

ZAR3 / ZAR3 +



www.hexagon.de

Worm Gear Design

Software for Windows

© Copyright 1996-2015 by HEXAGON Software, Berlin, Kirchheim, Neidlingen

ZAR3+ Worm gear - NIEMAN1E.zr3

File Edit View CAD Database Document QLE Help

Worm 1111111
Worm wheel 222222
Application example for Pre-dimensioning
Source: Niemann/Winter Maschinenelemente III

| Dimensions | | Material | Worm | Worm wheel |
|------------|----|----------|------------|------------|
| mx | mm | | Worm | Worm wheel |
| mn | mm | No | 1111111 | 2222222 |
| gam | m | Material | 16MnCr5 | 6Z-CuSn12 |
| a | mm | E | MPa 210000 | 88300 |
| alpha 0 | ° | SigHlim | MPa 1300 | 425 |
| alpha x | ° | Ulim | MPa 620 | 190 |
| alpha n | ° | tauFlimT | MPa | 76 |

| Dimensions | 1 | 2 |
|------------|-----------|---------|
| z | 2 | 41 |
| dm,d | mm 35,000 | 165,000 |
| da | mm 43,049 | 173,049 |
| df | mm 25,341 | 155,341 |
| db | mm 18,351 | 154,572 |
| b | mm 85,00 | 30,00 |
| x | 0,000 | 0,000 |

| efficiency | Niemann | DIN3996 |
|------------|----------|---------|
| mu z | 0,028 | 0,041 |
| eta z | 0,88 | 0,84 |
| PVz | kW 0,475 | 0,607 |
| PVd | kW 0,175 | 0,152 |
| PVLP | kW 0,041 | 0,097 |
| PVd | kW 0,000 | 0,022 |
| PV | kW 0,650 | 0,878 |
| eta | 0,83 | 0,79 |

| power | 1 | 2 (Niem.) | 2 (3996) |
|-------|-----------|-----------|----------|
| PN | kW 4,105 | 3,414 | 3,227 |
| TN | Nm 26,20 | 446,53 | 422,19 |
| n | /min 1497 | 73,0 | 73,0 |
| FN | N 1497 | 5414 | 5117 |

| Safety | Niemann | DIN3996 |
|--------|---------|---------|
| SH | 1,09 | 1,05 |
| SF | 4,24 | 2,93 |
| SW | - | 6,83 |

Calculation Base

ZAR3 calculates all dimensions of cylindrical worm gears with ZI, ZA, ZK, ZN or ZH worms according to DIN 3975, as well as efficiency, tooth forces and safety against tooth root fatigue fracture and pitting according to DIN 3996.

Pre-Dimensioning

In pre-dimensioning, recommendations are made for center distance, module and teeth numbers based on input data transmission ratio, input torque or power and speed, and material of worm and worm wheel. The recommendations can be used in the following geometry and strength calculations.

Rot. speed, Torque, Rated power 1

Gear ratio $u=n_1/n_2$ <

Service factor K_A < $K_A ?$

Diameter-Center distance ratio dm_1/a <

Worm Worm Wheel

n Rot. speed n 1/min

T Rated torque T Nm

P Rated power P kW

OK Cancel Help mm <-> inch Calc

ZAR3+ Worm gear - KOMPLEM1.zr3

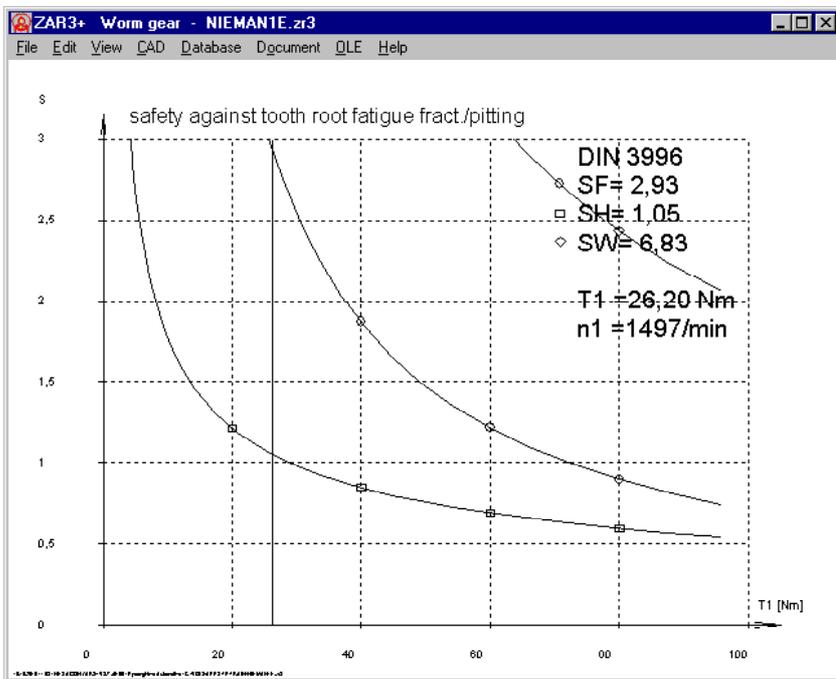
File Edit View CAD Database Document QLE Help

Geometry Calculation

In dimensioning you can adjust the recommended values to match available sizes or company standards. Or optimize gear pair by varying center distance and profile shift.

Strength Calculation

The strength calculation computes the safety factors SF (tooth breakage) and SH (pitting) along with tooth forces on the worm and worm wheel.



Efficiency

ZAR3 calculates efficiency and loss of power by tooth friction, idling, bearing and seals. The program provides recommended values and help graphics for determination of the tooth friction coefficient.

Gear Forces

Gear forces (axial, radial, tangential, normal) are calculated. These values can be used in WL1+ software for shaft calculation.

Material Data Base

The program includes a data base containing the most important gear materials and their properties.

Diagrams

Safety against tooth root fracture and pitting can be displayed as function of input torque.

Drawings and Tables

ZAR3 calculates drawings and tables of worm and worm wheel.

Production Drawing

ZAR3+ generates a production drawing of worm and worm wheel with ISO 7200 data field.

Tooth height and complementary gears

ZAR3+ provides an additional input window for modifications of tooth height factors and profile shift coefficient x . These functions are useful for design of complementary gears of steel worm (thin teeth) and plastic worm gear (thick teeth).

Tooth Profile in ZAR3+

ZAR3+ generates true-scale drawings of worm and worm gear in axial and radial cross-section

Tooth flank tolerance and measurement

ZAR3+ calculates tooth thickness and over pin/ball diameters. You can input flank tolerances, or select from DIN 3967 tolerance zone.

CAD Interface

Drawings and diagrams can be saved as DXF or IGES file to be loaded into CAD.

Animation

ZAR3+ animates rotation of worm and worm wheel on screen in axial or radial cross section.

Units

ZAR3+ can be switched between metric units (mm, N, MPa) and imperial units (inch, lbf, psi).

System Requirements

ZAR3+ is available as 32-bit app or as 64-bit app for Windows XP, Vista, Windows 7, 8, Windows 10.

Scope of Delivery

Software with user manual (pdf), non-expiring license for unlimited time use with update rights.

Guarantee

HEXAGON gives a 24 month guarantee on full functionality of the software.

