2 DIN 17665 / 17672***

Comparatively hard material for high torque and low speed.

| | *CuAl10Fe3 Mn2* | *CuAl10Ni5F4* |
|---|---|---|
| Tensile strength $R_m$: | 590 N/mm$^2$ | 700 N/mm$^2$ |
| Strain limit $R_{p0,2}$: | 250 N/mm$^2$ | 300 N/mm$^2$ |
| Strain at failure $A_5$: | 12 % | 13% |
| Hardness HB 2,5 / 62,5: | 150 | 160 |

**Torque factor**

The catalog torque ratings are based on 2,800 rpm worm speed. The following table shows the torque factors for different worm speeds:

| $n_1$ | 2800 rpm | 1400 rpm | 950 rpm | 700 rpm | 500 rpm | 250 rpm | 125 rpm |
|---|---|---|---|---|---|---|---|
| Factor $n_1$ | 1 | 1,12 | 1,2 | 1,26 | 1,33 | 1,49 | 1,67 |

**Lifetime factor**

The catalog torque ratings are based on 3000 hours expected lifetime. The following table shows the torque ratings for different lifetimes:

| life time | appr. 3000 h | appr. 1500 h | appr. 6000 h |
|---|---|---|---|
| factor $L_h$ | 1 | 1,4 | 0,71 |



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# Worm gear sets

**1. Calculation example (*without* consideration of the operating conditions)**

worm gear set A40 U35, lubrication with mineral oil,
worm speed 700 $min^{-1}$, life time 1500 h

Question: What's the expected maximum torque?

**Output torque:** $=T_2$ (Mineral oil) x $n_1$ (Factor) x $L_h$ (Factor)

= 37,2 Nm x 1,26 x 1,4 $T_2$ see table on page 14

= 65,6 Nm

**Attention!** The torque is limited by the tooth strength of the gear. The tooth strength is reached at approx. 300% of the catalog specification for synthetic oil ($T_2$ SO).
EXAMPLE: Breaking point for A40 U35 = 46,5 Nm x 3 = 139,5 Nm.

**Application factors**
Due to the wide range of applications the following factors are recommendations which enable the customer to choose the correct configuration. The case temperature shouldn't exceed 80°C.

| Shocks | none | moderate | heavy |
|---|---|---|---|
| shock factor $f_1$ | 1 | 1,2 | 1,5 |

| No. of starts | 10/h | 60/h | 360/h |
|---|---|---|---|
| start factor $f_2$ | 1 | 1,1 | 1,2 |

| duty cycle | <40 % | <70 % | <100 % |
|---|---|---|---|
| duty cycle factor $f_3$ | 1 | 1,15 | 1,3 |

**2. Calculation example (*with* consideration of the operating conditions)**

worm gear set A40 Ü35; $T_2$ = 65,6 Nm (see above), but with the following operating conditions:
- heavy shocks
- 360 starts / h
- 100 % duty cycle

Output torque $= \frac{T_2}{f_1 \times f_2 \times f_3}$

$= \frac{65{,}6 \text{ Nm}}{1{,}5 \times 1{,}2 \times 1{,}3}$

= 28 Nm

**The relationship between life time, speed and torque can be calculated by these simplified formulas**

Calculation of the life time ($L_{h\,neu}$) with given torque ($T_{2\,neu}$)

$$L_{h\,neu} = \left( \frac{T_{2\,Nenn.} \times \text{Factor } n_1}{T_{2\,neu}} \right)^2 \cdot L_{h\,Nenn}$$

$T_{2\,Nenn.}$=Output torque (catalog specification)

$L_{h\,Nenn}$= Life time (catalog specification ca. 3000 h)



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# Worm gear sets

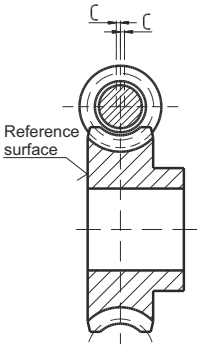
Calculation of the torque ($T_{2\,neu}$) with given life time ($L_{hneu}$)

$$T_{2\,neu} = \frac{T_{2\,Nenn.} \times \text{Factor } n_1}{\sqrt{\frac{L_{h\,neu}}{L_{h\,Nenn}}}}$$

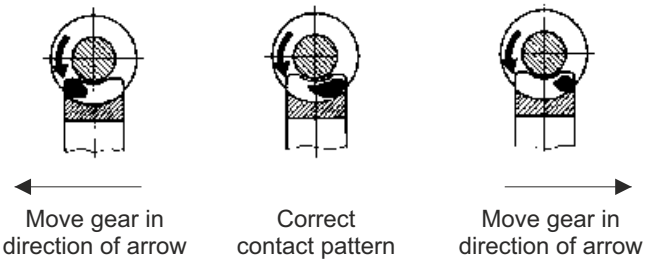
**Self locking**
Self-locking is affected by lead angle, surface quality, running speed, lubrication and temperature. A distinction must be made between dynamic (from motion) and static (standstill) self-locking.
**Dynamic self locking:** lead angle up to 3° with grease lubrication; lead angle up to 2,5° with synthetic oil lubrication.
**Static self locking:** lead angle from 3° up to 5° with grease lubrication; lead angle from 2,5° up to 4,5° with synthetic oil lubrication.
Lead angles above 4,5° or 5° are not self locking.

Shocks or vibrations can neutralize self-locking.
A number of factors associated with lubrication, running speed and loading can favour slip characteristics to such an extent that self-locking is counteracted.
Therefore it is impossible for us to accept warranty obligations in respect to self-locking.

**Mounting of the worm gear**




Use the reference surface for latheral adjustment. The latheral tolerance “c” must not exceed 0,15 mm regardless of the center dictance.




The contact pattern shows installation errors. The contact pattern should tend to the outgoing side. In case of reversing operation the contact pattern should tend to the center of the worm gear.

**Efficiency**
Generally efficiency depends on the following conditions:
• lead angle of the worm,
• running speed,
• lubrication,
• surface quality,
• mounting conditions.

The efficiency increases with growing center distance. The use of plain bearings with high coefficients of friction may affect the overall efficiency. The stated efficiency values apply for optimum mounting conditions.

**Starting efficiency**
The lubricating film between the flanks is not formed until the gear is running. That is the reason for a lower starting efficiency (approx. 30% below running efficiency).



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**Efficiency with driving worm gear**
The efficiency with driving worm gear is smaller than with driving worm. The following formula can be used:

$$\eta' = 2 - \frac{1}{\eta}$$

with: $\eta'$ => efficiency with driving worm gear
$\eta$ => efficiency with driving worm (specified in catalog)

if $\eta'$ is negative, self locking is likely.

**Customer-Specific Worm Gear Sets**
Customised worm gear sets can be manufactured in compliance with customer specifications in various versions and materials.
Framo Morat supplies customised worm gear sets in a centre distance range from 17 to 125 mm, with a max. worm gear diameter of 200 mm. If necessary, Framo Morat calculates the toothing data, defines the materials and surface treatment, and provides advice for lubrication and torque loads.
We use to that purpose a calculation programme based on the DIN standard. Framo Morat's vast experience gained all along 60 years of worm gear sets production has shown that, especially in the case of short delivery times and small quantities, our customer mainly opt for existing gear cutting tools. The production method must then be examined on a case-by-case basis.

**Crossed helical gears**
Crossed helical gears are nothing but a spur gear, which helix angle meets the lead angle of the worm. The gliding surface is only a line. The result is reduced torque or reduced life time compared with conventional worm gear sets.



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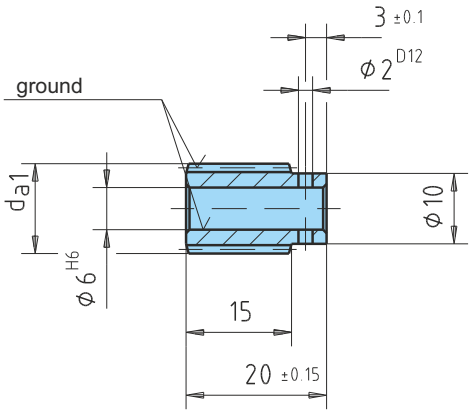
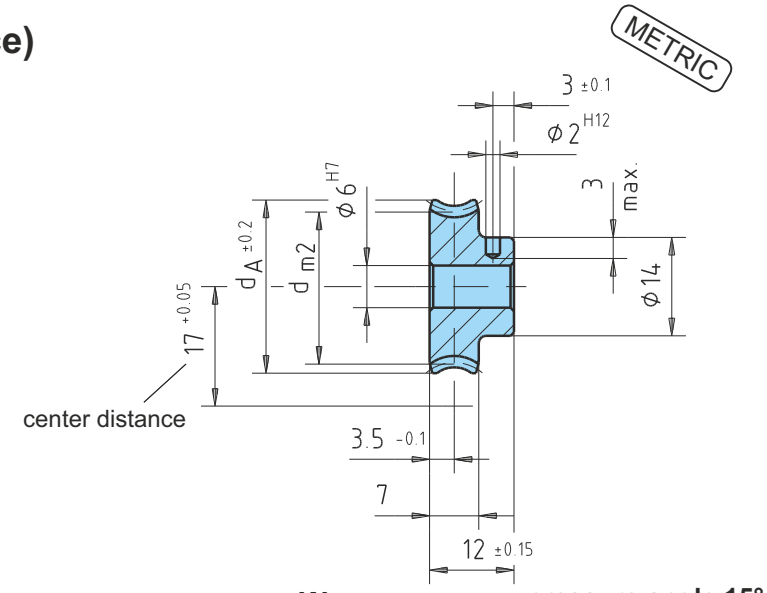
# A17 (17 mm center distance)




**Worm**




**Wormgear** **pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | worm | | | | | | wormgear | | | $T_2$ [Nm] No. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bronze | | | Phe- |
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A17U2*** | 2.25 | 48°15' | 0.9 | 8 | 10.15 | 11.95 | 18 | 23.85 | 25.63 | 1.1 | 1.3 | 1.6 | 0.4 |
| **A17U4** | 4.5 | 21°50' | 0.75 | 6 | 12.1 | 13.6 | 27 | 21.9 | 24.6 | 1.7 | 2.0 | 2.6 | 0.7 |
| **A17U5** | 5 | 21°37' | 0.7 | 6 | 11.4 | 12.8 | 30 | 22.6 | 24.6 | 1.8 | 2.2 | 2.7 | 0.7 |
| **A17U7** | 7 | 14°4' | 1 | 3 | 12.34 | 14.34 | 21 | 21.66 | 24.6 | 1.6 | 1.9 | 2.4 | 0.6 |
| **A17U9** | 9 | 9°40' | 0.75 | 3 | 13.4 | 14.9 | 27 | 20.6 | 22.7 | 1.5 | 1.8 | 2.2 | 0.6 |
| **A17U10** | 10 | 11°48' | 0.75 | 3 | 11.0 | 12.5 | 30 | 23.0 | 24.6 | 1.9 | 2.3 | 2.8 | 0.8 |
| **A17U15** | 15 | 7°38' | 0.75 | 2 | 11.3 | 12.8 | 30 | 22.7 | 24.6 | 1.9 | 2.3 | 2.8 | 0.8 |
| **A17U25** | 25 | 4°32' | 0.9 | 1 | 11.4 | 13.2 | 25 | 22.6 | 24.6 | 1.8 | 2.2 | 2.7 | 0.7 |
| **A17U30** | 30 | 3°45' | 0.75 | 1 | 11.45 | 12.95 | 30 | 22.55 | 24.6 | 1.9 | 2.3 | 2.8 | 0.8 |
| **A17U40** | 40 | 2°3' | 0.5 | 1 | 13.98 | 14.98 | 40 | 20.02 | 21.6 | 1.4 | 1.7 | 2.1 | 0.6 |
| **A17U50**** | 50 | 3°12' | 0.5 | 1 | 8.95 | 9.95 | 50 | 25.05 | 27.2 | 1.0 | 1.2 | 1.5 | 0.4 |
| **A17U60** | 60 | 2°18' | 0.4 | 1 | 9.95 | 10.75 | 60 | 24.05 | 26.0 | 1.6 | 1.9 | 2.4 | 0.6 |
| **A17U75** | 75 | 1°28' | 0.3 | 1 | 11.74 | 12.34 | 75 | 22.26 | 24.0 | - | - | - | - |
| **A17U80** | 80 | 1°43' | 0.3 | 1 | 10.0 | 10.6 | 80 | 24.0 | 26.0 | - | - | - | - |

* Worm gear set A17U2 only available with polished worm profile and crossed helical gear.

** The hub diameter of the A17U50 worm is 9 mm.

All worms and worm gears stocked right hand only.
Worm made of case hardened and ground steel (HV 620 - 700).
Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083). Phenolic worm gears do not have the pre-drilled start for a pin. The outside diameter of the phenolic gear hub is 18 mm.



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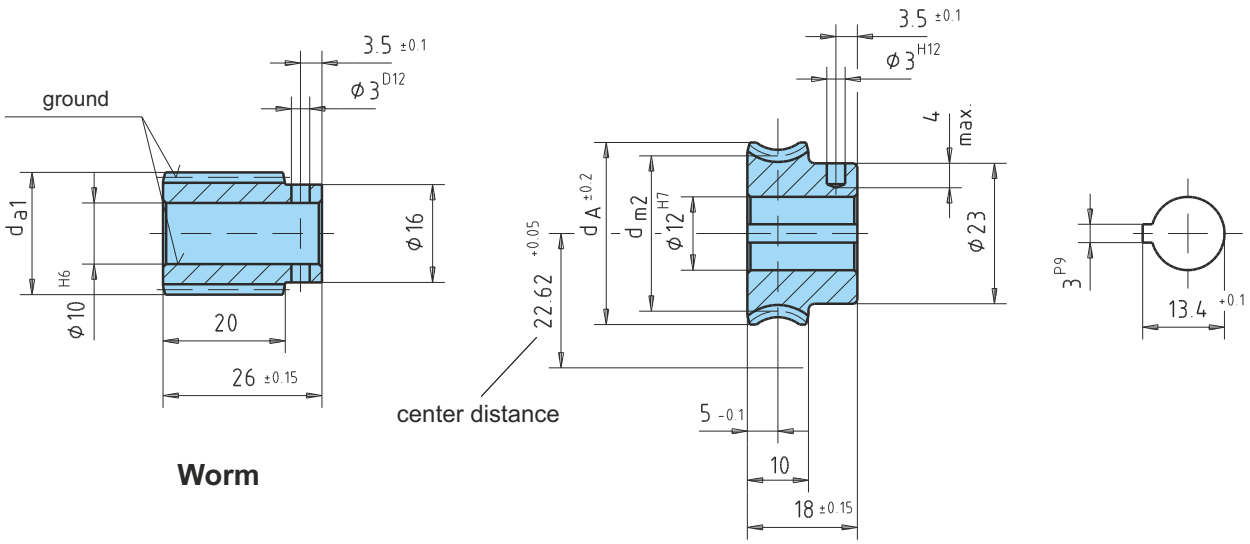
# Worm gear sets

METRIC

## A22 (22.62 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] No. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bronze | | | Phe- |
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A22U3** | 3:1 | 17°36' | 1.0 | 7 | 23.15 | 25.15 | 21 | 22.09 | 24.8 | 2.2 | 2.6 | 3.3 | 0.9 |
| **A22U4** | 4:1 | 19°32' | 1.25 | 5 | 18.7 | 21.2 | 20 | 26.54 | 29.8 | 3.6 | 4.3 | 5.4 | 1.4 |
| **A22U7** | 7:1 | 11°46' | 1.25 | 3 | 18.4 | 20.9 | 21 | 26.84 | 29.8 | 3.6 | 4.3 | 5.4 | 1.4 |
| **A22U11** | 10.5:1 | 7°41' | 1.25 | 2 | 18.7 | 21.2 | 21 | 26.54 | 29.8 | 3.4 | 4.1 | 5.1 | 1.4 |
| **A22U21** | 21:1 | 3°48' | 1.25 | 1 | 18.9 | 21.4 | 21 | 26.34 | 29.8 | 3.4 | 4.1 | 5.1 | 1.4 |
| **A22U30** | 30:1 | 2°50' | 0.9 | 1 | 18.2 | 20 | 30 | 27.04 | 29.8 | 3.6 | 4.3 | 5.4 | 1.4 |
| **A22U40** | 40:1 | 2°20' | 0.7 | 1 | 17.2 | 18.6 | 40 | 28.04 | 29.8 | 3.9 | 4.7 | 5.8 | 1.6 |

All worms and worm gears stocked right hand only.
Worm made of case hardened and ground steel (HV 620 - 700).
Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083).



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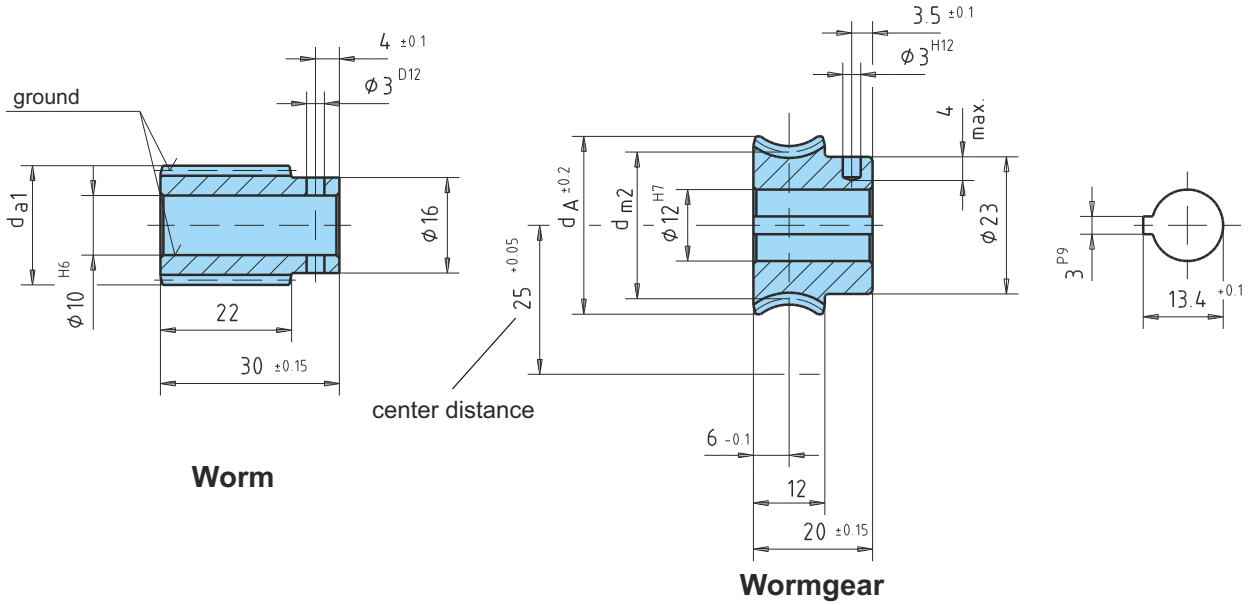
METRIC

# A25 (25 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)
$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of theeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | worm | | | | | | wormgear | | | $T_2$ [Nm] No. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bronze | | | Phe- |
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A25U4** | 4:1 | 20°29' | 1.4 | 5 | 20 | 22.8 | 20 | 30.0 | 33.5 | 5.1 | 6.1 | 7.6 | 2.0 |
| **A25U5** | 5:1 | 19°15' | 1.5 | 4 | 18.2 | 21.2 | 20 | 31.8 | 34.8 | 6.5 | 7.8 | 9.7 | 2.6 |
| **A25U6** | 6.5:1 | 13°52' | 1.15 | 4 | 19.2 | 21.5 | 26 | 30.8 | 34.8 | 6 | 7.2 | 9 | 2.4 |
| **A25U10** | 10:1 | 8°48' | 1.5 | 2 | 19.6 | 22.6 | 20 | 30.4 | 34.8 | 5.9 | 7.1 | 8.8 | 2.4 |
| **A25U15** | 15:1 | 6°29' | 1.0 | 2 | 17.7 | 19.7 | 30 | 32.3 | 34.8 | 5.7 | 6.8 | 8.5 | 2.3 |
| **A25U20** | 20:1 | 4°19' | 1.5 | 1 | 19.9 | 22.9 | 20 | 30.1 | 34.8 | 5.8 | 7.0 | 8.7 | 2.3 |
| **A25U25** | 25:1 | 2°18' | 1.0 | 1 | 24.96 | 26.96 | 25 | 25.04 | 27.8 | 4.1 | 4.9 | 6.1 | 1.6 |
| **A25U30** | 30:1 | 2°53' | 1.0 | 1 | 19.9 | 21.9 | 30 | 30.1 | 33.5 | 5.9 | 7.1 | 8.8 | 2.4 |
| **A25U40** | 40:1 | 2°33' | 0.8 | 1 | 17.96 | 19.56 | 40 | 32.04 | 34.8 | 6.2 | 7.4 | 9.3 | 2.5 |
| **A25U50** | 50:1 | 1°43' | 0.6 | 1 | 19.96 | 21.16 | 50 | 30.04 | 33.5 | 5.1 | 6.1 | 7.6 | 2.0 |

All worms and worm gears stocked right hand only.
Worm made of case hardened and ground steel (HV 620 - 700).
Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083).



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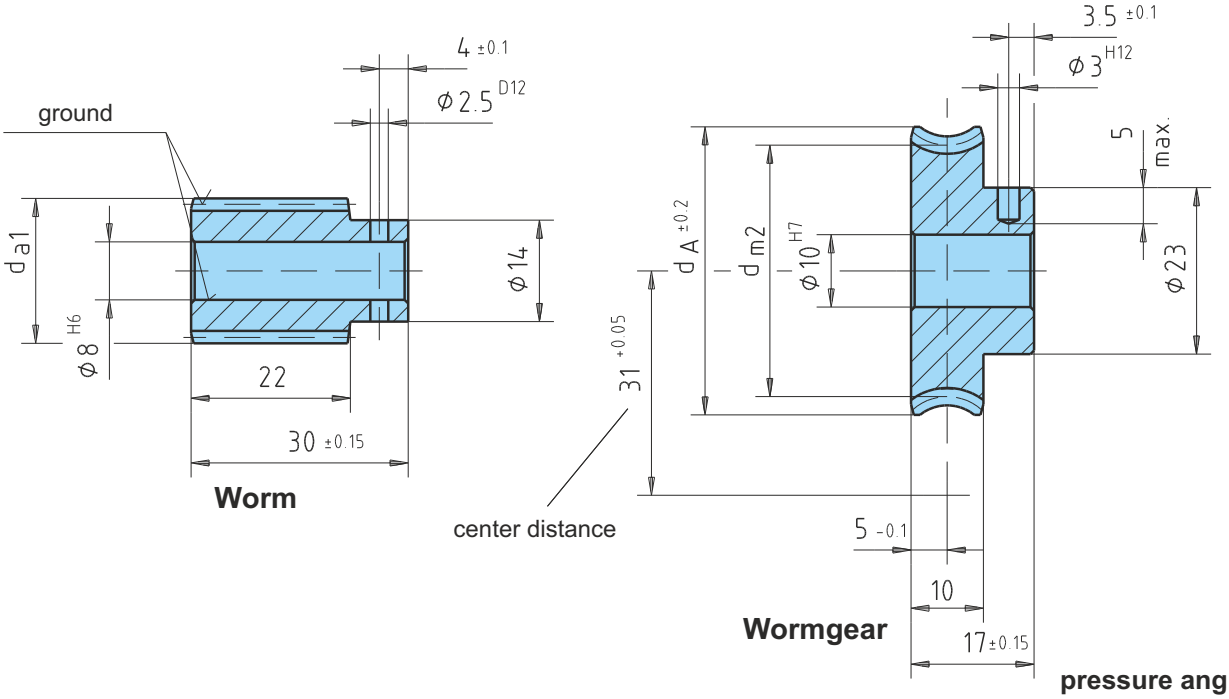
# Worm gear sets

METRIC

## A31 (31 mm center distance)




i = gear ratio
$_m$ = lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | worm | | | | wormgear | | | $T_2$ [Nm] No. Bronze | | | Phe- |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A31U2*** | 2.5:1 | 45°15' | 1.25 | 10 | 17.6 | 20.1 | 25 | 44.4 | 46.9 | 4.4 | 5.3 | 6.6 | 1.7 |
| **A31U3*** | 3:1 | 35°10' | 1.15 | 10 | 19.97 | 22.27 | 30 | 42.03 | 44.5 | 4.5 | 5.4 | 6.7 | 1.8 |
| **A31U4** | 4.28:1 | 25°24' | 1.25 | 7 | 20.4 | 22.9 | 30 | 41.6 | 45 | 9 | 10.8 | 13.5 | 3.6 |
| **A31U5** | 5:1 | 23°46' | 1.3 | 6 | 19.35 | 21.95 | 30 | 42.65 | 46.5 | 9.5 | 11.4 | 14.2 | 3.8 |
| **A31U6** | 6:1 | 18°13' | 1.3 | 5 | 20.8 | 23.4 | 30 | 41.2 | 45 | 7.6 | 9.1 | 11.4 | 3.0 |
| **A31U7** | 7:1 | 20°32' | 1.5 | 4 | 17.1 | 20.1 | 28 | 44.9 | 48.8 | 9.7 | 11.6 | 14.5 | 3.9 |
| **A31U8** | 8.33:1 | 19°49' | 1.75 | 3 | 15.5 | 19 | 25 | 46.5 | 51 | 10 | 12 | 15 | 4.0 |
| **A31U10** | 10:1 | 12°50' | 1.4 | 3 | 18.9 | 21.7 | 30 | 43.1 | 47 | 9.5 | 11.4 | 14.2 | 3.8 |
| **A31U12** | 12:1 | 13°55' | 1.25 | 3 | 15.6 | 18.1 | 36 | 46.4 | 50 | 12.1 | 14.5 | 18.1 | 4.8 |
| **A31U15** | 15:1 | 10°40' | 1.5 | 2 | 16.2 | 19.2 | 30 | 45.8 | 50 | 10.7 | 12.8 | 16 | 4.3 |
| **A31U18/1.25** | 18:1 | 8°44' | 1.25 | 2 | 16.46 | 18.96 | 36 | 45.54 | 48.8 | 10.3 | 12.4 | 15.4 | 4.1 |
| **A31U20/0.75** | 20:1 | 7°49' | 0.75 | 3 | 16.54 | 18.04 | 60 | 45.46 | 48 | 8.3 | 10 | 12.4 | 3.3 |
| **A31U20/1.15** | 20:1 | 8°33' | 1.15 | 2 | 15.47 | 17.77 | 40 | 46.53 | 50 | 10.3 | 12.4 | 15.4 | 4.1 |
| **A31U22** | 22:1 | 6°29' | 1 | 2 | 17.7 | 19.7 | 44 | 44.3 | 48 | 9.6 | 11.5 | 14.4 | 3.8 |
| **A31U23** | 23:1 | 7°29' | 2 | 1 | 15.35 | 19.35 | 23 | 46.65 | 52 | 10.5 | 12.6 | 15.7 | 4.2 |
| **A31U24** | 24:1 | 5°4' | 1.75 | 1 | 19.8 | 23.3 | 24 | 42.2 | 47 | 9.2 | 11 | 13.8 | 3.7 |

* Worm gear set only available with polished worm profile and crossed helical gear.

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083). Also available with keyway 3P9.



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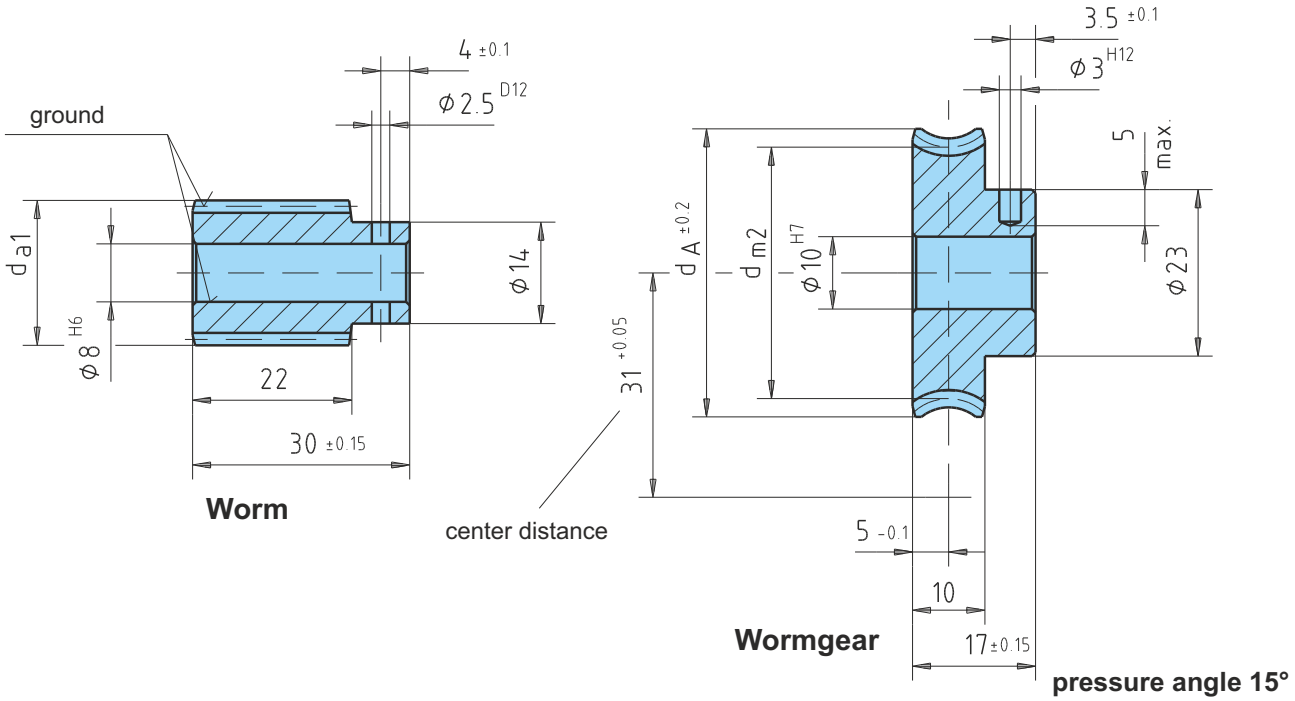
METRIC

# A31 (31 mm center distance)




i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] No. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bronze | | | Phe- |
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A31U25** | 25:1 | 5°35' | 1.75 | 1 | 18 | 21.5 | 25 | 44 | 48.5 | 9.6 | 11.5 | 14.4 | 3.8 |
| **A31U28** | 28:1 | 4°20' | 1.5 | 1 | 19.85 | 22.85 | 28 | 42.15 | 46.5 | 9.1 | 10.9 | 13.6 | 3.6 |
| **A31U30** | 30:1 | 5°7' | 1.5 | 1 | 16.8 | 19.8 | 30 | 45.2 | 48.8 | 10.3 | 12.4 | 15.4 | 4.1 |
| **A31U32** | 32:1 | 4°45' | 1.4 | 1 | 16.9 | 19.7 | 32 | 45.1 | 48.8 | 10.2 | 12.2 | 15.3 | 4.1 |
| **A31U38** | 38:1 | 5°1' | 1.25 | 1 | 14.3 | 16.8 | 38 | 47.7 | 51.2 | 11.4 | 13.7 | 17.1 | 4.6 |
| **A31U45** | 45:1 | 3°23' | 1 | 1 | 16.93 | 18.93 | 45 | 45.07 | 48 | 9.5 | 11.4 | 14.2 | 3.8 |
| **A31U50** | 50:1 | 3°3' | 0.9 | 1 | 16.9 | 18.7 | 50 | 45.1 | 48 | 9 | 10.8 | 13.5 | 3.6 |
| **A31U55** | 55:1 | 4°12' | 0.9 | 1 | 12.3 | 14.1 | 55 | 49.7 | 52 | 10.4 | 12.5 | 15.6 | 4.2 |
| **A31U60** | 60:1 | 2°33' | 0.75 | 1 | 16.9 | 18.4 | 60 | 45.1 | 48 | 8.2 | 9.8 | 12.3 | 3.3 |
| **A31U70** | 70:1 | 3°7' | 0.7 | 1 | 12.9 | 14.3 | 70 | 49.1 | 52 | 9 | 10.8 | 13.5 | 3.6 |
| **A31U75** | 75:1 | 2°2' | 0.6 | 1 | 16.9 | 18.1 | 75 | 45.1 | 47 | 7.3 | 8.8 | 10.9 | 2.9 |
| **A31U90** | 90:1 | 1°41' | 0.5 | 1 | 17 | 18 | 90 | 45 | 48 | 6.4 | 7.7 | 9.6 | 2.6 |
| **A31U100** | 100:1 | 2°24' | 0.5 | 1 | 11.96 | 12.96 | 100 | 50.04 | 52.7 | 7.4 | 8.9 | 11.1 | 3.0 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083). Also available with keyway 3P9.



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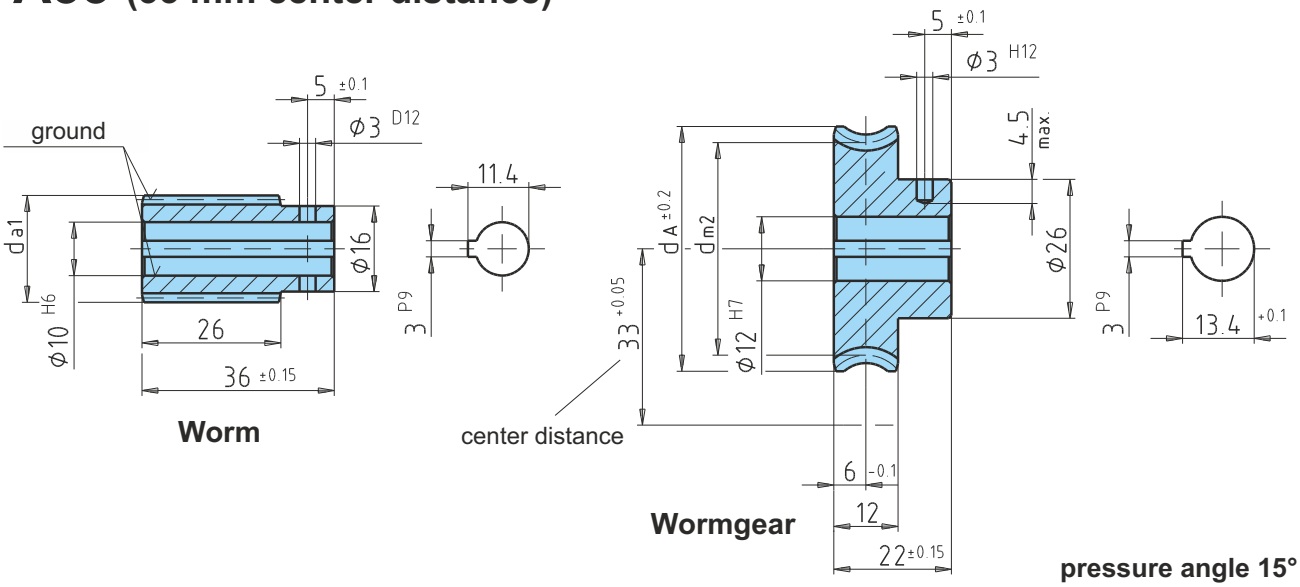
# Worm gear sets

FramoMorat
Franz Morat Group

METRIC

## A33 (33 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

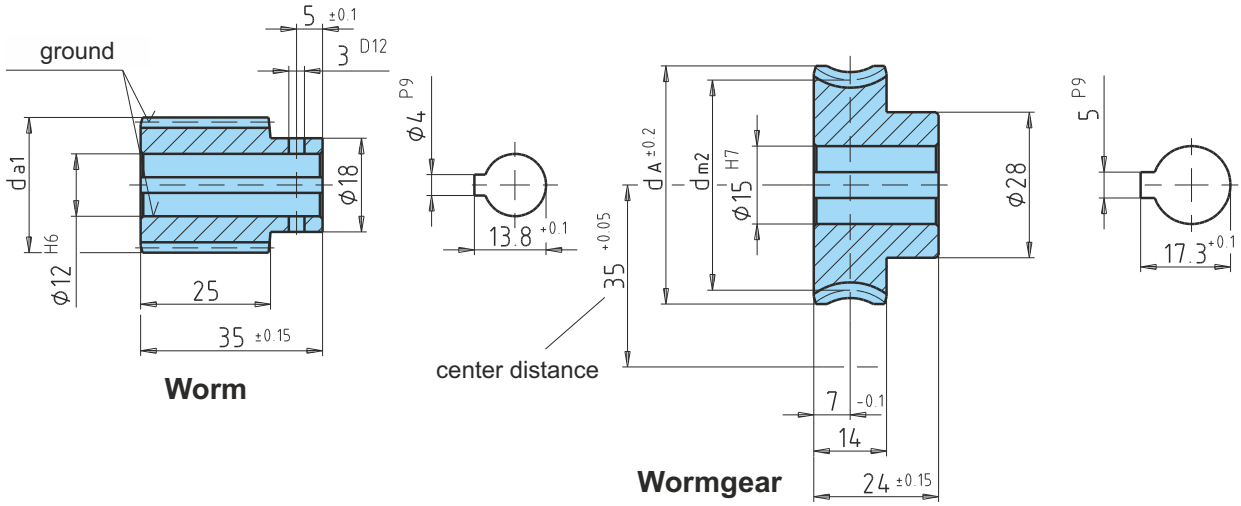
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | worm | | | | | | wormgear | | | $T_2$ [Nm] No. | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Bronze | | | Phe- |
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO | nolic |
| **A33U3** | 3.5:1 | 25°57' | 1.75 | 6 | 24 | 27.5 | 21 | 42 | 47 | 10.1 | 12.1 | 15.1 | 4.0 |
| **A33U5** | 5:1 | 20°50' | 2 | 4 | 22.5 | 26.5 | 20 | 43.5 | 49 | 10.6 | 12.7 | 15.9 | 4.2 |
| **A33U7** | 7:1 | 15°32' | 1.5 | 4 | 22.4 | 25.4 | 28 | 43.6 | 48 | 12.2 | 14.6 | 18.3 | 4.9 |
| **A33U10** | 10:1 | 13°10' | 1.5 | 3 | 19.75 | 22.75 | 30 | 46.25 | 51 | 13.3 | 16 | 19.9 | 5.3 |
| **A33U11** | 11.33:1 | 10°42' | 1.3 | 3 | 21 | 23.6 | 34 | 45 | 49.2 | 13.3 | 16 | 19.9 | 5.3 |
| **A33U12** | 12:1 | 11°14' | 1.9 | 2 | 19.5 | 23.3 | 24 | 46.5 | 52 | 13.5 | 16.2 | 20.2 | 5.4 |
| **A33U14** | 14:1 | 7°20' | 1.5 | 2 | 23.5 | 26.5 | 28 | 42.5 | 47 | 11.4 | 13.7 | 17.1 | 4.6 |
| **A33U15** | 15:1 | 8°25' | 1.5 | 2 | 20.5 | 23.5 | 30 | 45.5 | 50 | 13 | 15.6 | 19.5 | 5.2 |
| **A33U16** | 16:1 | 10°1' | 1.5 | 2 | 17.24 | 20.24 | 32 | 48.76 | 53 | 14 | 16.8 | 21 | 5.6 |
| **A33U17** | 17:1 | 9°3' | 1.4 | 2 | 17.8 | 20.6 | 34 | 48.2 | 52.5 | 14.2 | 17 | 21.3 | 5.7 |
| **A33U18** | 18:1 | 6°57' | 1.25 | 2 | 20.65 | 23.15 | 36 | 45.35 | 49.2 | 12.6 | 15.1 | 18.9 | 5.0 |
| **A33U20** | 20:1 | 6°43' | 1.15 | 2 | 19.66 | 21.96 | 40 | 46.34 | 50.5 | 12.7 | 15.2 | 19 | 5.1 |
| **A33U24** | 24:1 | 5°27' | 1.9 | 1 | 20 | 23.8 | 24 | 46 | 51 | 13.2 | 15.8 | 19.8 | 5.3 |
| **A33U28** | 28:1 | 3°36' | 1.5 | 1 | 23.9 | 26.9 | 28 | 42.1 | 46.6 | 11.2 | 13.4 | 16.8 | 4.5 |
| **A33U30** | 30:1 | 4°8' | 1.5 | 1 | 20.85 | 23.85 | 30 | 45.15 | 50 | 12.7 | 15.2 | 19 | 5.1 |
| **A33U32** | 32:1 | 4°50' | 1.5 | 1 | 17.8 | 20.8 | 32 | 48.2 | 52.5 | 13.5 | 16.2 | 20.2 | 5.4 |
| **A33U38** | 38:1 | 3°55' | 1.25 | 1 | 18.26 | 20.76 | 38 | 47.74 | 51.6 | 13.9 | 16.7 | 20.8 | 5.6 |
| **A33U50** | 50:1 | 2°27' | 0.9 | 1 | 21 | 22.8 | 50 | 45 | 48 | 10 | 12 | 15 | 4.0 |
| **A33U56** | 56:1 | 2°10' | 0.8 | 1 | 21.15 | 22.75 | 56 | 44.85 | 48 | 10.1 | 12.1 | 15.1 | 4.0 |
| **A33U60** | 60:1 | 2°33' | 0.8 | 1 | 17.96 | 19.56 | 60 | 48.04 | 51.5 | 11.4 | 13.7 | 17.1 | 4.6 |
| **A33U72** | 72:1 | 1°30' | 0.6 | 1 | 22.8 | 24 | 72 | 43.2 | 46 | 8.4 | 1001 | 12.6 | 3.4 |
| **A33U75** | 75:1 | 1°41' | 0.6 | 1 | 20.5 | 21.7 | 75 | 45.5 | 48 | 9 | 10.8 | 13.5 | 3.6 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So or phenolic (Hgw 2083).

METRIC

# A35 (35 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$ = lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A35U3*** | 2.78:1 | 31°01' | 1.5 | 9 | 26.2 | 29.2 | 25 | 43.8 | 46.76 | 6.6 | 8.2 | 10.2 |
| **A35U5** | 5:1 | 22°52' | 1.75 | 5 | 22.52 | 26.02 | 25 | 47.48 | 53 | 15.3 | 18.4 | 22.9 |
| **A35U7** | 7.25:1 | 13°47' | 1.5 | 4 | 25.18 | 28.18 | 29 | 44.82 | 50 | 14.7 | 17.6 | 22 |
| **A35U8** | 8:1 | 14°25' | 1.9 | 3 | 22.89 | 26.69 | 24 | 47.11 | 53 | 16.7 | 20 | 25 |
| **A35U10** | 10:1 | 10°43' | 1.5 | 3 | 24.2 | 27.2 | 30 | 45.8 | 51 | 16 | 19.2 | 24 |
| **A35U11** | 11:1 | 10°32' | 1.4 | 3 | 22.98 | 25.78 | 33 | 47.02 | 52 | 16.7 | 20 | 25 |
| **A35U12** | 12:1 | 9°11' | 1.9 | 2 | 23.8 | 27.6 | 24 | 46.2 | 52 | 16.1 | 19.3 | 24 |
| **A35U15** | 15:1 | 7° | 1.5 | 2 | 24.62 | 27.62 | 30 | 45.38 | 50 | 15.3 | 18.4 | 22.9 |
| **A35U20** | 20:1 | 5°33' | 1.15 | 2 | 23.78 | 26.08 | 40 | 46.22 | 50.5 | 14.8 | 17.8 | 22.2 |
| **A35U25** | 25:1 | 4°9' | 0.9 | 2 | 24.87 | 26.67 | 50 | 45.13 | 49 | 12.9 | 15.5 | 19.3 |
| **A35U30** | 30:1 | 3°27' | 1.5 | 1 | 24.92 | 27.92 | 30 | 45.08 | 50 | 15 | 18 | 22.5 |
| **A35U35** | 35:1 | 3°51' | 1.4 | 1 | 20.85 | 23.65 | 35 | 49.15 | 53 | 17.1 | 20.5 | 25.6 |
| **A35U40** | 40:1 | 2°45' | 1.15 | 1 | 23.91 | 26.21 | 40 | 46.09 | 50.5 | 14.7 | 17.6 | 22 |
| **A35U50** | 50:1 | 2°4' | 0.9 | 1 | 24.93 | 26.73 | 50 | 45.07 | 49 | 12.9 | 15.5 | 19.3 |
| **A35U58** | 58:1 | 2°21' | 0.85 | 1 | 20.65 | 22.35 | 58 | 49.35 | 53 | 14.5 | 17.4 | 21.7 |
| **A35U90** | 90:1 | 1°9' | 0.5 | 1 | 25 | 26 | 90 | 45 | 49 | 9.1 | 10.9 | 13.6 |

* The worm gear of the A35U3 gear set can also be delivered as a crossed helical gear, pressure angle 20°.

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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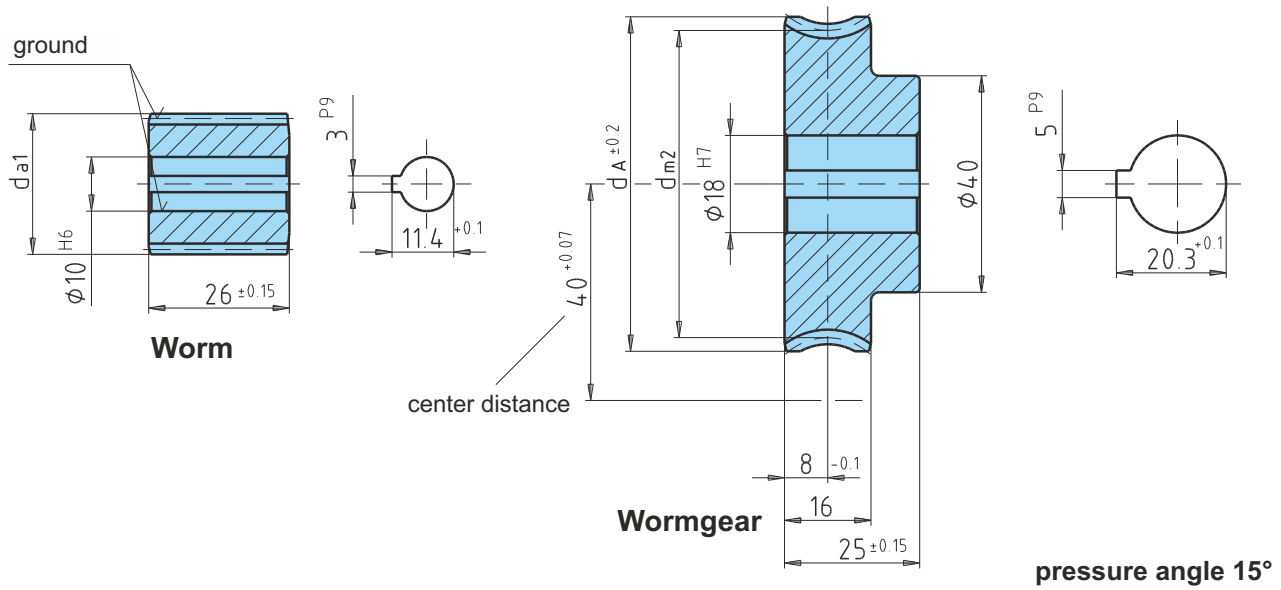
# Worm gear sets

FramoMorat
Franz Morat Group

METRIC

## A40 (40 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$ = lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A40U7** | 6.75:1 | 21°19' | 2 | 4 | 22 | 26 | 27 | 58 | 64 | 29.5 | 35.4 | 44.2 |
| **A40U8** | 8:1 | 16°35' | 2.25 | 3 | 23.64 | 28.14 | 24 | 56.36 | 62.5 | 27.5 | 33 | 41.2 |
| **A40U10** | 10:1 | 16°1' | 1.9 | 3 | 20.66 | 24.46 | 30 | 59.34 | 65 | 29.5 | 35.4 | 44.2 |
| **A40U12** | 12:1 | 10°21' | 1.5 | 3 | 25.05 | 28.05 | 36 | 54.95 | 60 | 25.2 | 30.2 | 37.8 |
| **A40U15** | 15:1 | 9°53' | 1.9 | 2 | 22.14 | 25.94 | 30 | 57.86 | 64 | 28 | 33.6 | 42 |
| **A40U20** | 20:1 | 8°59' | 1.5 | 2 | 19.2 | 22.2 | 40 | 60.8 | 66 | 28.9 | 34.6 | 43.3 |
| **A40U25** | 25:1 | 5°58' | 1.15 | 2 | 22.15 | 24.45 | 50 | 57.85 | 62 | 24.4 | 29.2 | 36.6 |
| **A40U28** | 28:1 | 4°47' | 2 | 1 | 24 | 28 | 28 | 56 | 61.5 | 28.4 | 34 | 42.6 |
| **A40U30** | 30:1 | 5°50' | 2 | 1 | 19.68 | 23.68 | 30 | 60.32 | 66 | 30.1 | 36.1 | 45.1 |
| **A40U35** | 35:1 | 5°26' | 1.75 | 1 | 18.48 | 21.98 | 35 | 61.52 | 67 | 31 | 37.2 | 46.5 |
| **A40U36** | 36:1 | 3°19 | 1.5 | 1 | 25.91 | 28.91 | 36 | 54.09 | 59 | 23.9 | 28.6 | 35.8 |
| **A40U40** | 40:1 | 4°20' | 1.5 | 1 | 19.83 | 22.83 | 40 | 60.17 | 65 | 28.3 | 33.9 | 42.4 |
| **A40U50** | 50:1 | 4°8' | 1.25 | 1 | 17.3 | 19.8 | 50 | 62.7 | 68 | 27 | 32.4 | 40.5 |
| **A40U56** | 56:1 | 2°23' | 1 | 1 | 24 | 26 | 56 | 56 | 59 | 21.9 | 26.2 | 32.8 |
| **A40U60** | 60:1 | 1°59' | 0.9 | 1 | 25.92 | 27.72 | 60 | 54.08 | 57.5 | 19.3 | 23.1 | 28.9 |
| **A40U70** | 70:1 | 3°3' | 0.9 | 1 | 16.91 | 18.71 | 70 | 63.09 | 67 | 24.1 | 28.9 | 36.1 |
| **A40U75** | 75:1 | 1°48' | 0.75 | 1 | 23.75 | 25.25 | 75 | 56.26 | 60 | 18.8 | 22.5 | 28.2 |
| **A40U80** | 80:1 | 2°10' | 0.75 | 1 | 19.9 | 21.4 | 80 | 60.1 | 64 | 20.1 | 24.1 | 30.1 |
| **A40U90** | 90:1 | 2°22' | 0.7 | 1 | 16.95 | 18.35 | 90 | 63.05 | 67 | 19.1 | 22.9 | 28.6 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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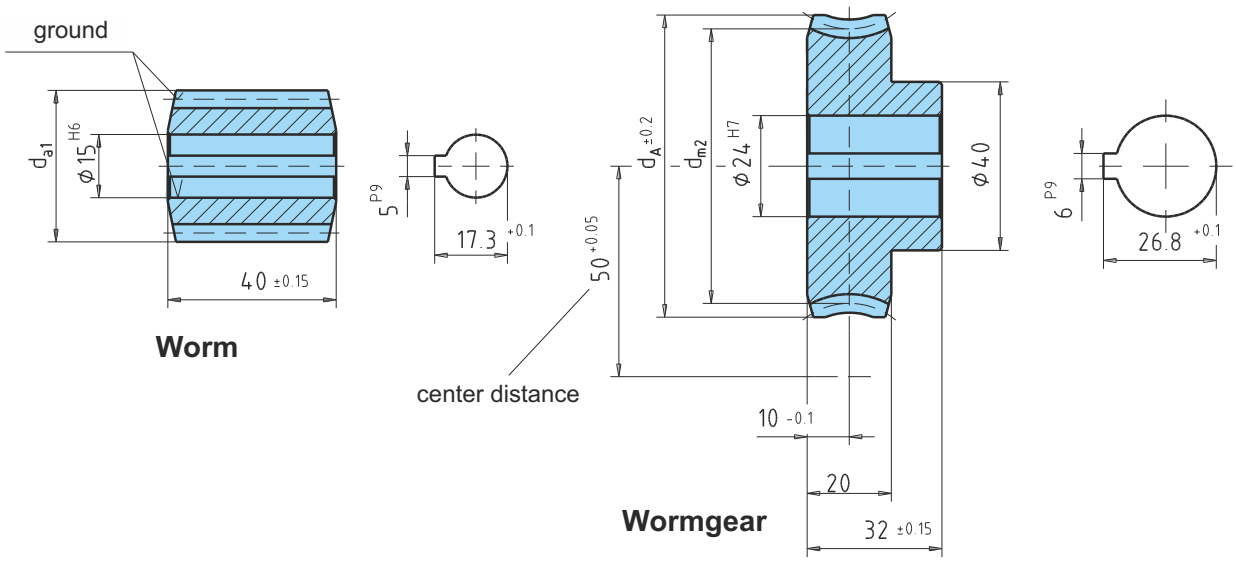
# Worm gear sets

METRIC

## A50 (50 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A50U4** | 4.25:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 17 | 67.9 | 77 | 34 | 40.8 | 51 |
| **A50U6** | 6:1 | 19°17' | 3.5 | 3 | 31.8 | 38.8 | 18 | 68.2 | 77 | 52 | 62.4 | 78 |
| **A50U9** | 8.66:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 26 | 68.71 | 77 | 64.3 | 77.1 | 96.4 |
| **A50U12** | 12:1 | 10°23' | 2.75 | 2 | 30.5 | 36 | 24 | 69.5 | 77 | 66.4 | 79.6 | 99.6 |
| **A50U14** | 13.5:1 | 9°38' | 2.5 | 2 | 29.9 | 34.9 | 27 | 70.1 | 77 | 62.8 | 75.4 | 94.2 |
| **A50U19** | 19:1 | 6°17' | 3.5 | 1 | 32 | 39 | 19 | 68 | 77 | 78.2 | 93.8 | 117.3 |
| **A50U23** | 23:1 | 5°38' | 3 | 1 | 30.58 | 36.58 | 23 | 69.42 | 77 | 71.1 | 85.3 | 106.6 |
| **A50U27** | 27:1 | 4°40' | 2.5 | 1 | 30.73 | 35.73 | 27 | 69.27 | 77 | 64.5 | 77.4 | 96.7 |
| **A50U35** | 35:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 35 | 70.22 | 77 | 56.7 | 68 | 85 |
| **A50U46** | 46:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 46 | 69.15 | 74 | 50.6 | 60.7 | 75.9 |
| **A50U55** | 55:1 | 2°19' | 1.25 | 1 | 30.9 | 33.4 | 55 | 69.1 | 74 | 46.2 | 55.4 | 69.3 |
| **A50U69** | 69:1 | 1°51' | 1 | 1 | 30.9 | 32.9 | 69 | 69.1 | 74 | 41.4 | 49.6 | 62.8 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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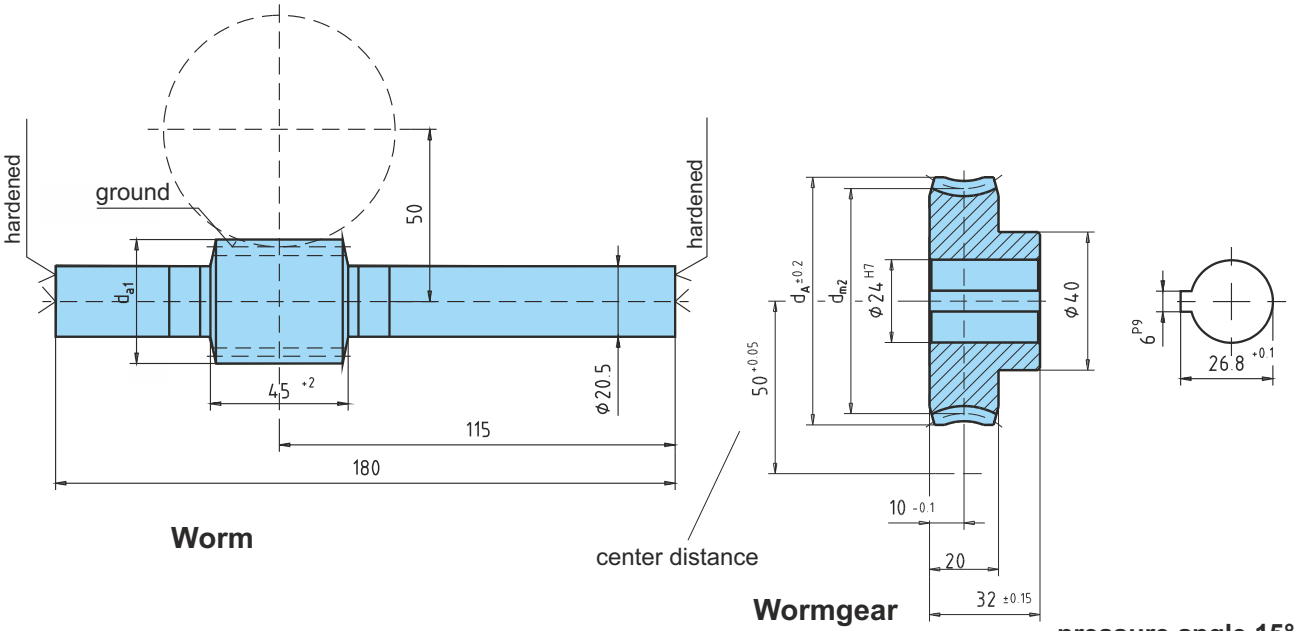
# Worm gear sets

FramoMorat
Franz Morat Group

METRIC

## A50 (50 mm center distance)




i = gear ratio
$\gamma_m$ = lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)
$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze No. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $\gamma_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A50U4** | 4.25:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 17 | 67.9 | 77 | 34 | 40.8 | 51 |
| **A50U6** | 6:1 | 19°17' | 3.5 | 3 | 31.8 | 38.8 | 18 | 68.2 | 77 | 52 | 62.4 | 78 |
| **A50U9** | 8.66:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 26 | 68.71 | 77 | 64.3 | 77.1 | 96.4 |
| **A50U12** | 12:1 | 10°23' | 2.75 | 2 | 30.5 | 36 | 24 | 69.5 | 77 | 66.4 | 79.6 | 99.6 |
| **A50U14** | 13.5:1 | 9°38' | 2.5 | 2 | 29.9 | 34.9 | 27 | 70.1 | 77 | 62.8 | 75.4 | 94.2 |
| **A50U19** | 19:1 | 6°17' | 3.5 | 1 | 32 | 39 | 19 | 68 | 77 | 78.2 | 93.8 | 117.3 |
| **A50U23** | 23:1 | 5°38' | 3 | 1 | 30.58 | 36.58 | 23 | 69.42 | 77 | 71.1 | 85.3 | 106.6 |
| **A50U27** | 27:1 | 4°40' | 2.5 | 1 | 30.73 | 35.73 | 27 | 69.27 | 77 | 64.5 | 77.4 | 96.7 |
| **A50U35** | 35:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 35 | 70.22 | 77 | 56.7 | 68 | 85 |
| **A50U46** | 46:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 46 | 69.15 | 74 | 50.6 | 60.7 | 75.9 |
| **A50U55** | 55:1 | 2°19' | 1.25 | 1 | 30.9 | 33.4 | 55 | 69.1 | 74 | 46.2 | 55.4 | 69.3 |
| **A50U69** | 69:1 | 1°51' | 1 | 1 | 30.9 | 32.9 | 69 | 69.1 | 74 | 41.4 | 49.6 | 62.8 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700), shafts not hardened. Worm gear made of CuZn40Al2/So.



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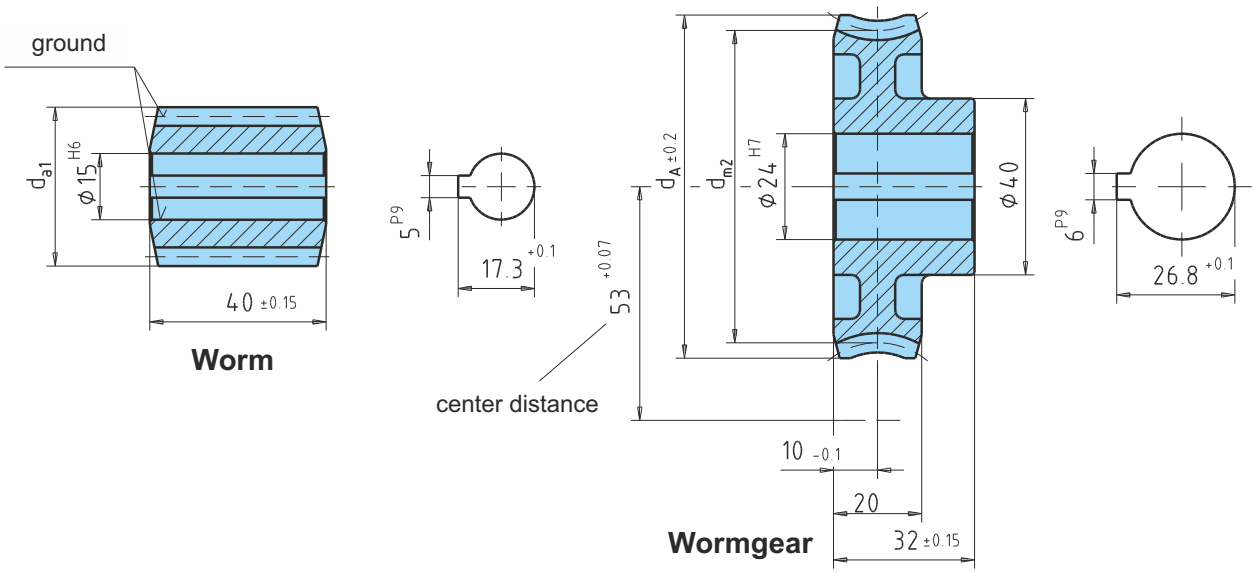
# Worm gear sets

METRIC

## A53 (53 mm center distance)




**pressure angle 15°**

i = gear ratio
$\gamma_m$ = lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $\gamma_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A53U5** | 4.75:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 19 | 73.9 | 83 | 45 | 54 | 67.5 |
| **A53U7** | 6.67:1 | 19°17' | 3.5 | 3 | 31.8 | 38.8 | 20 | 74.2 | 84 | 67 | 81 | 101 |
| **A53U10** | 9.67:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 29 | 74.71 | 82 | 77 | 93 | 116 |
| **A53U14** | 13.5:1 | 10°23' | 2.75 | 2 | 30.5 | 36 | 27 | 75.5 | 84 | 80 | 96 | 120 |
| **A53U15** | 15:1 | 9°38' | 2.5 | 2 | 29.9 | 34.9 | 30 | 76.1 | 83 | 75 | 90 | 113 |
| **A53U21** | 21:1 | 6°17' | 3.5 | 1 | 32 | 39 | 21 | 74 | 83 | 94 | 113 | 141 |
| **A53U25** | 25:1 | 5°38' | 3 | 1 | 30.58 | 36.58 | 25 | 75.42 | 84 | 84 | 101 | 127 |
| **A53U28** | 28:1 | 3°59' | 2.5 | 1 | 36 | 41 | 28 | 70 | 77.5 | 87 | 104 | 130 |
| **A53U30** | 30:1 | 4°40' | 2.5 | 1 | 30.73 | 35.73 | 30 | 75.27 | 83 | 77 | 93 | 116 |
| **A53U38** | 38:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 38 | 76.21 | 83 | 68 | 81 | 102 |
| **A53U50** | 50:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 50 | 75.15 | 81 | 60 | 72 | 90 |
| **A53U60** | 60:1 | 2°19' | 1.25 | 1 | 30.9 | 33.4 | 60 | 75.1 | 80 | 55 | 66 | 82 |
| **A53U75** | 75:1 | 1°51' | 1 | 1 | 30.9 | 32.9 | 75 | 75.1 | 78 | 49 | 59 | 74 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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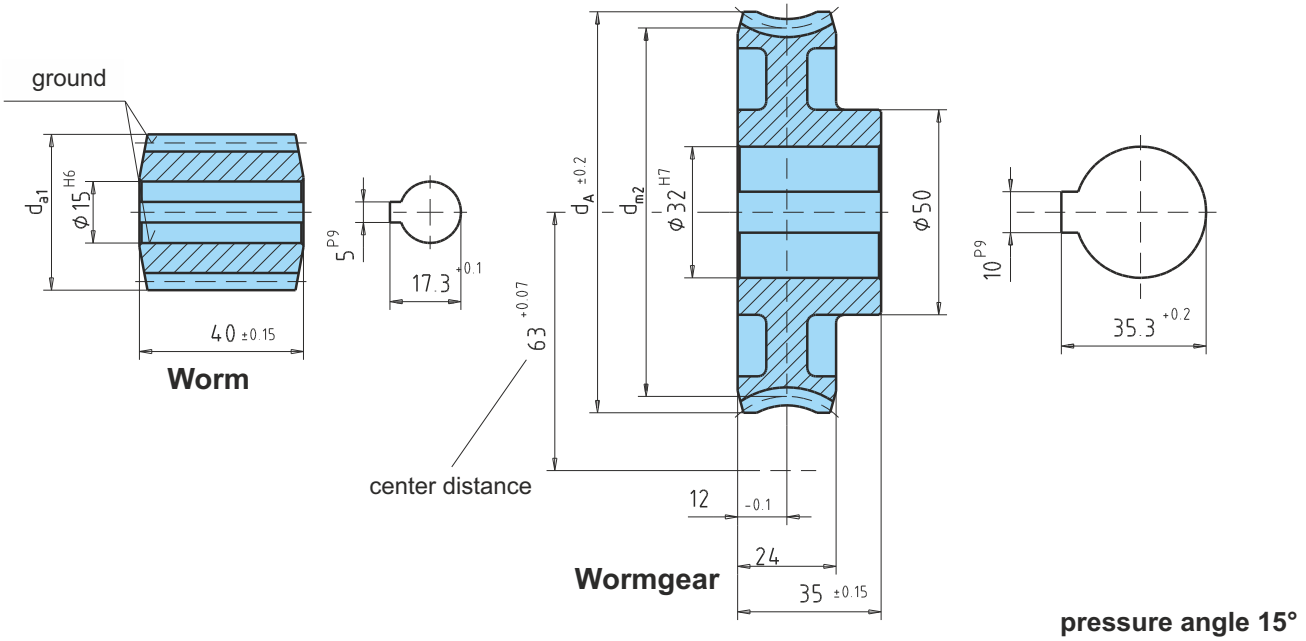
# Worm gear sets

METRIC

## A63 (63 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque
MG = mineral grease

MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | worm | | | | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A63U6** | 6:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 24 | 93.9 | 104 | 89 | 107 | 134 |
| **A63U12** | 12:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 36 | 94.71 | 104 | 141 | 170 | 212 |
| **A63U19** | 19:1 | 10°8' | 2.5 | 2 | 28.4 | 33.4 | 38 | 97.6 | 104 | 133 | 159 | 199 |
| **A63U26** | 26:1 | 6°17’ | 3.5 | 1 | 32 | 39 | 26 | 94 | 104 | 172 | 206 | 258 |
| **A63U34** | 34:1 | 5°9' | 2.75 | 1 | 30.6 | 36.1 | 34 | 95.4 | 104 | 148 | 178 | 222 |
| **A63U48** | 48:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 48 | 96.22 | 104 | 125 | 150 | 187 |
| **A63U63** | 63:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 63 | 95.15 | 101 | 111 | 133 | 166 |
| **A63U70** | 70:1 | 1°59 | 1.25 | 1 | 36.1 | 38.6 | 70 | 89.9 | 97 | 112 | 135 | 169 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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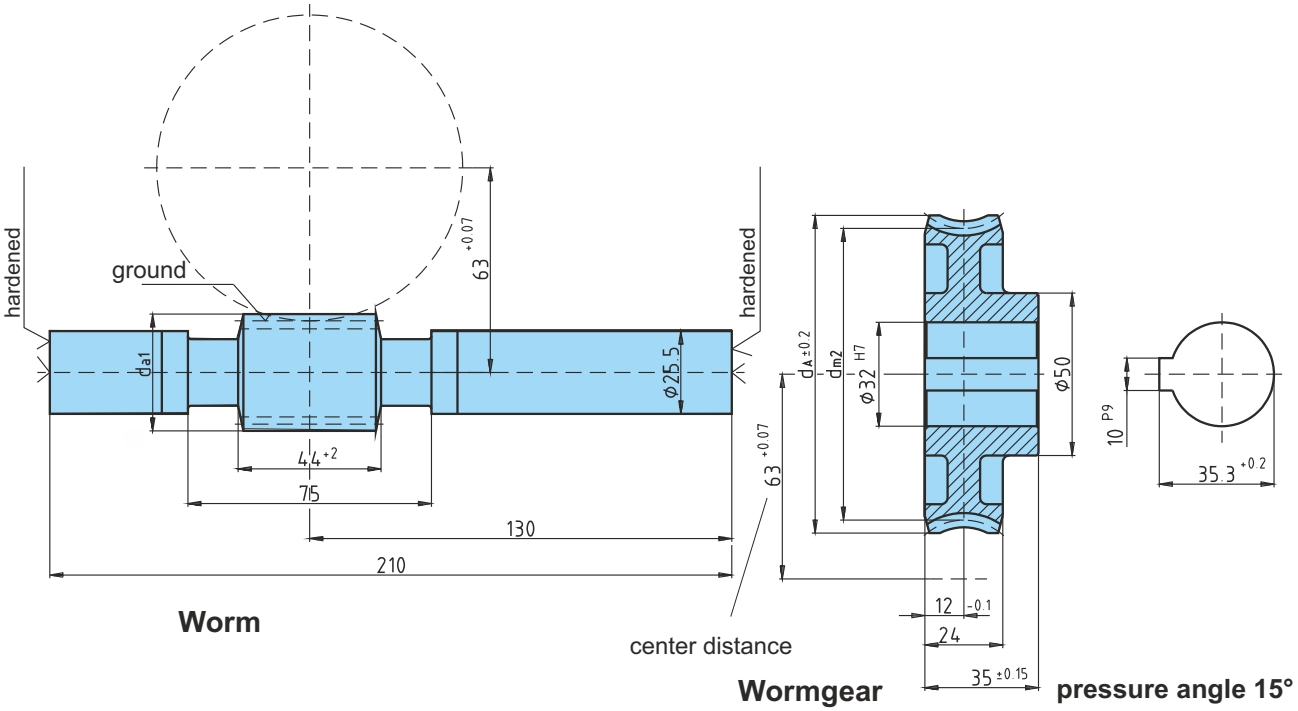
METRIC

# A63 (63 mm center distance)




i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A63U6** | 6:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 24 | 93.9 | 104 | 89 | 107 | 134 |
| **A63U12** | 12:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 36 | 94.71 | 104 | 141 | 170 | 212 |
| **A63U19** | 19:1 | 10°8' | 2.5 | 2 | 28.4 | 33.4 | 38 | 97.6 | 104 | 133 | 159 | 199 |
| **A63U26** | 26:1 | 6°17' | 3.5 | 1 | 32 | 39 | 26 | 94 | 104 | 172 | 206 | 258 |
| **A63U34** | 34:1 | 5°9' | 2.75 | 1 | 30.6 | 36.1 | 34 | 95.4 | 104 | 148 | 178 | 222 |
| **A63U48** | 48:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 48 | 96.22 | 104 | 125 | 150 | 187 |
| **A63U63** | 63:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 63 | 95.15 | 101 | 111 | 133 | 166 |
| **A63U70** | 70:1 | 1°59 | 1.25 | 1 | 36.1 | 38.6 | 70 | 89.9 | 97 | 112 | 135 | 169 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700), shafts not hardened. Worm gear made of CuZn40Al2/So.



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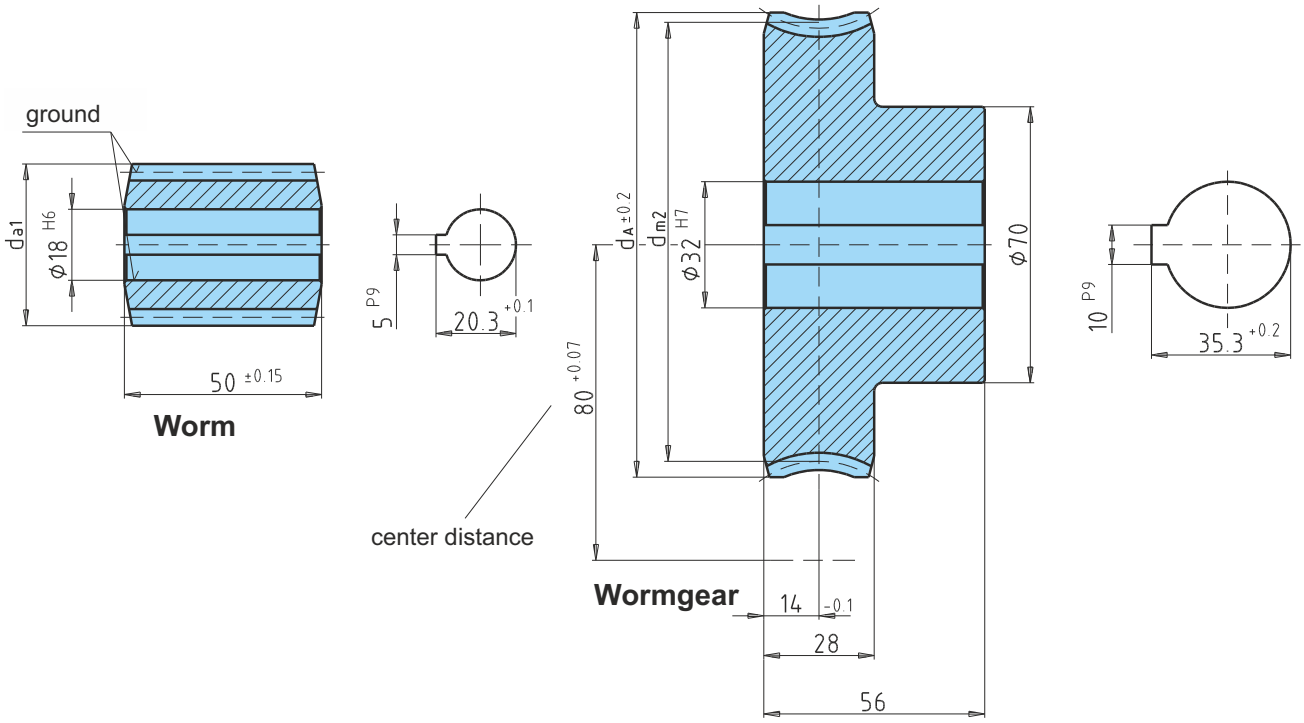
METRIC

# A80 (80 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)
$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] No. Bronze | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A80U7** | 6.75:1 | 23°35' | 4 | 4 | 40 | 48 | 27 | 120 | 132 | 150 | 180 | 225 |
| **A80U12** | 12:1 | 16°36' | 2.5 | 4 | 35 | 40 | 48 | 125 | 132,5 | 243 | 290 | 365 |
| **A80U20** | 20:1 | 8°58' | 3 | 2 | 38.5 | 44.5 | 40 | 121.5 | 130,5 | 290 | 348 | 435 |
| **A80U30** | 30:1 | 5°44' | 4 | 1 | 40 | 48 | 30 | 120 | 132,5 | 348 | 417 | 522 |
| **A80U50** | 50:1 | 4°6' | 2.5 | 1 | 35 | 40 | 50 | 125 | 132,5 | 248 | 297 | 372 |
| **A80U80** | 80:1 | 2°9' | 1.5 | 1 | 40 | 43 | 80 | 120 | 124,5 | 213 | 255 | 320 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700).
Worm gear made of CuZn40Al2.



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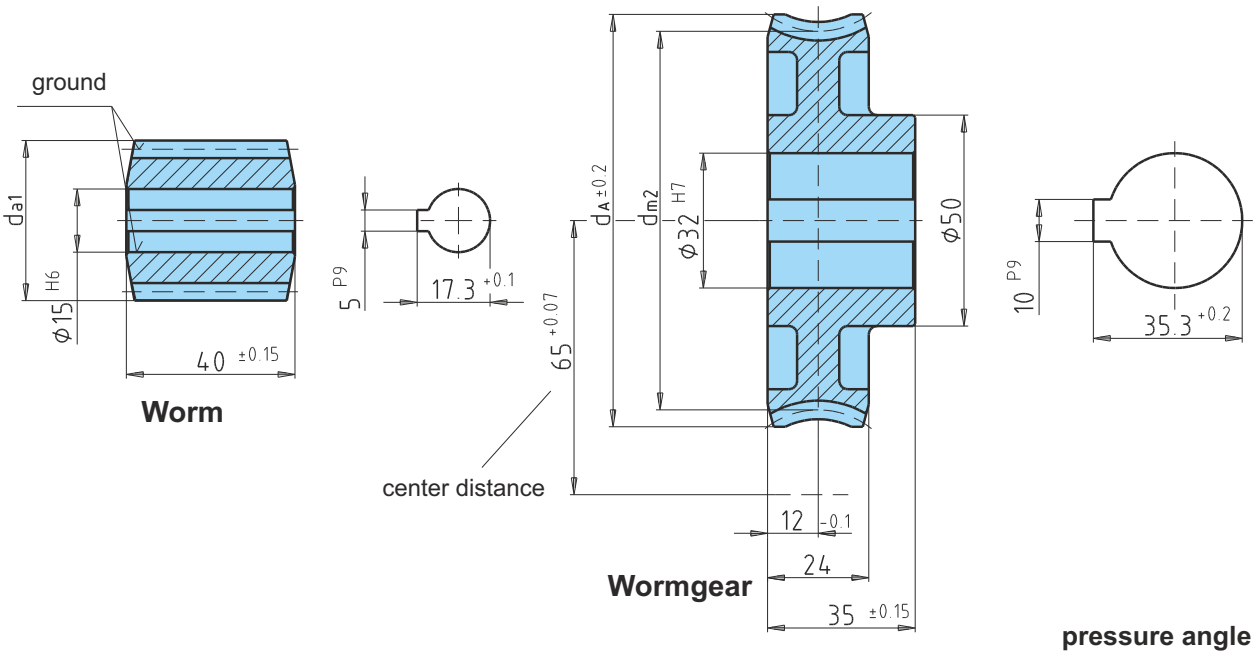
METRIC

# A65 (65 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)

$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque

MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | worm | | | | wormgear | | | $T_2$ [Nm] Bronze | | No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A65U6** | 6.25:1 | 25°51' | 3.5 | 4 | 32.1 | 39.1 | 25 | 97.9 | 108 | 101 | 121 | 151 |
| **A65U13** | 12.66:1 | 13°52' | 2.5 | 3 | 31.29 | 36.29 | 38 | 98.71 | 108 | 156 | 187 | 234 |
| **A65U20** | 20:1 | 10°8' | 2.5 | 2 | 28.4 | 33.4 | 40 | 101.6 | 108 | 146 | 176 | 220 |
| **A65U28** | 28:1 | 6°17' | 3.5 | 1 | 32 | 39 | 28 | 98 | 108 | 192 | 230 | 288 |
| **A65U36** | 36:1 | 5°9' | 2.75 | 1 | 30.6 | 36.1 | 36 | 99.4 | 108 | 164 | 197 | 246 |
| **A65U50** | 50:1 | 3°51' | 2 | 1 | 29.78 | 33.78 | 50 | 100.22 | 108 | 137 | 164 | 205 |
| **A65U66** | 66:1 | 2°47' | 1.5 | 1 | 30.85 | 33.85 | 66 | 99.15 | 107 | 122 | 146 | 183 |
| **A65U75** | 75:1 | 1°59' | 1.25 | 1 | 36.1 | 38.6 | 75 | 93.9 | 100 | 125 | 150 | 188 |

All worms and worm gears stocked right hand only, worm made of case hardened and ground steel (HV 620 - 700). Worm gear made of CuZn40Al2/So.



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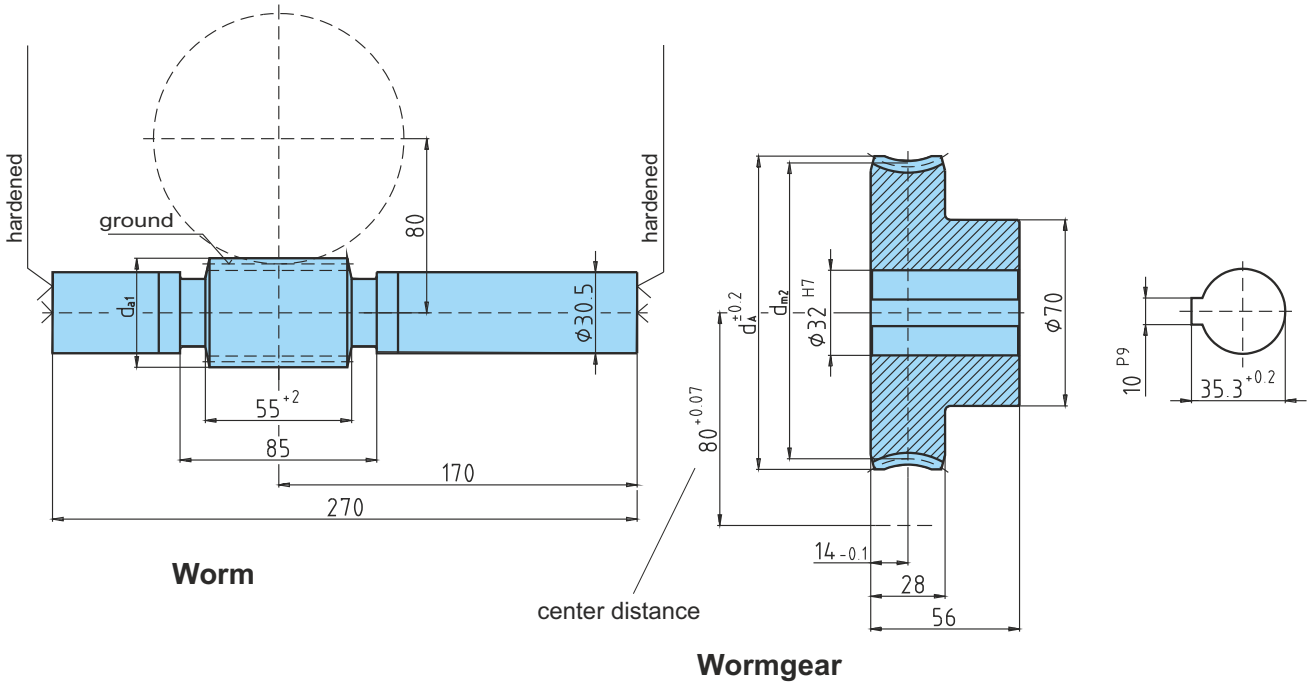
METRIC

# A80 (80 mm center distance)




**pressure angle 15°**

i = gear ratio
$_m$= lead angle
m = module
$z_1$ = number of threads
$d_{m1}$ = pitch diameter (worm)
$d_{a1}$ = tip diameter (worm)
$z_2$ = No. of teeth
$d_{m2}$ = pitch diameter (worm gear)
$d_A$ = max. diameter (worm gear)
$T_2$ = output torque
MG = mineral grease
MO = mineral oil / synthetic grease
SO = synthetic oil

| Catalog | | | | worm | | | wormgear | | | $T_2$ [Nm] Bronze No. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | i | $_m$ | m | $z_1$ | $d_{m1}$ | $d_{a1}$ | $z_2$ | $d_{m2}$ | $d_A$ | MG | MO | SO |
| **A80U7** | 6.75:1 | 23°35' | 4 | 4 | 40 | 48 | 27 | 120 | 132 | 150 | 180 | 225 |
| **A80U12** | 12:1 | 16°36' | 2.5 | 4 | 35 | 40 | 48 | 125 | 132,5 | 243 | 290 | 365 |
| **A80U20** | 20:1 | 8°58' | 3 | 2 | 38.5 | 44.5 | 40 | 121.5 | 130,5 | 290 | 348 | 435 |
| **A80U30** | 30:1 | 5°44' | 4 | 1 | 40 | 48 | 30 | 120 | 132,5 | 348 | 417 | 522 |
| **A80U50** | 50:1 | 4°6' | 2.5 | 1 | 35 | 40 | 50 | 125 | 132,5 | 248 | 297 | 372 |
| **A80U80** | 80:1 | 2°9' | 1.5 | 1 | 40 | 43 | 80 | 120 | 124,5 | 213 | 255 | 320 |

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# Worm gear sets

## Efficiency factors

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A17

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U2** | 0,8 | 0,84 | 0,87 | 0,77 | 0,81 | 0,85 | 0,76 | 0,8 | 0,84 | 0,76 | 0,8 | 0,84 | 0,76 | 0,8 | 0,84 |
| **U4** | 0,75 | 0,79 | 0,83 | 0,72 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,7 | 0,74 | 0,79 | 0,7 | 0,74 | 0,79 |
| **U5** | 0,74 | 0,79 | 0,82 | 0,71 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,79 | 0,69 | 0,74 | 0,79 |
| **U7** | 0,68 | 0,73 | 0,77 | 0,64 | 0,7 | 0,75 | 0,63 | 0,68 | 0,73 | 0,62 | 0,68 | 0,73 | 0,62 | 0,68 | 0,73 |
| **U9** | 0,61 | 0,66 | 0,71 | 0,57 | 0,63 | 0,68 | 0,55 | 0,61 | 0,66 | 0,54 | 0,6 | 0,66 | 0,54 | 0,6 | 0,66 |
| **U10** | 0,64 | 0,69 | 0,74 | 0,6 | 0,66 | 0,71 | 0,59 | 0,65 | 0,7 | 0,59 | 0,64 | 0,7 | 0,59 | 0,64 | 0,7 |
| **U15** | 0,54 | 0,6 | 0,65 | 0,51 | 0,57 | 0,62 | 0,49 | 0,55 | 0,61 | 0,49 | 0,55 | 0,61 | 0,49 | 0,55 | 0,61 |
| **U25** | 0,42 | 0,48 | 0,53 | 0,38 | 0,44 | 0,5 | 0,37 | 0,43 | 0,48 | 0,37 | 0,42 | 0,48 | 0,37 | 0,42 | 0,48 |
| **U30** | 0,37 | 0,43 | 0,49 | 0,34 | 0,4 | 0,45 | 0,33 | 0,38 | 0,44 | 0,33 | 0,38 | 0,44 | 0,33 | 0,38 | 0,44 |
| **U40** | 0,26 | 0,3 | 0,36 | 0,23 | 0,27 | 0,32 | 0,22 | 0,26 | 0,31 | 0,21 | 0,25 | 0,3 | 0,21 | 0,25 | 0,3 |
| **U50** | 0,33 | 0,38 | 0,44 | 0,3 | 0,35 | 0,41 | 0,29 | 0,34 | 0,4 | 0,29 | 0,34 | 0,4 | 0,29 | 0,34 | 0,4 |
| **U60** | 0,26 | 0,31 | 0,36 | 0,24 | 0,28 | 0,33 | 0,23 | 0,27 | 0,32 | 0,23 | 0,27 | 0,32 | 0,23 | 0,27 | 0,32 |
| **U75** | 0,19 | 0,23 | 0,27 | 0,17 | 0,21 | 0,25 | 0,16 | 0,2 | 0,24 | 0,16 | 0,19 | 0,23 | 0,16 | 0,19 | 0,23 |
| **U80** | 0,21 | 0,25 | 0,3 | 0,19 | 0,23 | 0,27 | 0,18 | 0,22 | 0,26 | 0,18 | 0,22 | 0,26 | 0,18 | 0,22 | 0,26 |

### A22

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U3** | 0,74 | 0,79 | 0,82 | 0,71 | 0,76 | 0,8 | 0,69 | 0,74 | 0,79 | 0,68 | 0,73 | 0,78 | 0,67 | 0,72 | 0,77 |
| **U4** | 0,75 | 0,79 | 0,83 | 0,72 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,78 | 0,68 | 0,73 | 0,77 |
| **U7** | 0,66 | 0,71 | 0,76 | 0,63 | 0,68 | 0,73 | 0,61 | 0,66 | 0,71 | 0,6 | 0,65 | 0,7 | 0,59 | 0,64 | 0,69 |
| **U10,5** | 0,57 | 0,63 | 0,68 | 0,53 | 0,59 | 0,65 | 0,51 | 0,57 | 0,63 | 0,5 | 0,56 | 0,62 | 0,49 | 0,55 | 0,61 |
| **U21** | 0,4 | 0,46 | 0,52 | 0,37 | 0,42 | 0,48 | 0,35 | 0,4 | 0,46 | 0,34 | 0,39 | 0,45 | 0,33 | 0,38 | 0,44 |
| **U30** | 0,34 | 0,39 | 0,45 | 0,3 | 0,35 | 0,41 | 0,29 | 0,34 | 0,39 | 0,27 | 0,32 | 0,38 | 0,27 | 0,32 | 0,37 |
| **U40** | 0,29 | 0,34 | o,4 | 0,26 | 0,31 | 0,36 | 0,25 | 0,29 | 0,34 | 0,24 | 0,28 | 0,33 | 0,23 | 0,28 | 0,33 |

### A25

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U4** | 0,76 | 0,8 | 0,84 | 0,73 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,78 |
| **U5** | 0,75 | 0,79 | 0,83 | 0,71 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,78 | 0,68 | 0,73 | 0,77 |
| **U6,5** | 0,7 | 0,74 | 0,79 | 0,66 | 0,71 | 0,76 | 0,64 | 0,7 | 0,75 | 0,63 | 0,68 | 0,73 | 0,62 | 0,67 | 0,72 |
| **U10** | 0,61 | 0,66 | 0,71 | 0,57 | 0,62 | 0,68 | 0,55 | 0,61 | 0,66 | 0,53 | 0,59 | 0,65 | 0,52 | 0,58 | 0,64 |
| **U15** | 0,53 | 0,59 | 0,64 | 0,49 | 0,55 | 0,61 | 0,47 | 0,53 | 0,59 | 0,46 | 0,52 | 0,58 | 0,45 | 0,51 | 0,57 |
| **U20** | 0,44 | 0,5 | 0,55 | 0,4 | 0,46 | 0,51 | 0,38 | 0,44 | 0,5 | 0,37 | 0,42 | 0,48 | 0,36 | 0,41 | 0,47 |
| **U25** | 0,3 | 0,36 | 0,41 | 0,27 | 0,32 | 0,38 | 0,26 | 0,3 | 0,35 | 0,25 | 0,29 | 0,34 | 0,23 | 0,28 | 0,33 |
| **U30** | 0,34 | 0,4 | 0,46 | 0,31 | 0,36 | 0,42 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 | 0,27 | 0,32 | 0,37 |
| **U40** | 0,31 | 0,36 | 0,42 | 0,28 | 0,33 | 0,38 | 0,26 | 0,31 | 0,37 | 0,25 | 0,3 | 0,35 | 0,25 | 0,29 | 0,35 |
| **U50** | 0,24 | 0,28 | 0,33 | 0,21 | 0,25 | 0,3 | 0,2 | 0,24 | 0,28 | 0,19 | 0,23 | 0,27 | 0,18 | 0,22 | 0,26 |

The stated values are approximate values



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## Operative efficiency

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A31

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U2,5** | 0,82 | 0,85 | 0,88 | 0,79 | 0,83 | 0,86 | 0,78 | 0,82 | 0,85 | 0,77 | 0,81 | 0,85 | 0,76 | 0,8 | 0,84 |
| **U3** | 0,81 | 0,85 | 0,87 | 0,78 | 0,82 | 0,86 | 0,77 | 0,81 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 |
| **U4,28** | 0,79 | 0,82 | 0,86 | 0,76 | 0,8 | 0,83 | 0,74 | 0,78 | 0,82 | 0,73 | 0,77 | 0,81 | 0,72 | 0,76 | 0,81 |
| **U5** | 0,78 | 0,82 | 0,85 | 0,75 | 0,79 | 0,83 | 0,73 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 |
| **U6** | 0,74 | 0,79 | 0,82 | 0,71 | 0,76 | 0,8 | 0,7 | 0,74 | 0,79 | 0,68 | 0,73 | 0,78 | 0,67 | 0,72 | 0,77 |
| **U7** | 0,75 | 0,79 | 0,83 | 0,72 | 0,77 | 0,81 | 0,71 | 0,75 | 0,8 | 0,69 | 0,74 | 0,79 | 0,69 | 0,74 | 0,78 |
| **U8,33** | 0,74 | 0,79 | 0,82 | 0,71 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,78 | 0,68 | 0,73 | 0,78 |
| **U12** | 0,69 | 0,74 | 0,78 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | 0,74 | 0,62 | 0,68 | 0,73 | 0,62 | 0,67 | 0,72 |
| **U15** | 0,64 | 0,69 | 0,74 | 0,6 | 0,66 | 0,71 | 0,58 | 0,64 | 0,69 | 0,57 | 0,63 | 0,68 | 0,56 | 0,62 | 0,68 |
| **U18** | 0,59 | 0,65 | 0,7 | 0,56 | 0,61 | 0,67 | 0,54 | 0,6 | 0,65 | 0,53 | 0,58 | 0,64 | 0,52 | 0,58 | 0,63 |
| **U20 *** | 0,57 | 0,63 | 0,68 | 0,53 | 0,59 | 0,64 | 0,51 | 0,57 | 0,63 | 0,5 | 0,56 | 0,62 | 0,49 | 0,55 | 0,61 |
| **U20 **** | 0,59 | 0,64 | 0,69 | 0,55 | 0,61 | 0,66 | 0,53 | 0,59 | 0,64 | 0,52 | 0,58 | 0,63 | 0,51 | 0,57 | 0,63 |
| **U22** | 0,53 | 0,59 | 0,64 | 0,49 | 0,55 | 0,61 | 0,47 | 0,53 | 0,59 | 0,46 | 0,52 | 0,58 | 0,45 | 0,51 | 0,57 |
| **U23** | 0,56 | 0,61 | 0,67 | 0,52 | 0,58 | 0,63 | 0,5 | 0,56 | 0,61 | 0,49 | 0,55 | 0,6 | 0,48 | 0,54 | 0,6 |
| **U24** | 0,48 | 0,54 | 0,59 | 0,44 | 0,49 | 0,55 | 0,42 | 0,48 | 0,54 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 |
| **U25** | 0,49 | 0,55 | 0,61 | 0,45 | 0,51 | 0,57 | 0,44 | 0,5 | 0,55 | 0,42 | 0,48 | 0,54 | 0,41 | 0,47 | 0,53 |
| **U28** | 0,44 | 0,5 | 0,56 | 0,4 | 0,46 | 0,51 | 0,38 | 0,44 | 0,5 | 0,37 | 0,42 | 0,48 | 0,36 | 0,41 | 0,47 |
| **U30** | 0,47 | 0,53 | 0,59 | 0,43 | 0,49 | 0,55 | 0,41 | 0,47 | 0,53 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 |
| **U32** | 0,45 | 0,51 | 0,57 | 0,41 | 0,47 | 0,53 | 0,4 | 0,45 | 0,51 | 0,38 | 0,44 | 0,5 | 0,38 | 0,43 | 0,49 |
| **U38** | 0,46 | 0,52 | 0,57 | 0,42 | 0,48 | 0,54 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 | 0,39 | 0,45 | 0,51 |
| **U45** | 0,37 | 0,43 | 0,49 | 0,34 | 0,39 | 0,45 | 0,32 | 0,37 | 0,43 | 0,31 | 0,36 | 0,42 | 0,3 | 0,36 | 0,41 |
| **U50** | 0,35 | 0,4 | 0,46 | 0,31 | 0,37 | 0,42 | 0,3 | 0,35 | 0,4 | 0,29 | 0,34 | 0,39 | 0,28 | 0,33 | 0,39 |
| **U55** | 0,4 | 0,46 | 0,52 | 0,37 | 0,43 | 0,48 | 0,36 | 0,41 | 0,47 | 0,35 | 0,41 | 0,46 | 0,35 | 0,41 | 0,46 |
| **U60** | 0,31 | 0,36 | 0,42 | 0,28 | 0,32 | 0,38 | 0,26 | 0,31 | 0,36 | 0,25 | 0,3 | 0,35 | 0,25 | 0,29 | 0,34 |
| **U70** | 0,34 | 0,39 | 0,45 | 0,31 | 0,36 | 0,41 | 0,29 | 0,34 | 0,4 | 0,29 | 0,34 | 0,39 | 0,29 | 0,34 | 0,39 |
| **U75** | 0,26 | 0,31 | 0,36 | 0,23 | 0,28 | 0,33 | 0,22 | 0,26 | 0,31 | 0,21 | 0,25 | 0,3 | 0,21 | 0,25 | 0,3 |
| **U90** | 0,23 | 0,27 | 0,32 | 0,2 | 0,24 | 029 | 0,19 | 0,23 | 0,27 | 0,18 | 0,22 | 0,26 | 0,18 | 0,22 | 0,26 |
| **U100** | 0,28 | 0,33 | 0,38 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 | 0,24 | 0,28 | 0,33 | 0,24 | 0,28 | 0,33 |

The stated values are approximate values

* module m = 0,75
** module m = 1,15



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## Operative efficiency

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A33

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U3,5** | 0,79 | 0,83 | 0,86 | 0,77 | 0,81 | 0,84 | 0,75 | 0,79 | 0,83 | 0,74 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 |
| **U5** | 0,77 | 0,81 | 0,84 | 0,74 | 0,78 | 0,82 | 0,72 | 0,76 | 0,81 | 0,71 | 0,75 | 0,8 | 0,69 | 0,74 | 0,79 |
| **U7** | 0,72 | 0,77 | 0,81 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,77 | 0,66 | 0,71 | 0,76 | 0,65 | 0,7 | 0,75 |
| **U10** | 0,69 | 0,74 | 0,78 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | 0,74 | 0,62 | 0,68 | 0,73 | 0,61 | 0,67 | 0,72 |
| **U11** | 0,65 | 0,7 | 0,75 | 0,61 | 0,67 | 0,72 | 0,6 | 0,65 | 0,7 | 0,58 | 0,64 | 0,69 | 0,57 | 0,63 | 0,68 |
| **U12** | 0,66 | 0,71 | 0,75 | 0,62 | 0,67 | 0,72 | 0,6 | 0,66 | 0,71 | 0,59 | 0,64 | 0,7 | 0,58 | 0,63 | 0,69 |
| **U14** | 0,57 | 0,63 | 0,68 | 0,53 | 0,59 | 0,65 | 0,51 | 0,57 | 0,63 | 0,5 | 0,56 | 0,62 | 0,49 | 0,54 | 0,6 |
| **U15** | 0,6 | 0,65 | 0,7 | 0,56 | 0,62 | 0,67 | 0,54 | 0,6 | 0,65 | 0,53 | 0,58 | 0,64 | 0,51 | 0,57 | 0,63 |
| **U16** | 0,63 | 0,68 | 0,73 | 0,59 | 0,64 | 0,7 | 0,57 | 0,63 | 0,68 | 0,56 | 0,62 | 0,67 | 0,55 | 0,61 | 0,66 |
| **U17** | 0,61 | 0,66 | 0,71 | 0,57 | 0,62 | 0,68 | 0,55 | 0,61 | 0,66 | 0,54 | 0,6 | 0,65 | 0,53 | 0,59 | 0,64 |
| **U18** | 0,55 | 0,61 | 0,67 | 0,51 | 0,57 | 0,63 | 0,5 | 0,55 | 0,61 | 0,48 | 0,54 | 0,6 | 0,47 | 0,53 | 0,59 |
| **U20** | 0,54 | 0,6 | 0,66 | 0,5 | 0,56 | 0,62 | 0,49 | 0,54 | 0,6 | 0,47 | 0,53 | 0,59 | 0,46 | 0,52 | 0,58 |
| **U24** | 0,49 | 0,55 | 0,61 | 0,45 | 0,51 | 0,57 | 0,44 | 0,5 | 0,55 | 0,42 | 0,48 | 0,54 | 0,41 | 0,47 | 0,53 |
| **U28** | 0,4 | 0,46 | 0,52 | 0,37 | 0,42 | 0,48 | 0,35 | 0,4 | 0,46 | 0,33 | 0,39 | 0,45 | 0,32 | 0,38 | 0,43 |
| **U30** | 0,43 | 0,49 | 0,55 | 0,39 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,42 | 0,47 | 0,35 | 0,4 | 0,46 |
| **U32** | 0,46 | 0,52 | 0,58 | 0,42 | 0,48 | 0,54 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 | 0,38 | 0,44 | 0,5 |
| **U38** | 0,41 | 0,47 | 0,53 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 | 0,33 | 0,39 | 0,45 |
| **U50** | 0,31 | 0,36 | 0,42 | 0,28 | 0,33 | 0,38 | 0,26 | 0,31 | 0,38 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 |
| **U56** | 0,29 | 0,34 | 0,39 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 | 0,23 | 0,27 | 0,32 | 0,22 | 0,26 | 0,31 |
| **U60** | 0,31 | 0,36 | 0,42 | 0,28 | 0,33 | 0,38 | 0,26 | 0,31 | 0,37 | 0,25 | 0,3 | 0,35 | 0,25 | 0,29 | 0,35 |
| **U72** | 0,22 | 0,26 | 0,31 | 0,19 | 0,23 | 0,28 | 0,18 | 0,22 | 0,26 | 0,17 | 0,21 | 0,25 | 0,17 | 0,2 | 0,24 |
| **U75** | 0,24 | 0,28 | 0,33 | 0,21 | 0,25 | 0,29 | 0,2 | 0,24 | 0,28 | 0,19 | 0,23 | 0,27 | 0,18 | 0,22 | 0,26 |

### A35

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U2,78** | 0,81 | 0,85 | 0,87 | 0,79 | 0,83 | 0,86 | 0,77 | 0,81 | 0,84 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 |
| **U5** | 0,78 | 0,82 | 0,85 | 0,75 | 0,79 | 0,83 | 0,73 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 |
| **U7,25** | 0,71 | 0,75 | 0,8 | 0,68 | 0,73 | 0,77 | 0,65 | 0,71 | 0,75 | 0,64 | 0,69 | 0,74 | 0,63 | 0,68 | 0,73 |
| **U8** | 0,71 | 0,76 | 0,8 | 0,68 | 0,73 | 0,77 | 0,66 | 0,71 | 0,76 | 0,65 | 0,7 | 0,75 | 0,63 | 0,69 | 0,74 |
| **U10** | 0,66 | 0,71 | 0,76 | 0,62 | 0,68 | 0,73 | 0,6 | 0,66 | 0,71 | 0,59 | 0,64 | 0,7 | 0,57 | 0,63 | 0,68 |
| **U11** | 0,65 | 0,7 | 0,75 | 0,62 | 0,67 | 0,72 | 0,6 | 0,65 | 0,7 | 0,58 | 0,64 | 0,69 | 0,57 | 0,63 | 0,68 |
| **U12** | 0,63 | 0,68 | 0,73 | 0,59 | 0,64 | 0,7 | 0,57 | 0,62 | 0,68 | 0,55 | 0,61 | 0,66 | 0,54 | 0,6 | 0,65 |
| **U15** | 0,57 | 0,62 | 0,68 | 0,53 | 0,59 | 0,64 | 0,5 | 0,56 | 0,62 | 0,49 | 0,55 | 0,61 | 0,48 | 0,54 | 0,59 |
| **U20** | 0,51 | 0,57 | 0,62 | 0,47 | 0,53 | 0,59 | 0,45 | 0,51 | 0,56 | 0,43 | 0,49 | 0,55 | 0,42 | 0,48 | 0,54 |
| **U25** | 0,44 | 0,5 | 0,56 | 0,4 | 0,46 | 0,52 | 0,38 | 0,44 | 0,5 | 0,37 | 0,42 | 0,48 | 0,35 | 0,41 | 0,47 |
| **U30** | 0,4 | 0,45 | 0,51 | 0,36 | 0,42 | 0,47 | 0,34 | 0,39 | 0,45 | 0,33 | 0,38 | 0,44 | 0,31 | 0,37 | 0,42 |
| **U35** | 0,41 | 0,47 | 0,53 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 | 0,33 | 0,39 | 0,44 |
| **U40** | 0,34 | 0,4 | 0,45 | 0,31 | 0,36 | 0,42 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 | 0,27 | 0,32 | 0,37 |
| **U50** | 0,28 | 0,33 | 0,39 | 0,25 | 0,3 | 0,35 | 0,24 | 0,28 | 0,33 | 0,23 | 0,27 | 0,32 | 0,22 | 0,26 | 0,31 |
| **U58** | 0,3 | 0,35 | 0,41 | 0,27 | 0,32 | 0,37 | 0,26 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 | 0,24 | 0,28 | 0,33 |
| **U90** | 0,18 | 0,22 | 0,26 | 0,16 | 0,19 | 0,23 | 0,15 | 0,18 | 0,22 | 0,14 | 0,17 | 0,21 | 0,13 | 0,16 | 0,2 |

The stated values are approximate values



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## Operative efficiency

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A40

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U6,75** | 0,77 | 0,81 | 0,84 | 0,74 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 | 0,7 | 0,75 | 0,79 |
| **U8** | 0,74 | 0,78 | 0,82 | 0,7 | 0,75 | 0,79 | 0,68 | 0,73 | 0,78 | 0,67 | 0,72 | 0,77 | 0,66 | 0,71 | 0,76 |
| **U10** | 0,72 | 0,77 | 0,81 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,77 | 0,66 | 0,71 | 0,76 | 0,65 | 0,7 | 0,75 |
| **U12** | 0,65 | 0,7 | 0,75 | 0,62 | 0,67 | 0,72 | 0,6 | 0,65 | 0,7 | 0,58 | 0,64 | 0,69 | 0,57 | 0,62 | 0,68 |
| **U15** | 0,64 | 0,69 | 0,74 | 0,6 | 0,65 | 0,71 | 0,58 | 0,64 | 0,69 | 0,57 | 0,62 | 0,68 | 0,55 | 0,61 | 0,66 |
| **U20** | 0,61 | 0,66 | 0,71 | 0,57 | 0,63 | 0,68 | 0,55 | 0,61 | 0,66 | 0,54 | 0,6 | 0,65 | 0,53 | 0,59 | 0,64 |
| **U25** | 0,52 | 0,58 | 0,64 | 0,48 | 0,54 | 0,6 | 0,46 | 0,52 | 0,58 | 0,45 | 0,51 | 0,56 | 0,43 | 0,49 | 0,55 |
| **U28** | 0,47 | 0,53 | 0,59 | 0,43 | 0,49 | 0,55 | 0,41 | 0,47 | 0,53 | 0,4 | 0,46 | 0,52 | 0,39 | 0,44 | 0,5 |
| **U30** | 0,51 | 0,57 | 0,62 | 0,47 | 0,53 | 0,59 | 0,45 | 0,51 | 0,57 | 0,44 | 0,5 | 0,55 | 0,43 | 0,48 | 0,54 |
| **U35** | 0,49 | 0,55 | 0,6 | 0,45 | 0,51 | 0,57 | 0,43 | 0,49 | 0,55 | 0,42 | 0,48 | 0,54 | 0,41 | 0,47 | 0,53 |
| **U36** | 0,39 | 0,45 | 0,5 | 0,35 | 0,41 | 0,47 | 0,33 | 0,39 | 0,44 | 0,32 | 0,37 | 0,43 | 0,31 | 0,36 | 0,42 |
| **U38** | 0,41 | 0,47 | 0,53 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,45 | 0,33 | 0,38 | 0,44 |
| **U40** | 0,44 | 0,5 | 0,56 | 0,4 | 0,46 | 0,52 | 0,38 | 0,44 | 0,5 | 0,37 | 0,43 | 0,48 | 0,36 | 0,41 | 0,47 |
| **U50** | 0,42 | 0,48 | 0,54 | 0,38 | 0,44 | 0,5 | 0,37 | 0,42 | 0,48 | 0,35 | 0,41 | 0,47 | 0,35 | 0,4 | 0,46 |
| **U56** | 0,31 | 0,36 | 0,42 | 0,28 | 0,33 | 0,38 | 0,26 | 0,31 | 0,36 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 |
| **U60** | 0,28 | 0,33 | 0,38 | 0,25 | 0,29 | 0,34 | 0,23 | 0,28 | 0,32 | 0,22 | 0,26 | 0,31 | 0,21 | 0,25 | 0,3 |
| **U70** | 0,35 | 0,4 | 0,46 | 0,31 | 0,37 | 0,42 | 0,3 | 0,35 | 0,4 | 0,29 | 0,34 | 0,39 | 0,28 | 0,33 | 0,39 |
| **U75** | 0,25 | 0,3 | 0,35 | 0,23 | 0,27 | 0,32 | 0,21 | 0,25 | 0,3 | 0,2 | 0,24 | 0,29 | 0,19 | 0,23 | 0,28 |
| **U80** | 0,28 | 0,33 | 0,39 | 0,25 | 0,3 | 0,35 | 0,24 | 0,28 | 0,33 | 0,23 | 0,27 | 0,32 | 0,22 | 0,26 | 0,31 |
| **U90** | 0,29 | 0,34 | 0,4 | 0,36 | 0,31 | 0,36 | 0,25 | 0,29 | 0,35 | 0,24 | 0,28 | 0,33 | 0,23 | 0,28 | 0,33 |

### A50

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U4,25** | 0,8 | 0,84 | 0,87 | 0,78 | 0,82 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 | 0,74 | 0,78 | 0,82 |
| **U6** | 0,77 | 0,81 | 0,84 | 0,74 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 | 0,7 | 0,74 | 0,79 |
| **U8** | 0,72 | 0,76 | 0,8 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,76 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | 0,74 |
| **U12** | 0,66 | 0,71 | 0,76 | 0,63 | 0,68 | 0,73 | 0,61 | 0,66 | 0,71 | 0,59 | 0,65 | 0,7 | 0,58 | 0,63 | 0,69 |
| **U13,5** | 0,65 | 0,7 | 0,74 | 0,61 | 0,67 | 0,72 | 0,59 | 0,64 | 0,7 | 0,57 | 0,63 | 0,68 | 0,56 | 0,62 | 0,67 |
| **U19** | 0,55 | 0,61 | 0,66 | 0,52 | 0,57 | 0,63 | 0,49 | 0,55 | 0,61 | 0,48 | 0,54 | 0,59 | 0,46 | 0,52 | 0,58 |
| **U23** | 0,52 | 0,58 | 0,64 | 0,49 | 0,55 | 0,6 | 0,46 | 0,52 | 0,58 | 0,45 | 0,51 | 0,57 | 0,43 | 0,49 | 0,55 |
| **U27** | 0,48 | 0,54 | 0,59 | 0,44 | 0,5 | 0,56 | 0,42 | 0,48 | 0,54 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 |
| **U35** | 0,43 | 0,49 | 0,55 | 0,4 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 |
| **U46** | 0,36 | 0,41 | 0,47 | 0,32 | 0,38 | 0,43 | 0,3 | 0,36 | 0,41 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 |
| **U55** | 0,31 | 0,37 | 0,42 | 0,29 | 0,34 | 0,39 | 0,27 | 0,31 | 0,37 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 |
| **U69** | 0,27 | 0,32 | 0,37 | 0,24 | 0,29 | 0,34 | 0,23 | 0,27 | 0,32 | 0,21 | 0,26 | 0,3 | 0,2 | 0,25 | 0,29 |

The stated values are approximate values



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## Operative efficiency

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A53

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U4,75** | 0,8 | 0,84 | 0,87 | 0,78 | 0,82 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 | 0,74 | 0,78 | 0,82 |
| **U6,67** | 0,77 | 0,81 | 0,84 | 0,74 | 0,78 | 0,82 | 0,72 | 0,77 | 0,81 | 0,71 | 0,76 | 0,8 | 0,7 | 0,74 | 0,79 |
| **U9,67** | 0,72 | 0,76 | 0,8 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,76 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | **0,74** |
| **U13,5** | 0,66 | 0,71 | 0,76 | 0,63 | 0,68 | 0,73 | 0,61 | 0,66 | 0,71 | 0,59 | 0,65 | 0,7 | 0,58 | 0,63 | 0,69 |
| **U15** | 0,65 | 0,7 | 0,74 | 0,61 | 0,67 | 0,72 | 0,59 | 0,64 | 0,7 | 0,57 | 0,63 | 0,68 | 0,56 | 0,62 | 0,67 |
| **U21** | 0,55 | 0,61 | 0,66 | 0,52 | 0,57 | 0,63 | 0,49 | 0,55 | 0,61 | 0,48 | 0,54 | 0,59 | 0,46 | 0,52 | 0,58 |
| **U25** | 0,52 | 0,58 | 0,64 | 0,49 | 0,55 | 0,6 | 0,46 | 0,52 | 0,58 | 0,45 | 0,51 | 0,57 | 0,43 | 0,49 | 0,55 |
| **U28** | 0,44 | 0,5 | 0,56 | 0,41 | 0,47 | 0,53 | 0,39 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,42 | 0,47 |
| **U30** | 0,48 | 0,54 | 0,59 | 0,44 | 0,5 | 0,56 | 0,42 | 0,48 | 0,54 | 0,4 | 0,46 | 0,52 | 0,39 | 0,45 | 0,51 |
| **U38** | 0,43 | 0,49 | 0,55 | 0,4 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 |
| **U50** | 0,36 | 0,41 | 0,47 | 0,32 | 0,38 | 0,43 | 0,3 | 0,36 | 0,41 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 |
| **U60** | 0,31 | 0,37 | 0,42 | 0,29 | 0,34 | 0,39 | 0,27 | 0,31 | 0,37 | 0,25 | 0,3 | 0,35 | 0,24 | 0,29 | 0,34 |
| **U75** | 0,27 | 0,32 | 0,37 | 0,24 | 0,29 | 0,34 | 0,23 | 0,27 | 0,32 | 0,21 | 0,26 | 0,3 | 0,2 | 0,25 | 0,29 |

### A63

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U6** | 0,8 | 0,84 | 0,87 | 0,78 | 0,82 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 | 0,74 | 0,78 | 0,82 |
| **U12** | 0,72 | 0,76 | 0,8 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,76 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | 0,74 |
| **U19** | 0,65 | 0,71 | 0,75 | 0,62 | 0,67 | 0,72 | 0,6 | 0,65 | 0,7 | 0,58 | 0,64 | 0,69 | 0,57 | 0,62 | 0,68 |
| **U26** | 0,55 | 0,61 | 0,66 | 0,52 | 0,57 | 0,63 | 0,49 | 0,55 | 0,61 | 0,48 | 0,54 | 0,59 | 0,46 | 0,52 | 0,58 |
| **U34** | 0,5 | 0,56 | 0,62 | 0,47 | 0,53 | 0,58 | 0,44 | 0,5 | 0,56 | 0,43 | 0,49 | 0,54 | 0,41 | 0,47 | 0,53 |
| **U48** | 0,43 | 0,49 | 0,55 | 0,4 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 |
| **U63** | 0,36 | 0,41 | 0,47 | 0,32 | 0,38 | 0,43 | 0,3 | 0,36 | 0,41 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 |
| **U70** | 0,29 | 0,34 | 0,39 | 0,26 | 0,31 | 0,36 | 0,24 | 0,29 | 0,34 | 0,23 | 0,28 | 0,32 | 0,22 | 0,26 | 0,3 |

The stated values are approximate values



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## Operative efficiency

Efficiency factors depending on input (worm) speed and lubrication (mineral grease 'MG', mineral oil 'MO' or synthetic grease, synthetic oil 'SO')

### A65

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U6,25** | 0,8 | 0,84 | 0,87 | 0,78 | 0,82 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 | 0,74 | 0,78 | 0,82 |
| **U12,66** | 0,72 | 0,76 | 0,8 | 0,69 | 0,74 | 0,78 | 0,67 | 0,72 | 0,76 | 0,65 | 0,7 | 0,75 | 0,64 | 0,69 | 0,74 |
| **U20** | 0,65 | 0,71 | 0,75 | 0,62 | 0,67 | 0,72 | 0,6 | 0,65 | 0,7 | 0,58 | 0,64 | 0,69 | 0,57 | 0,62 | 0,68 |
| **U28** | 0,55 | 0,61 | 0,66 | 0,52 | 0,57 | 0,63 | 0,49 | 0,55 | 0,61 | 0,48 | 0,54 | 0,59 | 0,46 | 0,52 | 0,58 |
| **U36** | 0,5 | 0,56 | 0,62 | 0,47 | 0,53 | 0,58 | 0,44 | 0,5 | 0,56 | 0,43 | 0,49 | 0,54 | 0,41 | 0,47 | 0,53 |
| **U50** | 0,43 | 0,49 | 0,55 | 0,4 | 0,45 | 0,51 | 0,37 | 0,43 | 0,49 | 0,36 | 0,41 | 0,47 | 0,34 | 0,4 | 0,46 |
| **U66** | 0,36 | 0,41 | 0,47 | 0,32 | 0,38 | 0,43 | 0,3 | 0,36 | 0,41 | 0,29 | 0,34 | 0,4 | 0,28 | 0,33 | 0,38 |
| **U75** | 0,29 | 0,34 | 0,39 | 0,26 | 0,31 | 0,36 | 0,24 | 0,29 | 0,34 | 0,23 | 0,28 | 0,32 | 0,22 | 0,26 | 0,31 |

### A80

| | $n_1$ = 2800 rpm | | | $n_1$ = 1400 rpm | | | $n_1$ = 950 rpm | | | $n_1$ = 700 rpm | | | $n_1$ = 500 rpm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO | MG | MO | SO |
| **U6,75** | 0,79 | 0,83 | 0,86 | 0,78 | 0,82 | 0,85 | 0,76 | 0,8 | 0,84 | 0,75 | 0,79 | 0,83 | 0,73 | 0,78 | 0,82 |
| **U12** | 0,75 | 0,79 | 0,83 | 0,72 | 0,77 | 0,81 | 0,7 | 0,75 | 0,79 | 0,69 | 0,74 | 0,78 | 0,68 | 0,73 | 0,77 |
| **U20** | 0,63 | 0,69 | 0,74 | 0,61 | 0,66 | 0,71 | 0,59 | 0,64 | 0,7 | 0,57 | 0,63 | 0,68 | 0,55 | 0,61 | 0,67 |
| **U30** | 0,53 | 0,59 | 0,64 | 0,51 | 0,57 | 0,62 | 0,49 | 0,55 | 0,6 | 0,47 | 0,53 | 0,58 | 0,45 | 0,51 | 0,57 |
| **U50** | 0,45 | 0,51 | 0,57 | 0,42 | 0,48 | 0,53 | 0,4 | 0,45 | 0,51 | 0,38 | 0,44 | 0,49 | 0,37 | 0,42 | 0,48 |
| **U80** | 0,3 | 0,35 | 0,41 | 0,28 | 0,33 | 0,38 | 0,27 | 0,31 | 0,37 | 0,25 | 0,3 | 0,35 | 0,24 | 0,28 | 0,33 |

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# Worm gear sets

## Tolerance

**Backlash tolerances for worm gears (valid for gears with a pressure angle of 15°)**

$ß_0$ corresponds to $_m$ of the worm

| Pitch diameter of the worm gear | Module $m_n$ | Backlash tol. at pitch diameter [mm] $ß_0$ up to 24° | | $ß_0$ over 24° | |
|---|---|---|---|---|---|
| | | min. | max. | min. | max. |
| over 12 up to 25 | 0,4 - 0,6<br>>0,6 - 1,3<br>>1,3 - 2,0 | 0,07<br>0,075<br>0,08 | 0,092<br>0,099<br>0,106 | 0,077<br>0,083<br>0,089 | 0,102<br>0,109<br>0,117 |
| over 25 up to 50 | 0,4 - 0,6<br>>0,6 - 1,3<br>>1,3 - 2,0<br>>2,0 - 4,0 | 0,075<br>0,08<br>0,086<br>0,094 | 0,099<br>0,106<br>0,114<br>0,124 | 0,083<br>0,089<br>0,095<br>0,103 | 0,108<br>0,117<br>0,125<br>0,137 |
| over 50 up to 100 | 0,4 - 0,6<br>>0,6 - 1,3<br>>1,3 - 2,0<br>>2,0 - 4,0 | 0,08<br>0,086<br>0,094<br>0,102 | 0,106<br>0,114<br>0,124<br>0,134 | 0,089<br>0,095<br>0,103<br>0,112 | 0,117<br>0,125<br>0,137<br>0,148 |

The backlash values are based on an ideal center distance. More backlash will appear if the center distance is actually at the upper tolerance. 0.05mm above ideal center distance will result in 0.027 mm more backlash.

## Lubrication

Lubrication has an essential influence on efficiency, heat generation and life time. A good choice is a synthetic oil on the basis of polyglykol and synthetic oil or grease on the basis of polyalphaolefin. Moreover polyalphaolefin has a high compatibility to common sealing materials.

High viscosity synthetic oils (ISO VG 680 bzw. ISO VG 1000) are used preferably for worm gear sets. In case of smaller center distances mineral or synthetic grease in consistency-class 0 up to 00 can be used as well.

## Comparison of the different basis oils

| Characteristics | Mineral oil | Polyalphaolefin synth. | Polyglykol synth. |
|---|---|---|---|
| Viscosity at low temp. | 4 | 3 | 3 |
| Wear protection | 4 | 2 | 1 |
| Frictional behaviour | 3 | 2 | 1 |
| High temp. Oxidation stability | 4 | 2 | 1 |
| Water seperation ability | 4 | 2 | 5 |
| Air release ability | 3 | 2 | 4 |
| Rust protection | 1 | 1 | 3 |
| Mix with mineral oil | - | 1 | 5 |
| Laquer compatibility | 1 | 1 | 3 |
| Seal compatibility | 1 | 1 | 3 |
| Low evaporation losses | 4 | 1 | 3 |

1=excellent 2=very good 3=good 4=sufficient 5=bad



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