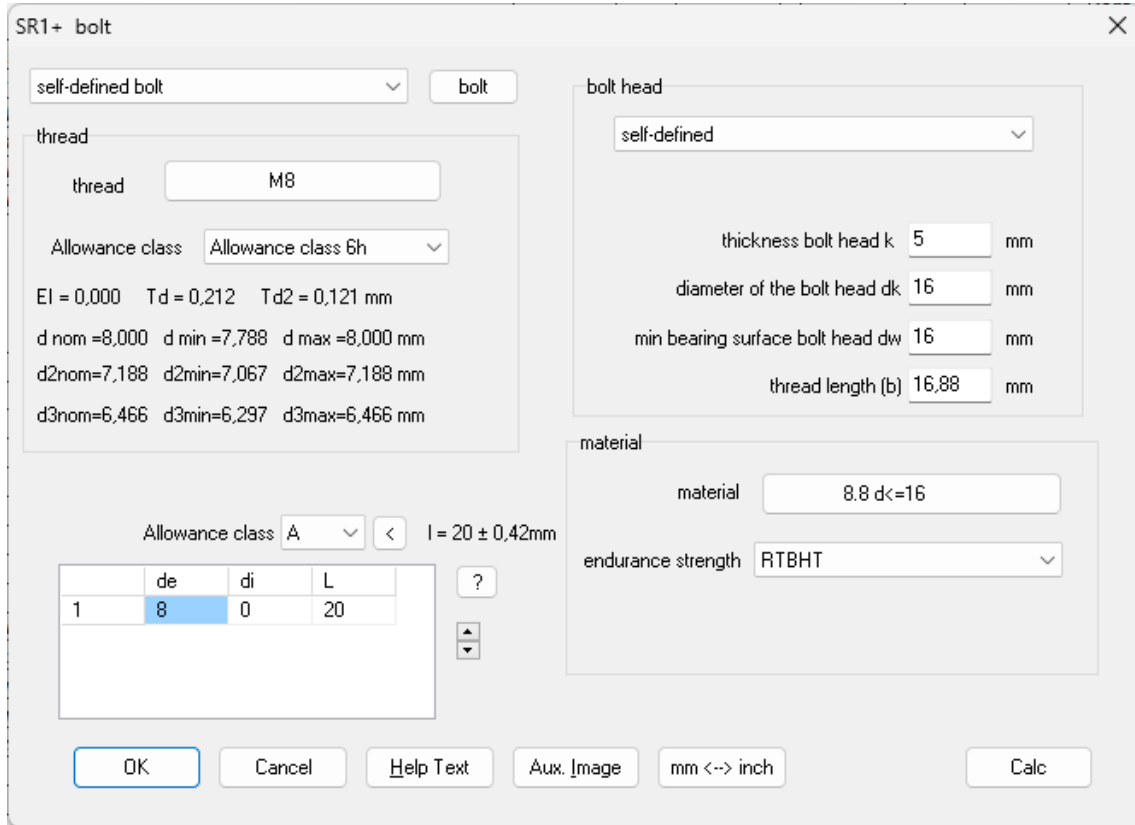
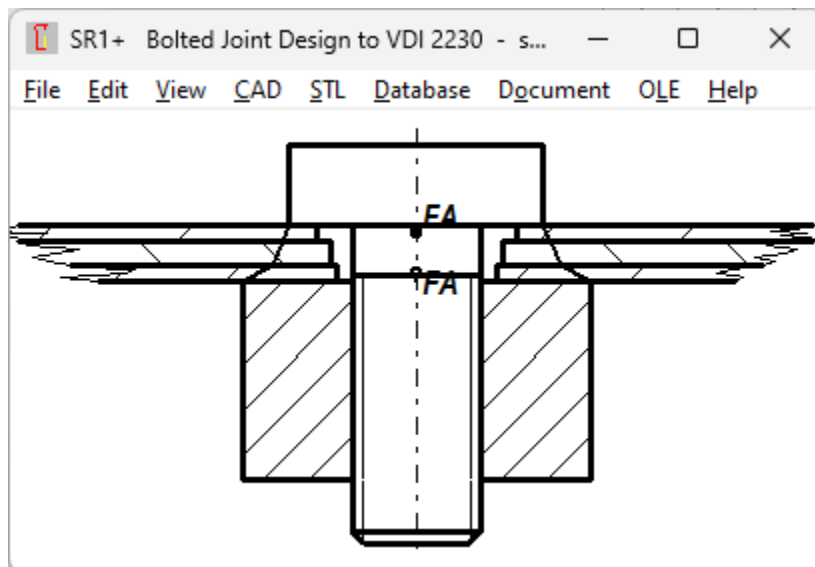


by Fritz Ruoss

SR1, SR1+: Input self-defined screw head without sondkopf database



For screws with a special head with a larger head diameter dK or head support diameter dw, the new screw head had to be added to the database file SONDKOPF.DBF. This can be quite cumbersome, for example with a network version if you do not have authorization to change databases. Therefore, there is now a new, simple round screw head "self-defined" with input of head diameter dK, support diameter dw and head height k. Incidentally, the strength of the screw head is not checked by SR1+ and VDI 2230, please note this for special heads with a large diameter and low height.



# Calculate wave spring washers by means of FED14

FED13

outer diameter De 134 mm

inner diameter Di 122 mm

number of waves z 4

spring thickness t 4,75 mm

spring height L0 6 mm

assembly length L1 5,5 mm L0

assembly length L2 5 mm Lc

Wave Spring closed  
 Wave Spring open

OK Cancel Help Text ? mm <-> inch Calc

FED14

De, Di  
 Dm, b  
 De, b  
 Di, b

outer diameter De 134 mm

inner diameter Di 122 mm

center diameter Dm 128 mm

flat width b 6 mm

flat thickness t 4,75 mm <

number of waves z 4 <

number of active coils n 1 <

spring height L0 6 mm <

assembly length L1 5,5 mm L0

assembly length L2 5 mm <

OK Cancel Help Text ? mm <-> inch Calc

A customer has discovered that he can calculate wave spring washers using FED14 instead of FED13. For open wave spring washers, similar values are obtained using FED14 calculation method 2 (Smalley), and for closed wave spring washers using calculation method 3 ( $R=0.516 E*b/n.....$ )

Calculation Method

$R=(n*z*0.516-0.456)*E*b/n^2*z^3*(t/Dm)^3$

Smalley:  $R=1/K*E*b/n*z^4*(t/Dm)^3*De/Di$

$R=0.516*E*b/n^2*z^4*(t/Dm)^3$

$R=0.417*E*b/n^2*z^4*(t/Dm)^3*De/Di$

$R=sum((n*z*0.516-0.456)*E*bi/n^2*z^3*(t/Dmi)^3)$

Non-show Quick3 View

FED14 - helical wave spring - fed13dem.f14

File Edit View CAD STL STP Database Document OLE Help

wellfeder FED13 Demo

DIMENSIONS		material		l L (mm) F (N) a (mm) sigma (avg. b)/F	
De	mm 134	EN 10151-1.4310 +C12	0	6,00	
Di	mm 122	band X10CrNi 15-8 +C1200	1	5,50 2186,51	0,50 302 0,16
Dm	mm 128	AISI 301	2	5,00 4333,01	1,00 603 0,31
L0	mm 6	Federband Nitrate	n	4,75 5416,27	1,25 754 0,39
b	mm 6	E = 125000 MPa	c	4,75 5416,27	1,25 754 0,39
t	mm 4,75	fm = 1217 MPa			
z	4	Sig. perm = 1342 MPa			
n	1				
nf	1				
De	mm 134				
L0	mm 6,00				
m	30,57				
PD	1,25				
q	1,042				

calculation method: Smalley:  $R=1/K*E*b/n^2*z^4*(t/Dm)^3*De/Di$

Warning: 1 > DMAX (2)

$R = 4333 \text{ N/mm}$   
 $R \text{ torsion} = 10,12 \text{ N/mm}$   
 $R \text{ torsion}^2 = 10,12 \text{ N/mm}$

char. line of spring

Goodman chart

Fatigue strength chart (Goodman Diagram)  
EN 10151-1.4310 +C12 (AISI 301) not steel-based

$E = 125000 \text{ MPa}$   
 $f_m = 1217 \text{ MPa}$   
 $\text{sig. z} / f_m = 0,70$   
 $\text{sig. z} = 1342 \text{ MPa}$   
 $\text{sig. oz} = 1174 \text{ MPa}$   
 $\text{sig. oz}^2 = 754 \text{ MPa}$   
 $\text{sig. rz} = 432 \text{ MPa}$

$\text{sigma1} = 302 \text{ MPa}$   
 $\text{sigma2} = 603 \text{ MPa}$   
 $\text{sigma1} = 314 \text{ MPa}$   
 $\text{sigma2} = 629 \text{ MPa}$

$t = 4,75 \text{ mm}$   
 $N = 10 \text{ mio. cycles}$

### FAQ: WN6 or WN13, WN7 or WN14?

WN6 and WN7 have been available since 2002. WN6 is used to calculate P3G polygon profiles according to DIN 32711. WN7 calculates P4C polygon profiles according to DIN 32712.

WN6 - polygon profile P3G - 32711-2.wn6

File Edit View CAD STL Database Document OLE Help

**Profile DIN 32711 - A P3G 25 k8**

Spherical diameter	d1	mm	25 k8
Outer circle diameter	d2	mm	26,6
Inner circle diameter	d3	mm	23,4
Eccentricity	e1	mm	0,8 JS4

**Profile DIN 32711 - B P3G 25 H7**

Spherical diameter	d4	mm	25 H7
Outer circle diameter	d5	mm	26,6
Inner circle diameter	d6	mm	23,4
Eccentricity	e2	mm	0,8 JS4

**STRENGTH DIN 8892 / DIN 32711**

			1	2
material			1.0050	1.0050
torque	T	Nm	150	150
Bending moment	Mb	Nm	0	0
Application factor	KA		1,00	1,00
Yield Point	Re	MPa	300	300
Support factor	fS		0,90	0,90
Hardness factor	fH		1,00	1,00
$Pzul = Re \cdot fS \cdot fH$	padm	MPa	270	270
$Sigma zul = Re \cdot fW$	Sig.zul	MPa	300	300
$Pa zul = pzul \cdot fW \cdot fapp$	pa zul	MPa	270	270
pressure	p max	MPa	96	96
$S = pa zul / pmax$	S p		2,82	2,82
$S = Sig.zul / Sig.vmax$	S e		3,01	14,10
$S = s wall / s min$	S w			1,07

WN13 and WN14 have been available since 2020. WN13 is used to calculate PnG polygon profiles. This also includes P3G profiles according to DIN 32711, WN13 also calculates polygons with 2,4,5,n corners.

WN13 - polygon profile PnG - 32711-2.w13

File Edit View CAD STL Database Document OLE Help

**Profile A P3G - e=0,8, d1=25 k8**

Spherical diameter	d1	mm	25 k8
Outer circle diameter	d2	mm	26,6
Inner circle diameter	d3	mm	23,4
Eccentricity	e1	mm	0,8
length	L1	mm	20

**Profile B P3G - e=0,8, d1=25 H7**

Spherical diameter	d4	mm	25 H7
Outer circle diameter	d5	mm	26,6
Inner circle diameter	d6	mm	23,4
Eccentricity	e2	mm	0,8
length	L2	mm	20

**STRENGTH DIN 8892 / DIN 7190**

			1	2
torque	T	Nm	150	150
Bending moment	Mb	Nm	0	0
Application factor	KA		1,00	1,00
Yield Point	Re	MPa	300	300
Support factor	fS		0,90	0,90
Hardness factor	fH		1,00	1,00
$Pzul = Re \cdot fS \cdot fH$	padm	MPa	270	270
Application factor	f app		1,00	1,00
$Sigma zul = Re \cdot fW$	Sig.zul	MPa	300	300
$Pa zul = pzul \cdot fW \cdot fapp$	pa zul	MPa	270	270
$p max = f / (mm^2) \cdot fW$	p max	MPa	126	126
Min. wall thickness	s min	mm	7,5	7,5
Wall thickness	s	mm	11,7	7,7
Shearing stress	tau max	MPa	50	12
torzion	sig.z	MPa	-126	264
Bending stress	s.bmax	MPa	0	0
Reference stress	s.vmax	MPa	87	264
$S = pa zul / pmax$	S p		2,15	2,15
$S = Sig.zul / Sig.vmax$	S e		3,45	1,14

**STRENGTH acc. to ISO 6031 / Metals**

Not drapable	f app		1,00
Application factor	KA		1,00
Load factor (Pulsat.load)	now Pa		1,00
Load factor (Alternat.load)	now Pa		4,00
Perm. pressure (Pulsat.load)	pPa adm	MPa	188
Perm. pressure (alternating)	pPa adm	MPa	75
Perm. torque (pulsating)	Tx adm	Nm	294
Perm. torque (alternating)	Tw adm	Nm	113

**P3G**

Spherical diameter	d	mm	25
Outer circle diameter	da	mm	26,6
Inner circle diameter	di	mm	23,4
Eccentricity	e	mm	0,8
Eccentricity max.	e max	mm	1,363
Section area	A	mm <sup>2</sup>	482,8
Moment of inertia, polar	Ip	mm <sup>4</sup>	37399
Section modulus, polar	Wp	mm <sup>3</sup>	2992
Section modulus, equibonal	Wx	mm <sup>3</sup>	1496
Length eff	L eff	mm	20
Number of teeth	n		3
Teeth height eff	h min	mm	1,59

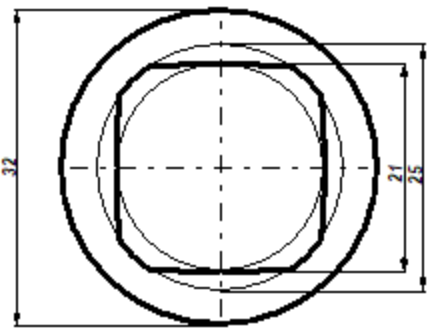
Berechnungsbeispiel  
aus DIN 32711-2

WN14 calculates PnC polygon profiles, which also includes P4C profiles according to DIN 32712. Therefore, you do not necessarily need WN6 and WN7 if you have WN13 and WN14.

However, in WN13 and WN14 the strength is not calculated according to DIN 32711 or DIN 32712, but according to DIN 7190 for interference fits and general formulas of strength of materials.

WN7 - polygon profile P4C - 32712-2.wn7

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Profile DIN 32712 - A P4C 25 k6	
Outer circle diameter	d1 mm 25 e9
Inner circle diameter	d2 mm 21 k6
Eccentricity	e1 mm 5 js4
length	L1 mm 25

Profile DIN 32712 - B P4C 25 H7	
Outer circle diameter	d3 mm 25 H11
Inner circle diameter	d4 mm 21 H7
Drill diameter	d4pre mm 20.8 H8
Eccentricity	e2 mm 5 JS5
length	L2 mm 25

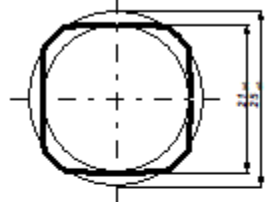
STRENGTH DIN 6892 / DIN 32712			
		1	2
material		1.0050	1.0050
torque	T Nm	150	150
Bending moment	Mb Nm	0	0
Application factor	KA	1,00	1,00
Yield Point	Re MPa	300	300
Support factor	fS	0,90	0,90
Hardness factor	fH	1,00	1,00
$P_{zul} = Re \cdot f_S \cdot f_H$	padm MPa	270	270
$\Sigma \sigma_{zul} = Re \cdot f_W$	Sig.zul MPa	300	300
$P_{a\ zul} = p_{zul} \cdot f_{app}$	pa zul MPa	270	270
pressure	p max MPa	76	76
$S = p_{zul} / p_{max}$	S p	3,55	3,55
$S = \Sigma \sigma_{zul} / \Sigma \sigma_{vmax}$	S e	2,14	6,05
$S = s_{wall} / s_{min}$	S w		1,00

In WN6 and WN7, a minimum wall thickness of the hub is calculated in accordance with DIN 32711 and 32712, in WN13 and WN14 a tensile stress is calculated instead and, together with torsional stress and bending stress, a comparative stress. These formulas apply not only to P3G and P4C, but to any number of teeth, see Info Letter 183.

[https://www.hexagon.de/info183/index\\_d.htm](https://www.hexagon.de/info183/index_d.htm)

WN14 - polygon profile PnC - 32712-2e.w14

File Edit View CAD STL Database Document OLE Help



Profile P4C (d1=25, d2=21, e1=5) - A 25 k6	
Outer circle diameter	d1 mm 25 k6
Inner circle diameter	d2 mm 21 k6
Eccentricity	e1 mm 5 js4
length	L1 mm 25

Profile P4C (d1=25, d2=21, e1=5) - B 25 H7	
Outer circle diameter	d3 mm 25 H11
Inner circle diameter	d4 mm 21 H7
Eccentricity	e2 mm 5 JS5
length	L2 mm 25

STRENGTH DIN 6892 / DIN 7190			
		1	2
torque	T Nm	150	150
Bending moment	Mb Nm	0	0
Application factor	KA	1,00	1,00
Yield Point	Re MPa	300	300
Support factor	fS	0,90	0,90
Hardness factor	fH	1,00	1,00
$P_{zul} = Re \cdot f_S \cdot f_H$	padm MPa	270	270
Alternating load factor	f app	1,00	1,00
Application factor	f app	1,00	1,00
$\Sigma \sigma_{zul} = Re \cdot f_W$	Sig.zul MPa	300	300
$P_{a\ zul} = p_{zul} \cdot f_{app}$	pa zul MPa	270	270
$P_{max} = f_{app} \cdot P_{a\ zul}$	p max MPa	84	84
Min. wall thickness	a min mm	3,2	3,5
Wall thickness	a mm	10,5	3,5
Shearing stress	tau max MPa	81	29
torsion	sig.2 MPa	-84	283
Bending stress	s.bmax MPa	0	0
Reference stress	s.vmax MPa	140	283
$S = p_{zul} / p_{max}$	S p	3,22	3,22
$S = \Sigma \sigma_{zul} / \Sigma \sigma_{vmax}$	S e	2,14	1,14

1 (shaft)		2 (hub)	
Drawing name	Shaft		Hub
Drawing number	1		2
Drawing name 2	P4C shaft		P4C hub
material	E295 (St 50)		E295 (St 50)
Material No.	1.0050		1.0050
Yield Point Re (MPa)	300		300
Tensile strength Rm (MPa)	300		300
Elasticity module E (MPa)	210000		210000
Poisson ratio nu	0,30		0,30

P4C	
Outer circle diameter	d1 mm 25
Inner circle diameter	d2 mm 21
Eccentricity	e mm 5
$D_{m1} = d2 + 4e$	dmm mm 47
$D_{m2} = d2 + 2e$	dmm mm 37
$E_r = (d1 - d2) / 4$	er mm 1
$D_r = d2 + 2 \cdot e_r = (d1 + d2) / 2$	dr mm 23
Sector angle PtoG	pa/PtoG ° 76,5
Sector angle arc	pa/Arc ° 13,5
PtoG where factor	f PtoG 6,78
Section area	A mm² 475,5
Section modulus, polar	Wp mm³ 1852
Section modulus, equatorial	Wx mm³ 926,1
Length eff	L eff mm 20
Number of teeth	n 4
Tooth height eff	h min mm 1,944

STRENGTH acc. to PtoG / Matek	
Not draplaceable	f app 1,00
Application factor	KA 1,00
Load factor (PtoG load)	nuw Pa 1,60
Load factor (Alternat. load)	nuw Pw 4,00
Perm. pressure (PtoG load)	pa adm MPa 558
Perm. pressure (alternating)	pa adm MPa 75
Perm. torque (PtoG load)	Tw adm Nm 370
Perm. torque (alternating)	Tw adm Nm 148

Warning: Sig.vA > fB /  
Warning: a < amin / (2)

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