

ZAR3 / ZAR3 +



www.hexagon.de

Worm Gear Design

Software for Windows

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ZAR3+ Worm gear - NIEMAN1E.zr3

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

Dimensions			Material		Worm	Worm wheel
mx	mm	4,024			Worm	Worm wheel
mn	mm	3,022	No		1111111	2222222
gam	m	12,95	Material		16MnCr5	6Z-CuSn12
a	mm	100,00	E	MPa	210000	88300
alpha 0	°	20,00	SigHlim	MPa	1300	425
alpha x	°	19,53	Ulim	MPa	620	190
alpha n	°	20,00	tauFlimT	MPa		76

Dimensions			efficiency		Niemann	DIN3996
z		2	mu z		0,028	0,041
dm,d	mm	35,000	eta z		0,88	0,84
da	mm	43,049	PVz	kW	0,475	0,607
df	mm	25,341	PVd	kW	0,175	0,152
db	mm	18,351	PVLP	kW	0,041	0,097
b	mm	65,00	PVd	kW	0,000	0,022
x		0,000	PV	kW	0,650	0,878
			eta		0,83	0,79

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

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 $u=n_1/n_2$ 20,5 <

Service factor KA 1 < KA ?

Diameter-Center distance ratio dm_1/a 0,261 <

Worm Worm Wheel

n Rot. speed n 1200 58,5365 1/min

T Rated torque T 4,775 Nm

P Rated power P 0,6 kW

OK Cancel Help mm <-> inch Calc

ZAR3+ Worm gear - KOMPLEM1.zr3

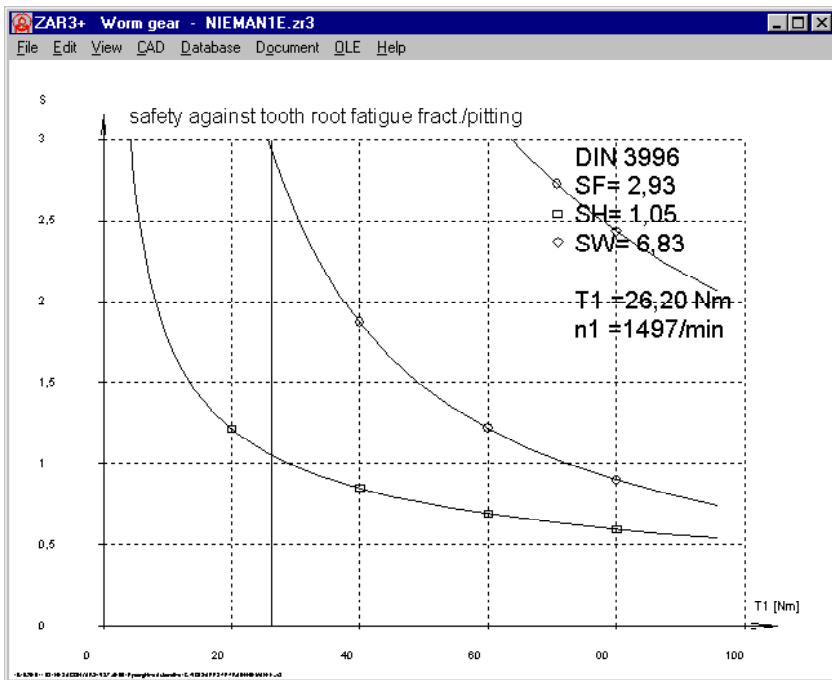
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Geometry Calculation

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.

