by Fritz Ruoss

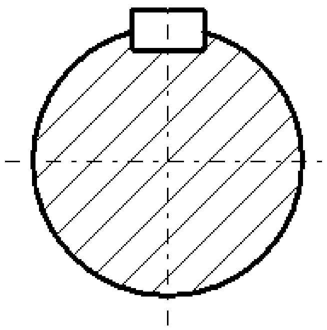
WN3, WN11: DIN 6892:2012 and Quick3 View

WN3 Parallel Key Design acc.to DIN 6892:2012 - d1_2012.wn3

File Edit View CAD Database Document OLE Help

D.1. Elastische Bolzenkupplung
aus DIN 6892:2012

Welle 1
Kupplungsnabe 2 Teil 1



load		
TN	Nm	4000
Tmax	Nm	15000
Mbmax	Nm	0
KA		1,50
fW		0,58
Teq	Nm	6000
Feq	N	100000
Fmax	N	250000

Calculation	
l tr mm	93,00
Kveq	1,00
Kvmax	1,00
Klambda	1,07
KReq	1,00
KRmax	1,00

Calculation		shaft	hub	slid.key
peq = Kveq*Kle*KReq*Feq/(ltr*ttr)	MPa	143	148	148
pmax = Kvmax*Kle*KRmax*Fmax/(ltr*ttr)	MPa	358	369	369
h tr (t1tr, t2tr)	mm	8,03	7,80	15,83
fL (NL = 10E3)		1,40	1,20	1,40

slid.key A32x18x125 DIN 6885-1		
number Parallel keys n		1
fillet r max	mm	0,80
shaft diameter d	mm	120 H7/n6
chamfer/fillet s1	mm	0,00
chamfer/fillet s2	mm	0,80

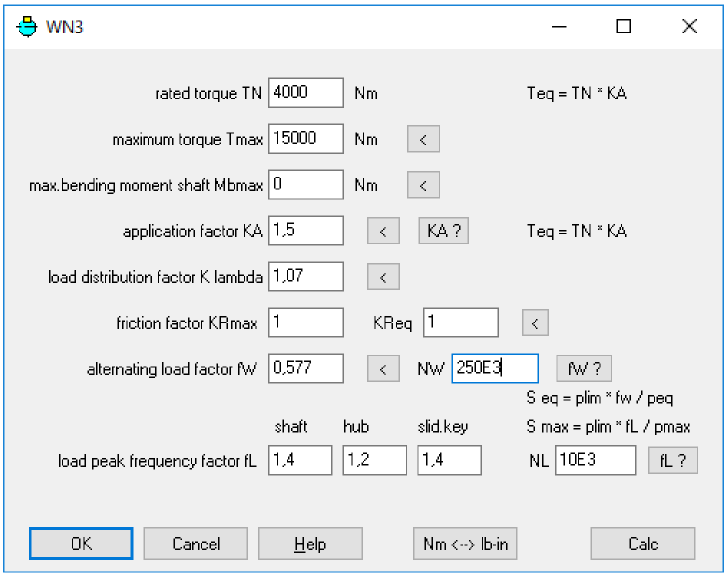
Calculation load shaft		
taumax	MPa	44
taueq	MPa	18
Sigmabmax	MPa	0
Sigmavmax	MPa	77
Sigmaveq	MPa	38
beta cb		2,06
beta ct		1,25
S1 = Re * fw / Sigmaveq		4,66

MATERIAL	shaft	hub	slid.key
material	1 C 60	EN-GJL-250	C 45 K
Re MPa	310	200	430
fS	1,30	2,00	1,10
fH	1,00	1,00	1,00
pzul = Re*fS*fH	403	400	473

Safety Margins	shaft	hub	slid.key
Seq = fW*pzul/peq	1,62	1,56	1,85
Smx = fL*pzul/pmax	1,57	1,30	1,80

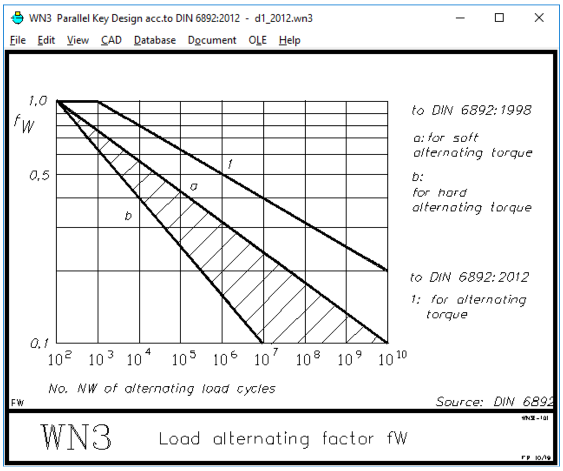
WN3 got a new Quick3 view, and was updated from DIN 6892 edition 1998 to DIN 6892: 2012. The friction factor KR is now entered as KRmax and KReq. Previously, KR was considered only at Fmax, at Feq, however, KReq = 1. The friction factor KR is used when the torque transmission by parallel keys is supported by a transition fit or press fit.
There were also changes in support factor fS, hardness influence factor fH, load alternation factor fW, load peak frequency factor fL. The new factors and curves according to DIN 6892: 2012 were additionally drawn in the help images, so you have old and new DIN data in one image. Since the factors fS, fH, fW, fL are also used in WN2, WN6, WN7, WN8, WN9, WN10, WN11, WN12 in the strength calculation, the corresponding help screens have also been updated there.

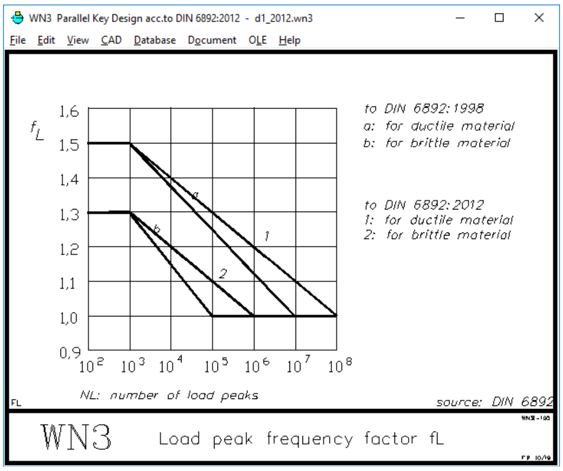
WN3, WN11, WN2, WN8, WN9, WN10: Calculate fW and fL from NW and NL



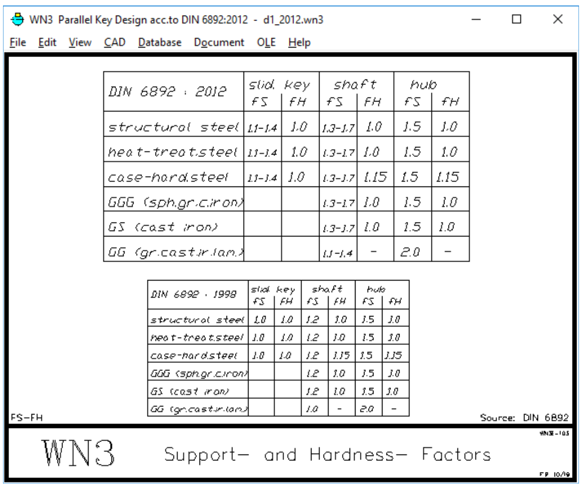
The alternating load factor fW and the peak load factor fL no longer needs to be read from the diagrams in help screens FW and FL. You can now enter the number of peak loads NL and the number of load direction changes NW. Then click on the "<" button to calculate fW or fL. NL and NW can also be entered with a decimal exponent, e.g. 1E4 or 10E3 instead of 10000.

WN2, WN6, WN7, WN8, WN9, WN10, WN11, WN12: Auxiliary Image Update





The help screens for the fS, fH, fW, fL have been updated in accordance with DIN 6892: 2012.


WN3 Parallel Key Design acc.to DIN 6892:2012 - d1_2012.wn3

File Edit View CAD Database Document OLE Help

DIN 6892 : 2012	slid. key fS	slid. key fH	shaft fS	shaft fH	hub fS	hub fH
structural steel	1.1-1.4	1.0	1.3-1.7	1.0	1.5	1.0
heat-treat.steel	1.1-1.4	1.0	1.3-1.7	1.0	1.5	1.0
case-hard.steel	1.1-1.4	1.0	1.3-1.7	1.15	1.5	1.15
GGG (sph.gr.c.iron)			1.3-1.7	1.0	1.5	1.0
GS (cast iron)			1.3-1.7	1.0	1.5	1.0
GG (gr.cast.ir.lam.)			1.1-1.4	–	2.0	–

DIN 6892 : 1998	slid. key fS	slid. key fH	shaft fS	shaft fH	hub fS	hub fH
structural steel	1.0	1.0	1.2	1.0	1.5	1.0
heat-treat.steel	1.0	1.0	1.2	1.0	1.5	1.0
case-hard.steel	1.0	1.0	1.2	1.15	1.5	1.15
GGG (sph.gr.c.iron)			1.2	1.0	1.5	1.0
GS (cast iron)			1.2	1.0	1.5	1.0
GG (gr.cast.ir.lam.)			1.0	-	2.0	-

FS-FH

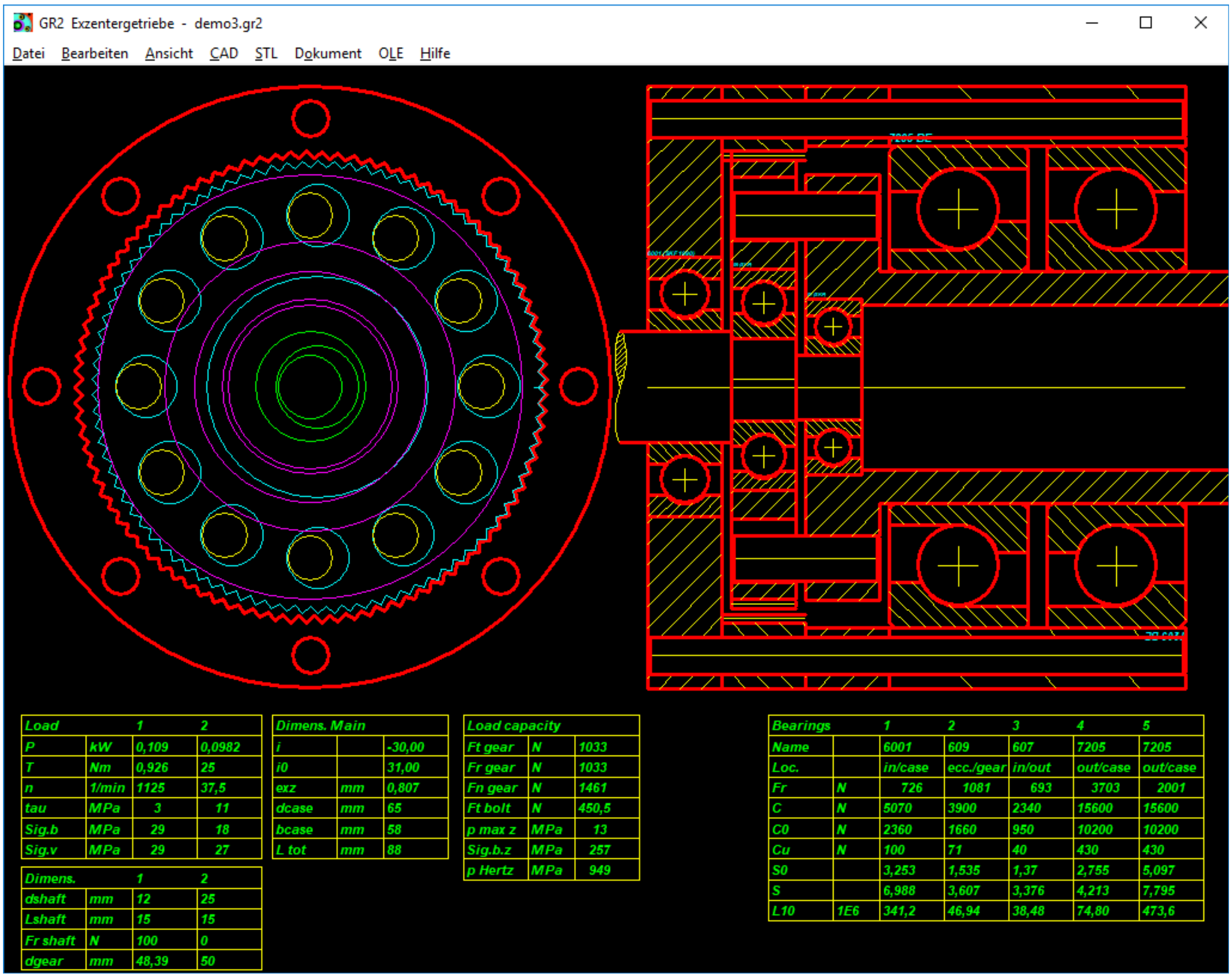
Source: DIN 6892

WN3 Support- and Hardness- Factors

TOL1: New Error message “upper tol. < lower.tol.”
If you have accidentally entered a lower value for the upper tolerance than for the lower tolerance, an error message appears immediately.

FED7: Access Violation Error Message in Module WFED7.EXE
In rare cases, when the calculated sum of coils differs from the total number of coils, an access violation occurred. If this happens to you too, please send the .fd7 file and a screenshot of the error message, then you will receive a free update to the latest version.

GR2: New software for eccentric gears
Eccentric gears are suitable for gearboxes with a large gear ratio with low backlash, with self-locking and centric axes.
On an eccentric gear, a planetary wheel rolls on a ring gear. For a large gear ratio, the number of teeth of the planetary gear wheel is only 1 or 2 teeth smaller than that of the ring gear. The ring gear is fixed, the drive shaft with eccentric drives the planet wheel. The output shaft transfers the rotation of the planetary gear around the center, in GR2 by means of pins and rollers on a bolt circle. Alternatively possible would be one or more springs (reduced torsional rigidity).
The gearing must be calculated with ZAR1+ if you choose involute gearing. GR2 generates zar files that can be opened directly in ZAR1+.
GR2 calculates load and life of 5 rolling bearings (2 for drive shaft, 2 for output shaft, 1 for planetary gear on eccentric).
For a model, STL files of the items are generated for 3D printing.



GR2 is available from 15.11.2019 for the price of 550 EUR for the single user license

Drive technology for the electric bicycle

Do you already have a pedelec? If not: buy, you have to have. Initially reviled as a "pensioner's bycicle", today also preferred by performance mountain bikers. Amazing how far you can get with half a kilowatt hour of energy in the battery. No wonder, a pedelec weighs only 25 kg, an electric car, however, more than 50 times. While you have to tow an electric car, when the battery is empty and no charging station in sight, you can continue on the pedelec with muscle power.

Earlier pedelecs had the engine mostly in the rear hub, today seems to have prevailed the "middle engine" at the bottom bracket. No good development, I think. Mid-engines have a gearbox for the transmission in the slow, with the help of derailleur is then translated back into the fast. The only disadvantage of a wheel hub motor, however, is too little torque on the mountain. Torque specifications of mid-engine and hub motor, however, you can not compare: In a mid-engine with 75 Nm of torque on the pedal there are after translation 2: 1 in the fast just 37 Nm at the rear wheel. In the fastest gear 75 * 11/36 = 23 Nm, in crawl speed 75 * 34/36 = 70 Nm. With the mid-engine with drive on the pedals, the unified torque of the engine and the cyclist runs through the derailleur. This means high load of chain and sprockets with correspondingly high wear. When changing from a bicycle to a mid-engined pedelec, you have to relearn when shifting: if you take off load to shift, the engine will continue to run for about a second, and an ugly crack will show you knocking the chain under load. Switching back on the mountain is a problem with the mid-engine bike. Pedelecs with mid-engine have a maximum of 10 gears, because you can not overturn the drive sprocket. When Pedelec with hub motor, however, you can turn his usual 3x10 gears. The hub motor even facilitates the shift here, because it takes away load.

A better technical solution than a mid-engine would be a hub motor with gear shift (1 additional gear would probably be sufficient) which switches automatically, depending on the speed and treading power and pedaling on the pedals. With a hub motor recuperation would be possible, the regeneration of braking energy. This should be designed by means of highly geared transmission so that you can dispense with disc brakes completely. Let's see what the future brings. Maybe a two-wheel drive with hub motors with integrated automatic transmission.

And in the battery unit one could integrate keyless-go and alarm in case of shock. Or even more comfortable a GPS with bike path and road map in the display and location by phone in case of theft.

Consumption data for plug-in hybrid cars

In plug-in hybrid cars is advertised with the favorable fuel consumption and low CO2 emissions, the electric power consumption is often not mentioned. As if electricity was free. And generated completely CO2-free.

If you google "hybrid cars", the paid ads will appear first, especially Toyota with an action in Germany. "Super refuel. Pay diesel. ". Because in Germany diesel is cheaper than gasoline, Toyota refunded the difference price. Toyota states fuel consumption at a Prius plug-in hybrid (122kW) at 1.3 l / 100 km and power consumption at 10 kWh / 100km. With a petrol price of 1.40 EUR / l and an electricity price of 0.30 EUR / kWh, this is 1.82 EUR for gasoline plus, however, 3.00 EUR for electricity per 100 km.

Next, Opel is promoting a "Grandland X Hybrid4" SUV with combined fuel consumption of 1.6 l / 100 km. How much power the 300 hp and 1875 kg heavy colossus consumed, you will find nowhere. If you retrieve the full 221 kW in E-mode (highway full throttle), then a 50 kWh battery in just 14 minutes drove empty.

Cost and state share for gasoline, diesel and electricity in comparison
The German energy tax for gasoline is 65.45 ct / l and for diesel 47.04 ct / l. Added to this is the 19% VAT, then makes 78 ct / l on gasoline and 56 ct / l on diesel. Why the tax for diesel is lower than for gasoline, although energy content and efficiency are higher and the exhaust gases are more toxic, understand who wants. Perhaps because of the fear that the price-conscious diesel drivers would otherwise fuel heating oil, agricultural diesel, or salad oil.
At a net price of 60 cents / liter gasoline is 60ct + 65.45ct + 19% VAT. to 1.49 Euro / l and diesel to 60 + 47.04 + 19% VAT. = 1.28 Euro / l. The tax share for gasoline in Germany is then about 60% and for diesel about 53% ..
The electricity is similar, the state share is about 55%. However, most of this is not provided by the state, but by subsidy recipients from the Renewable Energy Sources Act, which are allowed to feed their electricity at inflated prices.

How much does a kilowatt hour of gasoline and diesel cost?
To compare the costs, one must know the energy content of the fuels (converted from kJ / kg to kwh / l):
Gasoline: 9.3 kWh / l
Diesel: 10 kWh / l
With a gasoline price of 1.50 EUR and a diesel price of 1.30 EUR then costs
1 kWh of gas: 16 cents
1 kWh of diesel: 13 cents
This is cheaper than electricity (about 30 ct / kWh) and applies only at 100% efficiency. For example, if gasoline, diesel and electricity are not used for locomotion, but for heating. But it should be compared to the mechanical work that brings a car on the road. Therefore, it should be considered that the efficiency of internal combustion engines is much worse than that of electric motors.
Efficiency of cars: petrol engine about 30%, diesel about 40%, electric about 80%
Thus, the energy costs for 1 kWh of mechanical work put on the road would be:
Car petrol engine: 0.53 Euro / kWh (0.16 / 0.3) corresponds to 0.36 l of gasoline
Passenger car diesel: 0.32 Euro / kWh (0.13 / 0.4) corresponds to 0.25 l diesel
Car Electric: 0.38 Euro / kWh (0.3 / 0.8) equals 1.25 kWh of input electricity
According to this, the most poisonous combustor, the diesel, remains the cheapest means of transport. Whether that can be so politically desired? In winter when the heating is turned on, the energy cost balance for the burners in comparison to the electric motor even cheaper, because the waste product heat is blown into the interior for free.

Emission problem with cold engine
While the diesel fraud with excessive exhaust emissions is largely uncovered, one can blow quite high exhaust emissions completely legally through the exhaust: During the warm-up phase, the catalyst is ineffective until it has reached operating temperature. Unfortunately, especially in inner cities, on an exhaust level with pedestrians, many cars on the road do not even reach their operating temperature. Because the drivers only buy buns by car or bring the kids to the kindergarten. From the incomplete combustion also extremely poisonous gases such as carbon monoxide are blown through the exhaust.

Brexit effects
Question: What effect does Brexit have on the software industry?
Answer: none at all, if the product software is delivered via the Internet (non-taxable sales). The UK's exit from the EU even brings a relief of bureaucracy, because every single sale in EU states with the customer's VAT number had to be reported as an intra-Community supply to the "Federal Central Tax Office (BZSt)" in the "Summary Report (ZM)" ,

HEXAGON PRICE LIST 2019-11-01

Base price for single licences (perpetual)	EUR
DI1 Version 1.2 O-Ring Seal Software	190.-
DXF-Manager Version 9.1	383.-
DXFPLOT V 3.2	123.-
FED1+ V30.9 Helical Compression Springs incl. spring database, animation, relax., 3D,..	695.-
FED2+ V21.3 Helical Extension Springs incl. Spring database, animation, relaxation, ...	675.-
FED3+ V21.1 Helical Torsion Springs incl. prod.drawing, animation, 3D, rectang.wire, ...	600.-
FED4 Version 7.8 Disk Springs	430.-
FED5 Version 16.4 Conical Compression Springs	741.-
FED6 Version 16.9 Nonlinear Cylindrical Compression Springs	634.-
FED7 Version 13.9 Nonlinear Compression Springs	660.-
FED8 Version 7.2 Torsion Bar	317.-
FED9 Version 6.3 Spiral Spring	394.-
FED10 Version 4.3 Leaf Spring	500.-
FED11 Version 3.5 Spring Lock and Bushing	210.-
FED12 Version 2.7 Elastomer Compression Spring	220.-
FED13 Version 4.2 Wave Spring Washers	228.-
FED14 Version 2.4 Helical Wave Spring	395.-
FED15 Version 1.6 Leaf Spring (simple)	180.-
FED16 Version 1.3 Constant Force Spring	225.-
FED17 Version 1.9 Magazine Spring	725.-
GEO1+ V7.3 Cross Section Calculation incl. profile database	294.-
GEO2 V3.2 Rotation Bodies	194.-
GEO3 V3.3 Hertzian Pressure	205.-
GEO4 V5.2 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 V1.0 Eccentric Gear software	550,-
HPGL-Manager Version 9.1	383.-
LG1 V6.6 Roll-Contact Bearings	296.-
LG2 V3.0 Hydrodynamic Plain Journal Bearings	460.-
SR1 V23.5 Bolted Joint Design	640.-
SR1+ V23.5 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 V6.1 Girder Calculation	757.-
WL1+ V21.5 Shaft Calculation incl. Roll-contact Bearings	945.-
WN1 V12.2 Cylindrical and Conical Press Fits	485.-
WN2 V10.3 Involute Splines to DIN 5480	250.-
WN2+ V10.3 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 4.8 Involute Splines to ANSI B 92.1	276.-
WN5 V 4.8 Involute Splines to ISO 4156 and ANSI B 92.2 M	255.-
WN6 V 3.2 Polygon Profiles P3G to DIN 32711	180.-
WN7 V 3.2 Polygon Profiles P4C to DIN 32712	175.-
WN8 V 2.5 Serration to DIN 5481	195.-
WN9 V 2.4 Spline Shafts to DIN ISO 14	170.-
WN10 V 4.3 Involute Splines to DIN 5482	260.-
WN11 V 2.0 Woodruff Key Joints	240.-
WN12 V 1.2 Face Splines	256.-
WNXE V 2.2 Involute Splines - dimensions, graphic, measure	375.-
WNXK V 2.1 Serration Splines - dimensions, graphic, measure	230.-
WST1 V 10.2 Material Database	235.-
ZAR1+ V 26.4 Spur and Helical Gears	1115.-
ZAR2 V8.0 Spiral Bevel Gears to Klingelnberg	792.-
ZAR3+ V10.3 Cylindrical Worm Gears	620.-
ZAR4 V6.0 Non-circular Spur Gears	1610.-

ZAR5 V11.8 Planetary Gears	1355.-
ZAR6 V4.1 Straight/Helical/Spiral Bevel Gears	585.-
ZAR7 V1.7 Plus Planetary Gears	1380.-
ZAR8 V1.6 Ravigneaux Planetary Gears	1950.-
ZAR9 V1.0 Cross-Helical Screw Gears	650.-
ZARXP V2.5 Involute Profiles - dimensions, graphic, measure	275.-
ZAR1W V2.2 Gear Wheel Dimensions, tolerances, measure	450.-
ZM1.V2.5 Chain Gear Design	326.-

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, WN6, WN7, LG2, FED12, FED13, WN8, WN9, WN11, DI1, FED15,WNXE,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)	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:

Update prices	EUR
Software Update (software Win32/64 + pdf manual)	40.-
Software Update (software 64-bit Win + pdf manual)	50.-

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-ROM: EUR 60, (EUR 25 inside Europe)
Conditions of payment: bank transfer in advance with 2% discount, or by credit card (Master, Visa) net.

Key Code
After installation, software has to be released by key code. Key codes will be sent after receipt of payment.

HEXAGON Industriesoftware GmbH
Stiegelstrasse 8 D-73230 Kirchheim Tel. +49 7021 59578, Fax +49 7021 59986
Kieler Strasse 1A D-10115 Berlin Mühlstr. 13 D-73272 Neidlingen
Mobile: +49 163 7342509 E-Mail: info@hexagon.de Web: www.hexagon.de