by Fritz Ruoss

SR1/SR1+: Error from VDI 2230 regarding minimum screw-in depth corrected
Dr. Andreas Kroker discovered an error in the calculation of the minimum screw-in depth, which was also confirmed by the VDI. Thank you, SR1/SR1+ has been amended accordingly.

$$m_{\text{ges min}} = \frac{R_{\text{m max}} \cdot A_S \cdot P}{\left\{ C_1 \cdot C_2 \cdot \tau_{\text{BS min}} \left[\frac{P}{2} + (d_{2\,\text{min}} - D_{1\,\text{max}}) \tan 30^\circ \right] \cdot \pi \cdot d_{\text{min}} \right\}} + 2 \cdot P \qquad (213)$$

In equation (213) of VDI 2230:2015, "dmin" of the bolt should be replaced by "D1max" of the nut. D1max is smaller than dmin, resulting in a larger minimum screw-in depth and a lower stripping safety factor. This only applies to the "bolt thread critical" case. The printout now includes even more intermediate results for users who want to recalculate or understand the result.

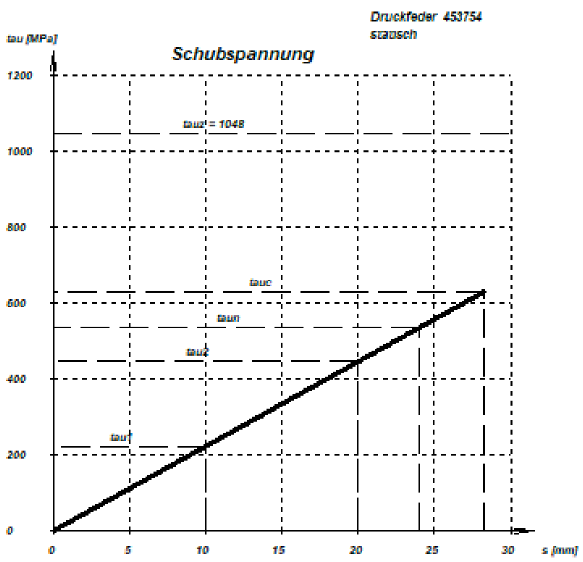
```
----------------------------------------------------------------------
Shear stress coefficient VDI2230  taub/Rm                  0,620
----------------------------------------------------------------------
Strength ratio VDI2230            RS                       1,349
----------------------------------------------------------------------
RS >= 1  -> bolt thread critical
----------------------------------------------------------------------
C1 coeff. VDI2230                 C1                       0,840
----------------------------------------------------------------------
C2 coeff. VDI2230                 C2                       1,037
----------------------------------------------------------------------
C3 coeff. VDI2230                 C3                       0,897
----------------------------------------------------------------------
Max/min m ges (bolt thread crit.) meffbolt mm          13,2        9,0
----------------------------------------------------------------------
Max/min m ges (nut thread crit.)  meffnut  mm          11,2        7,7
----------------------------------------------------------------------
Min.thread length engag. Rmmax VDImeffmin  mm               13,2
----------------------------------------------------------------------
Min.thread length engag. Rmmin VDImeffmin- mm                9,0
----------------------------------------------------------------------
Min.thread length engag. FS VDI   m min FS mm                9,7
----------------------------------------------------------------------
```

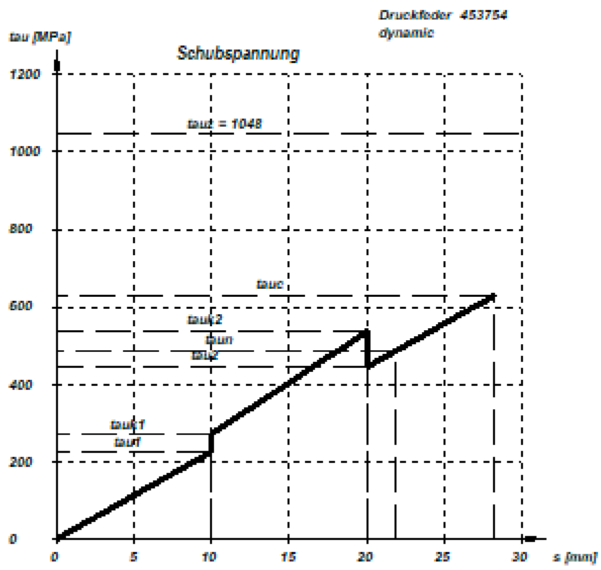
Using application examples 1 to 5 from VDI 2230-1:2015, we recalculated how the changes affect the results. Stripping safety B1 to B5, numbers in parentheses before the change (with dmin instead of D1max).
B1: mtr/meffmin = 1.52 unchanged, because RS<1 (nut thread critical)
B2: mtr/meffmin = 0.82 (0.91), RS>1 (bolt thread critical)
B3: mtr/meffmin = 1.89 (2.00), RS>1 (bolt thread critical)
B4: mtr/meffmin = 0.95 (1.07), RS>1 (bolt thread critical)
B5: mtr/meffmin = 1.09 unchanged, because RS<1 (nut thread critical)
Changes only apply to the "bolt thread critical" case. In Examples 2 and 4, the thread strip safety factor is even less than 1. According to VDI 2230, the minimum screw-in depth does not need to be calculated because a standard nut is used. Correct, the nut is secure. However, the bolt thread may be stripped.

FED1+ 2+ 5 6 7 17: New calculation option: Always apply stress correction factor k

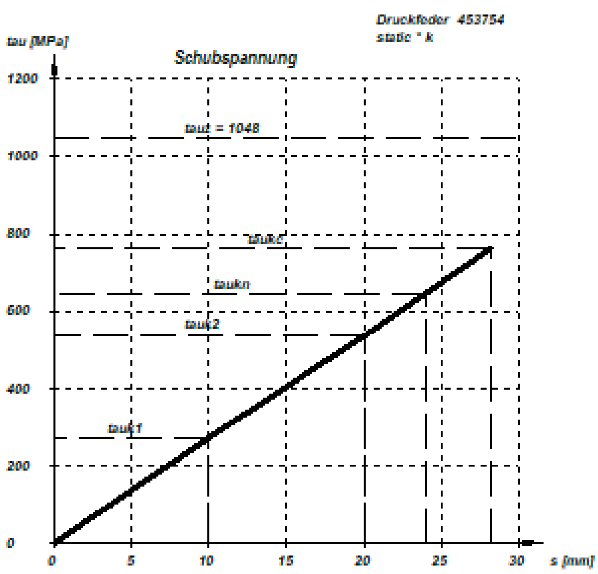
According to EN 13906, the stress correction factor k is only used for dynamically loaded springs, so corrected shear stresses (tau*k) tauk1, tauk2, taukh = tauk2 - tauk2 are only to be used for the working range. In British and American standards, however, the stress correction factor k is always used, even for purely statically loaded springs. Therefore, you can now check the box under "Edit\Calculation Method" to always include *k. This even has implications for dynamically loaded springs, because the block stress is then calculated using taukc instead of tauc.

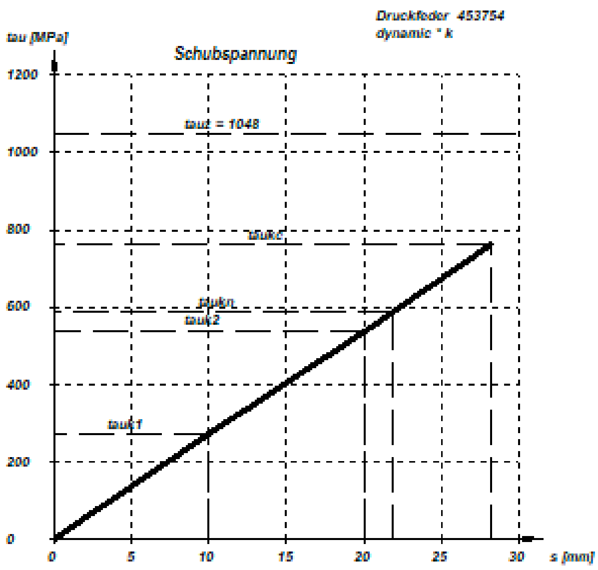
There are now three different versions of the tau-s diagram (shear stress-spring deflection):
1: static without *k
2: dynamic without "*k static+dynamic"
3: *k static+dynamic





Types 1 and 2 already existed, type 3 is new.





Type 3 is identical for static and dynamic application (only taukh differs).

FED1+ 2+ 5 6 7 17: Quick Views with/without "*k static+dynamic"
If "k static+dynamic" is set, the coefficients tau/tauz and tau/Rm are calculated with k in the Quick Views.

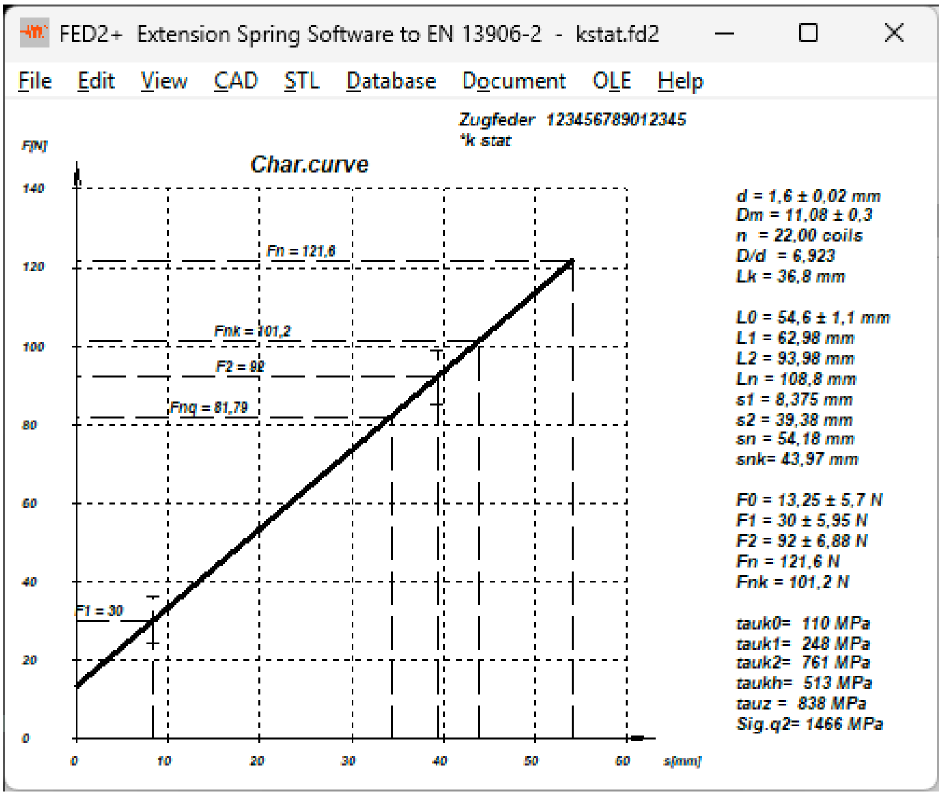
L [mm]	F [N]	tau [MPa]	s [mm]	tau/tauz	tau/Rm	De	aW
L0: 60,00						25,00	3,59
L1: 50,00	F1: 131,9	tauk1: 269	s1: 10,00	0,26	0,14	25,04	2,32
L2: 40,00	F2: 263,7	tauk2: 539	s2: 20,00	0,51	0,29	25,07	1,05
Ln: 38,18	Fn: 287,7	taukn: 588	sn: 21,82	0,56	0,31	25,07	0,81
Lc: 31,77	Fc: 372,2	taukc: 760	sc: 28,23	0,73	0,41	25,08	0,00

If "k static+dynamic" is not set, the coefficients tau/tauz and tau/Rm are calculated in the quick views as usual without k, including tau1 and tau2 for dynamic loading.

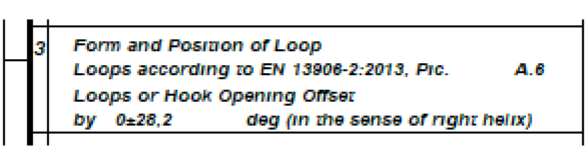
L [mm]	F [N]	tau [MPa]	s [mm]	tau/tauz	tau/Rm	De	aW
L0: 60,00						25,00	3,59
L1: 50,00	F1: 131,9	tauk1: 269	s1: 10,00	0,21	0,12	25,04	2,32
L2: 40,00	F2: 263,7	tauk2: 539	s2: 20,00	0,43	0,24	25,07	1,05
Ln: 38,18	Fn: 287,7	tau n: 487	sn: 21,82	0,47	0,26	25,07	0,81
Lc: 31,77	Fc: 372,2	tau c: 630	sc: 28,23	0,60	0,34	25,08	0,00

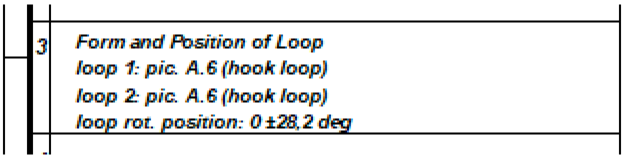
Note tau/tauz and tau/Rm with *k (above) and without *k (below)

FED2+ with/without "k static+dynamic"
For FED2+, the "*k" setting uses tauk0, tauk1, tauk2, and taukn for calculations. For FED2+, taukn=tauz instead of taun=tauz, which reduces the usable spring length Ln in Lnk for tension springs at the corresponding (reduced) spring force Fnk.

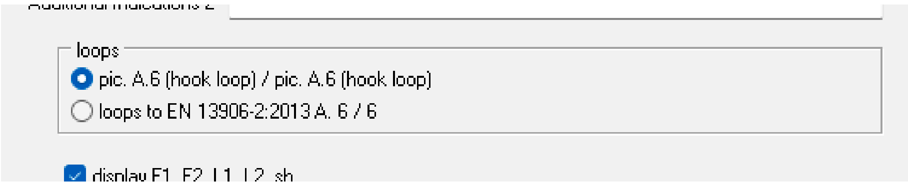


FED2+: Loop names in production drawing



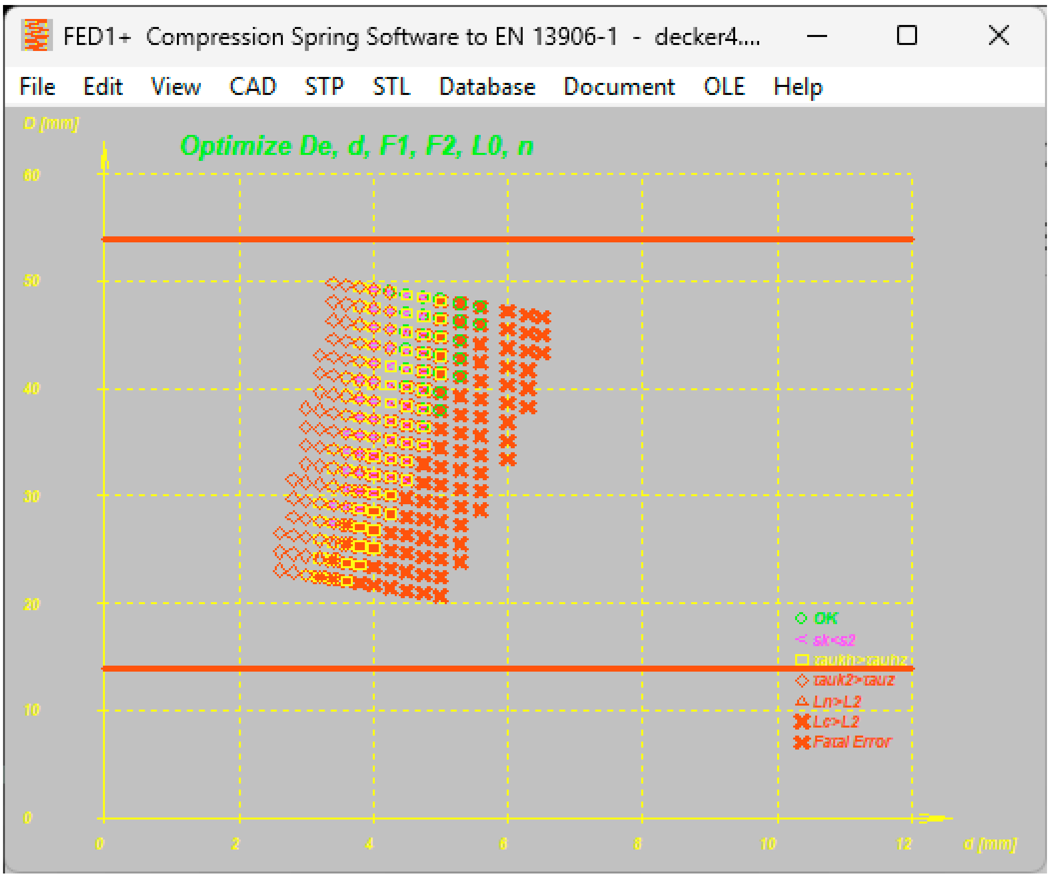


In the production drawing, only the EN number is used for the loops. You can now also configure the loop designation to be displayed in the production drawing.
However, you can also retain the previous display under “Edit\Production Drawing”.
International production drawings would always display the untranslated text, so the previous display is retained here.



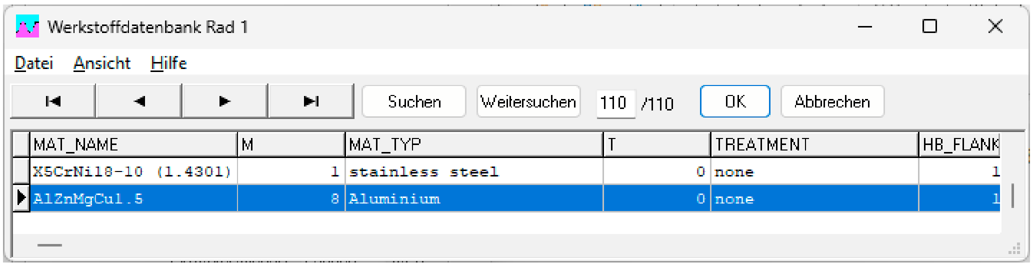
FED1+ Installation Space Design: Y-axis "D" instead of "De"

FED1+ calculates hundreds of springs for a given installation space, with warnings and error messages displayed as symbols in the diagram.

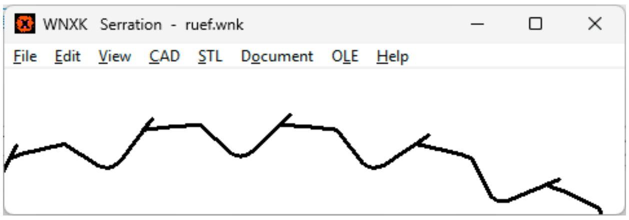


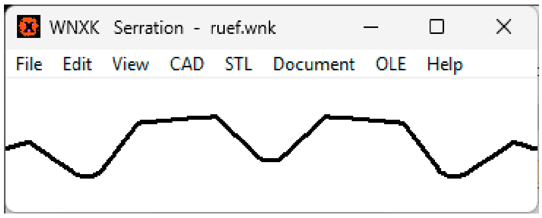
The labeling of the vertical axis with the coil diameter has been changed from "De" to "D." The upper limit is "De max," and the lower limit is "Di min." For the calculated springs, the wire diameter is marked "d" and the mean coil diameter is marked "Dm" (not "De").

ZAR1,2,3,4,5,6,7,8,9: Gear material database
X5CrNi18-10 (1.4301) and AlZnMgCu1.5 were added to the gear materials database.



WNXK Profile Drawing
If the outer diameter of the splined shaft was smaller than the pitch diameter, an extra line was drawn in the shaft profile. The display has been corrected.





FED14: Layered coil springs

Such wave springs cannot be calculated with FED14. In FED14, the number of waves is 2.5, 3.5, 4.5; here it is 3.0, 4.0, 5.0. Such wave springs can only be calculated with FED13, or with FED14, one coil (n=1.0), then the spring force multiplied by the number of coils n. This is analogous to layered disc springs with FED4.

HEXAGON PRICE LIST 2025-05-01

Base price for single licences (perpetual)	EUR
DI1 Version 2.2 O-Ring Seal Software	190.-
DXF-Manager Version 9.1	383.-
DXFPLOT V 3.2	123.-
FED1+ V32.2 Helical Compression Springs incl. spring database, animation, relax., 3D,..	695.-
FED2+ V22.7 Helical Extension Springs incl. Spring database, animation, relaxation, ...	675.-
FED3+ V22.1 Helical Torsion Springs incl. prod.drawing, animation, 3D, rectang.wire, ...	600.-
FED4 Version 8.0 Disk Springs	430.-
FED5 Version 17.7 Conical Compression Springs	741.-
FED6 Version 18.7 Nonlinear Cylindrical Compression Springs	634.-
FED7 Version 15.7 Nonlinear Compression Springs	660.-
FED8 Version 7.6 Torsion Bar	317.-
FED9+ Version 7.0 Spiral Spring incl. production drawing, animation, Quick input	490.-
FED10 Version 4.5 Leaf Spring	500.-
FED11 Version 3.6 Spring Lock and Bushing	210.-
FED12 Version 2.7 Elastomer Compression Spring	220.-
FED13 Version 4.3 Wave Spring Washers	228.-
FED14 Version 2.9 Helical Wave Spring	395.-
FED15 Version 1.7 Leaf Spring (simple)	180.-
FED16 Version 1.4 Constant Force Spring	225.-
FED17 Version 2.7 Magazine Spring	725.-
FED19 Version 1.0 Buffer Spring	620.-
GEO1+ V7.5 Cross Section Calculation incl. profile database	294.-
GEO2 V3.4 Rotation Bodies	194.-
GEO3 V4.1 Hertzian Pressure	205.-
GEO4 V5.3 Cam Software	265.-
GEO5 V1.0 Geneva Drive Mechanism Software	218.-
GEO6 V1.0 Pinch Roll Overrunning Clutch Software	232.-
GEO7 V1.0 Internal Geneva Drive Mechanism Software	219.-
GR1 V2.2 Gear Construction Kit Software	185.-
GR2 V1.4 Eccentric Gear Software	550,-
GR3 V1.3 Cycloidal Gear Software	600,-
HPGL Manager Version 9.1	383.-
LG1 V7.0 Roll-Contact Bearings	296.-
LG2 V3.1 Hydrodynamic Plain Journal Bearings	460.-
SR1 V25.4 Bolted Joint Design	640.-
SR1+ V25.4 Bolted Joint Design incl. Flange calculation	750.-
TOL1 V12.0 Tolerance Analysis	506.-
TOL2 Version 4.1 Tolerance Analysis	495.-
TOLPASS V4.1 Library for ISO tolerances	107.-
TR1 V6.5 Girder Calculation	757.-
WL1+ V21.9 Shaft Calculation incl. Roll-contact Bearings	945.-
WN1 V12.4 Cylindrical and Conical Press Fits	485.-
WN2 V11.6 Involute Splines to DIN 5480	250.-
WN2+ V11.6 Involute Splines to DIN 5480 and non-standard involute splines	380.-
WN3 V 6.0 Parallel Key Joints to DIN 6885, ANSI B17.1, DIN 6892	245.-
WN4 V 6.2 Involute Splines to ANSI B 92.1	276.-
WN5 V 6.2 Involute Splines to ISO 4156 and ANSI B 92.2 M	255.-
WN6 V 4.1 Polygon Profiles P3G to DIN 32711	180.-
WN7 V 4.1 Polygon Profiles P4C to DIN 32712	175.-
WN8 V 2.6 Serration to DIN 5481	195.-
WN9 V 2.4 Spline Shafts to DIN ISO 14	170.-
WN10 V 4.5 Involute Splines to DIN 5482	260.-
WN11 V 2.0 Woodruff Key Joints	240.-
WN12 V 1.2 Face Splines	256.-
WN13 V 1.0 Polygon Profiles PnG	238.-
WN14 V 1.0 Polygon Profiles PnC	236.-
WNXE V 2.4 Involute Splines – dimensions, graphic, measure	375.-
WNXK V 2.2 Serration Splines – dimensions, graphic, measure	230.-
WST1 V 10.2 Material Database	235.-

ZAR1+ V 27.1 Spur and Helical Gears	1115.-
ZAR2 V8.2 Spiral Bevel Gears to Klingelnberg	792.-
ZAR3+ V10.6 Cylindrical Worm Gears	620.-
ZAR4 V6.5 Non-circular Spur Gears	1610.-
ZAR5 V12.8 Planetary Gears	1355.-
ZAR6 V4.3 Straight/Helical/Spiral Bevel Gears	585.-
ZAR7 V2.7 Plus Planetary Gears	1380.-
ZAR8 V2.3 Ravigneaux Planetary Gears	1950.-
ZAR9 V1.1 Cross-Helical Screw Gears	650.-
ZARXP V2.6 Involute Profiles - dimensions, graphic, measure	275.-
ZAR1W V2.7 Gear Wheel Dimensions, tolerances, measure	450.-
ZM1.V3.1 Chain Gear Design	326.-
ZM2.V1.1 Pin Rack Drive Design	320.-
ZM3.V1.1 Synchronous Belt Drive Design	224.-

PACKAGES	EUR
HEXAGON Mechanical Engineering Package (TOL1, ZAR1+, ZAR2, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WN2+, WN3, WST1, SR1+, FED1+, FED2+, FED3+, FED4, ZARXP, TOLPASS, LG1, DXFPLOT, GEO1+, TOL2, GEO2, GEO3, ZM1, ZM3, WN6, WN7, LG2, FED12, FED13, WN8, WN9, WN11, DI1, FED15, GR1)	8,500.-
HEXAGON Mechanical Engineering Base Package (ZAR1+, ZAR3+, ZAR5, ZAR6, WL1+, WN1, WST1, SR1+, FED1,+, FED2+, FED3+)	4,900.-
HEXAGON Spur Gear Package (ZAR1+ and ZAR5)	1,585.-
HEXAGON Planetary Gear Package (ZAR1+, ZAR5, ZAR7, ZAR8, GR1)	3,600.-
HEXAGON Involute Spline Package (WN2+, WN4, WN5, WN10, WNXE)	1,200.-
HEXAGON Graphic Package (DXF-Manager, HPGL-Manager, DXFPLOT)	741.-
HEXAGON Helical Spring Package (FED1+, FED2+, FED3+, FED5, FED6, FED7)	2,550.-
HEXAGON Complete Spring Package (FED1+, FED2+, FED3+, FED4, FED5, FED6, FED7, FED8, FED9+, FED10, FED11, FED12, FED13, FED14,, FED15, FED16, FED17, FED19)	4,985.-
HEXAGON Tolerance Package (TOL1, TOL1CON, TOL2, TOLPASS)	945.-
HEXAGON Complete Package (All Programs)	14,950.-

Quantity Discount for Individual Licenses

Licenses	2	3	4	5	6	7	8	9	>9
Discount %	25%	27.5%	30%	32.5%	35%	37.5%	40%	42.5%	45%

Network Floating License

Licenses	1	2	3	4	5	6	7..8	9..11	>11
Discount/Add.cost	-50%	-20%	0%	10%	15%	20%	25%	30%	35%

(Negative Discount means additional cost)

Language Version:

- **German and English :** all Programs
- **French**: FED1+, FED2+, FED3+, FED4, FED5, FED6, FED7, FED9+, FED10, FED13, FED14, FED15, TOL1, TOL2.
- **Italiano**: FED1+, FED2+, FED3+, FED4, FED5, FED6, FED7, FED9+, FED13, FED14, FED17.
- **Swedish**: FED1+, FED2+, FED3+, FED5, FED6, FED7.
- **Portugues**: FED1+, FED17
- **Spanish**: FED1+, FED2+, FED3+, FED17

Updates:

Software Update Windows: 40 EUR, Update Win64: 50 EUR
Update Mechanical Engineering Package: 800 EUR, Update Complete Package: 1200 EUR
Maintenance contract for free updates: annual fee: 150 EUR + 40 EUR per program

Hexagon Software Network Licenses

Floating License in the time-sharing manner by integrated license manager.

Conditions for delivery and payment

Delivery by Email or download (zip file, manual as pdf files): EUR 0.
General packaging and postage costs for delivery on CD: EUR 60, (EUR 25 inside Europe)
Conditions of payment: bank transfer in advance with 2% discount, or PayPal (paypal.me/hexagoninfo) net.
After installation, software has to be released by key code. Key codes will be sent after receipt of payment.
Fee for additional key codes: 40 EUR

HEXAGON Industriesoftware GmbH E-Mail: info@hexagon.de Web: www.hexagon.de