

WN5

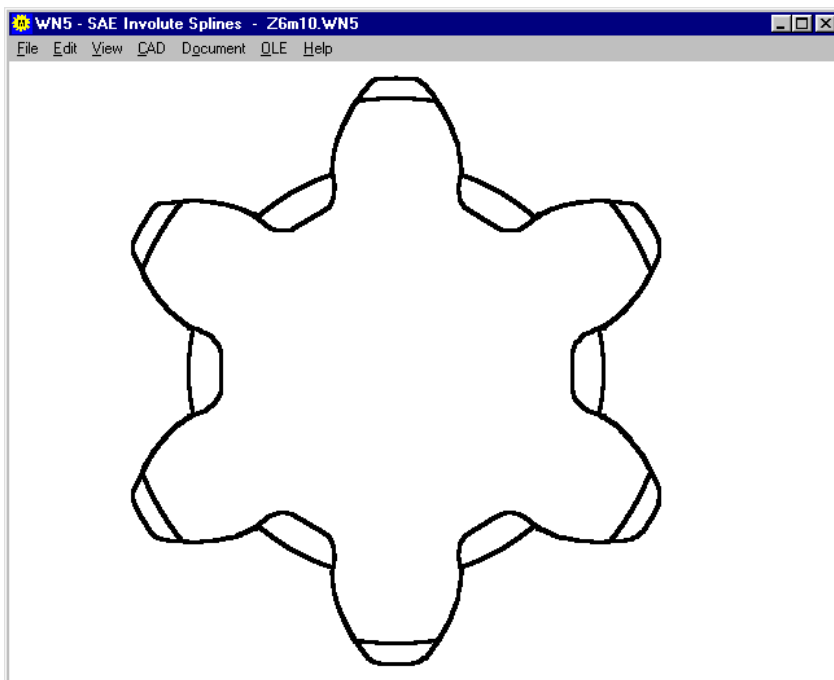


www.hexagon.de

Software for Calculation of Involute Splines according to ISO 4156 and ANSI B92.2M

for Windows

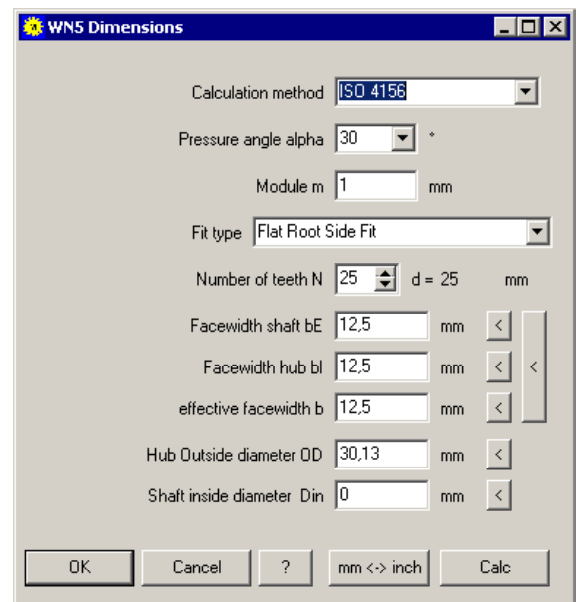
© Copyright 2001-2018 by HEXAGON Software, Berlin, Neidlingen, Kirchheim



External Spline ISO 4156				Internal Spline ISO 4156			
EXT 25z x 1m x 30P x 5h ISO 4156				INT 25z x 1m x 30P x 5H ISO 4156			
no. of teeth	z	25		no. of teeth	z	25	
module	m	1,00000		module	m	1,00000	
pressure angle	alphaD	30 °		pressure angle	alphaD	30 °	
pitch circle diameter	D	25,0000		pitch circle diameter	D	25,0000	
base circle diameter	Db	21,6506		base circle diameter	Db	21,6506	
Major diameter	Dee	26,00 h11		Major diameter	Dei	26,74 max.	
form diameter	DFe	23,89 max.		form diameter	DFi	26,20 min.	
Minor diameter	Die	23,26 min.		Minor diameter	Dii	24,09 H11	
tooth thickness				Space width			
max. effective	Svmax	1,571		max. actual	Emax	1,626	
max. actual	Smax	1,548		max. effective	Evmax	1,603	
min. effective	Svmin	1,538		min. actual	Emin	1,593	
min. actual	Smin	1,516		min. effective	Evmi	1,571	
Measurement over pins	MRe	27,835 max. aux.		Measurement between pins	MRI	22,324 max.	
Measurement over pins	MRe	27,784 min.		Measurement between pins	MRI	22,261 min. aux.	
Pin diameter	DRe	1,900		Pin diameter	DRi	1,800	
root fillet radius	rho fe	0,200		root fillet radius	rho fi	0,200	
Load and material data				STRESS			
Shaft torque	T	Nm	100			ext. spl.	int. spl.
Max. allow. compr. stress	Sac	MPa	110,3	Compressive stress	Sc	MPa	26,8
Max. allow. shear stress	Sas	MPa	344,7	Comp. stress (crown.)	Sc	MPa	2,0
				Hoop stress	Sh	MPa	0,0
				Bending stress	Sb	MPa	4,1
				Torsion. shear stress	St	MPa	89,1
				Equivalent stress	Se	MPa	154,4
							72,2

Calculation

WN5 calculates dimensions, tolerances, dimension over/between pins, stress and life expectation for involute splines according to ISO 4156 and ANSI B92.2M. Basically, WN5 uses metric units. Imperial units inch, psi, lb-in, can be configured as well. WN5 calculates the fit types „Flat Root Side Fit“ and „Fillet Root Side Fit“. Pressure angle can be 30°, 37.5° or 45°.



Flank Clearance, Tolerances

WN5 calculates tolerances for diameters, space width and tooth thickness according to ISO 4156 and ANSI B92.2M from Fit Class and Spline Tolerance Class. When entering centerline runout of internal and external spline, WN5 calculates required effective clearance.

Measurement

WN5 calculates dimension over/between pins, span measurement and tooth thickness. Pin diameter and number of teeth measured may be modified by the user.

WN5 - Involute Splines - 4156_A2.wn5

File Edit View CAD Document QLE Help

External Spline ISO 4156		Internal Spline ISO 4156	
E-XT 25x 1m x 3DP x 5H ISO 4156			
no. of teeth	z	25	25
module	m	1,0000	1,0000
pressure angle	alpha ₀	30°	30°
pitch circle diameter	d	25,000	25,000
base circle diameter	db	21,6906	21,6906
Major diameter	Dee	26,00 H11	26,7 + max.
form diameter	Dfe	23,28 max.	D fi 26,20 min.
Minor diameter	Die	23,26 min.	D ii 24,2B H11
Tooth thickness			
max. thickness	Smax	1,571	max. act.
min. thickness	Smin	1,538	E min. act.
min. thickness	Smin	1,516	E min. act.
Measurement over pins			
Measurement over pins	MRe	27,236 max. aux.	MRI 22,224 max.
Measurement over pins	MRe	27,784 min.	MRI 22,261 min. aux.
Pin diameter	D Re	1,900	D Ri 1,800
root fillet radius	rho r	0,200	rho r 0,200

tolerance tooth thickness / tooth gap
INT/FXT 25x 1m x 3DP x 5H/5h ISO 4156

ISO 4156 A2
Application Example

Load and material data	
Shaft torque	T Nm 100
Max. allow. comp. stress	Sac MPA 110,3
Max. allow. shear stress	Sas MPA 34,7

STRESS		actual	int. cal.
Compressive stress	S _c MPA	26,8	26,8
Comp. stress (conv.)	S _c MPA	2,0	2,0
Hoop stress	S _h MPA	0,0	0,0
Bending stress	S _b MPA	1,1	1,1
Torsional shear stress	S _t MPA	35,1	41,7
Equivalent stress	S _e MPA	15,4	22,2

Stress Calculation

WN5 calculates compressive stress, spline teeth shear stress, hoop stress, bending stress, torsional stress, and equivalent stress according to "SAE Design Guide for Involute Splines". Material, application factors and life expectation coefficients can be entered directly, or calculated by WN5.

WN5 Material Data

Spline: Flexible Spline Metric Units

Material: Carburized, Rc555 Shaft Torque, T: 885 lbf-in

Revolutions: 10.00 Millions Maximum allowable shear stress, S_{as}: 50000 psi

Torque cycles: 100,000 Maximum allowable compressive stress, S_{ac}: 12000 psi

Torque cycles: Uni directional Wear life factor, L_w: 1.4

Power Source: Light Fatigue life factor, L_f: 0.5

Load intermittent: Light shock Spline overload factor, K_o: 1.3

Misalignment: 0.002 in./in. Misalignment factor, K_m: 1.0

Misalignment face width: 1 in.

OK Cancel Help Text

Production Drawing

Drawing tables with spline dimension data according to ANSI B92.2M or ISO 4156 together with a spline draft may be printed or loaded with CAD via DXF-/IGES interface.

Tooth drawing

WN5 generates true-scale drawings of internal and external involute spline as DXF/IGES files for CAD Import.

WN5 - Involute Splines - 4156_A2.wn5

File Edit View CAD Document QLE Help

HEXAGON WN5 - Involute Splines V4.4

External Involute Spline base 000001		Internal Involute Spline base 000002	
E-XT 25x 1m x 3DP x 5H ISO 4156			
Hull Root Side H1 Tolerance Class 4			
no. of teeth	z	25	25
module	m	1,000	1,000
pressure angle	alpha ₀	30 deg	30 deg
base circle diameter	d	21,691 ref	21,691 ref
Pitch diameter	d	25,000 ref	25,000 ref
Major diameter D _{EE}	Dee	26,00 max	26,74 max
Form diameter D _{FE}	Dfe	23,28	26,20
Minor diameter D _{IE}	Die	23,267 23,60	24,2B 24,22
Circular tooth thickness			
Max. thickness	Smax	1,571	1,571
Min. thickness	Smin	1,516	1,526
Measurement over two pins			
Measurement over two pins	MRe	27,784 27,236	22,261 22,224
Pin diameter	D Re	1,90	1,80
Filet Radius	rho r	0,20	0,20

Shaft Hub

WN5

D = 25 mm

Fit Class: H / d (es = 65 µm) H / e (es = 40 µm) H / f (es = 20 µm) H / h (es = 0 µm)

Spline Tolerance Class: 4 5 6 7

Centerline runout (diametral) of external part CO_e: 0 mm

Centerline runout (diametral) of internal part CO_i: 0 mm

Number of points for involute polycurve: 20

OK Cancel ? mm <-> inch Calc

WN5 - Involute Splines - 4156_A2.wn5

File Edit View CAD Document QLE Help

tolerance tooth thickness / tooth gap
INT/FXT 25x 1m x 3DP x 5H/5h ISO 4156

Hub Shaft

T = 0,032 mm
lambda = 0,023 mm
T tot = 0,055 mm
es v = 0,000 mm

E max (act.) = 1,626 mm
E min (act.) = 1,593 mm
E v max (eff.) = 1,603 mm
E v min (eff.) = 1,571 mm

S v max (eff.) = 1,571 mm
S v min (eff.) = 1,538 mm
S max (act.) = 1,548 mm
S min (act.) = 1,516 mm

cv min = 0,000 mm
cv max = 0,065 mm

A_{eiE} = - lambda = - 0,023 mm
A_{ee} = - lambda - T = - 0,055 mm
A_{seE} = - lambda - esv = - 0,023 mm
A_{si} = - lambda - esv - T = - 0,055 mm

System Requirements

WN5 is available as 32-bit app or as 64-bit app for Windows 7, 8, Windows 10.

Scope of Delivery

Program with user manual (pdf), example applications and help images, non-expiring license for unlimited time use with update rights.

Software Maintenance

HEXAGON Software is continuously improved and updated. Registered users are regularly kept informed of updates and new editions.

Guarantee

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