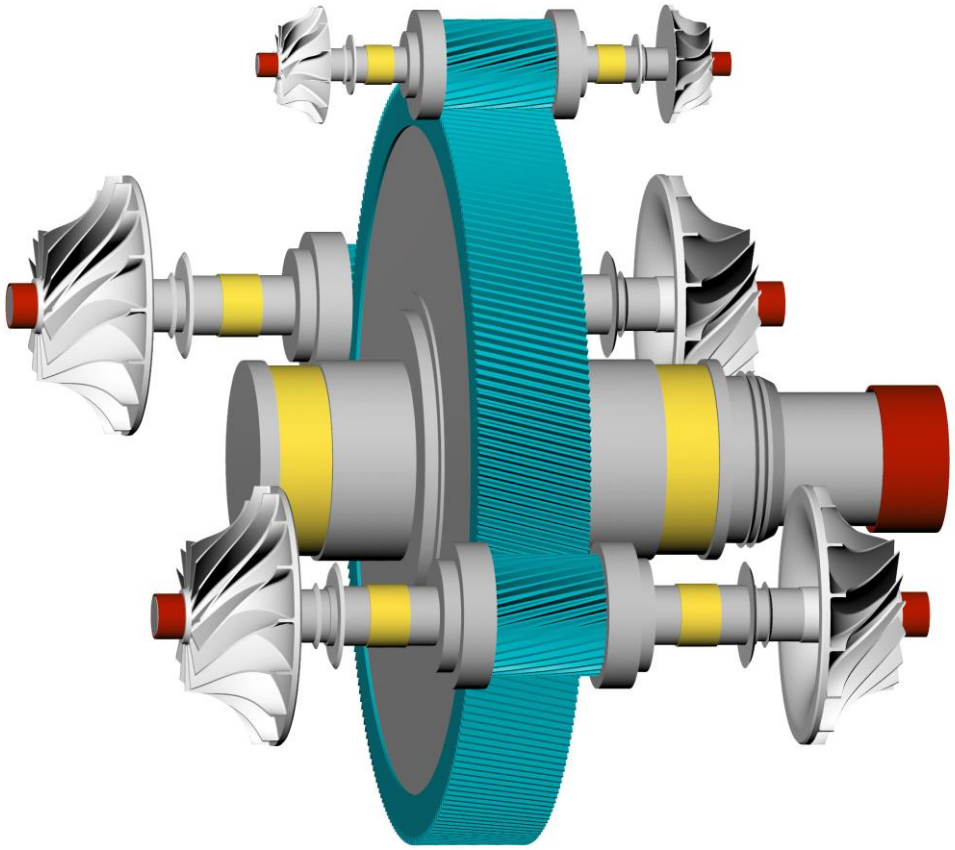
Shaft and Bearing Calculation with TIMKEN Cloud Services

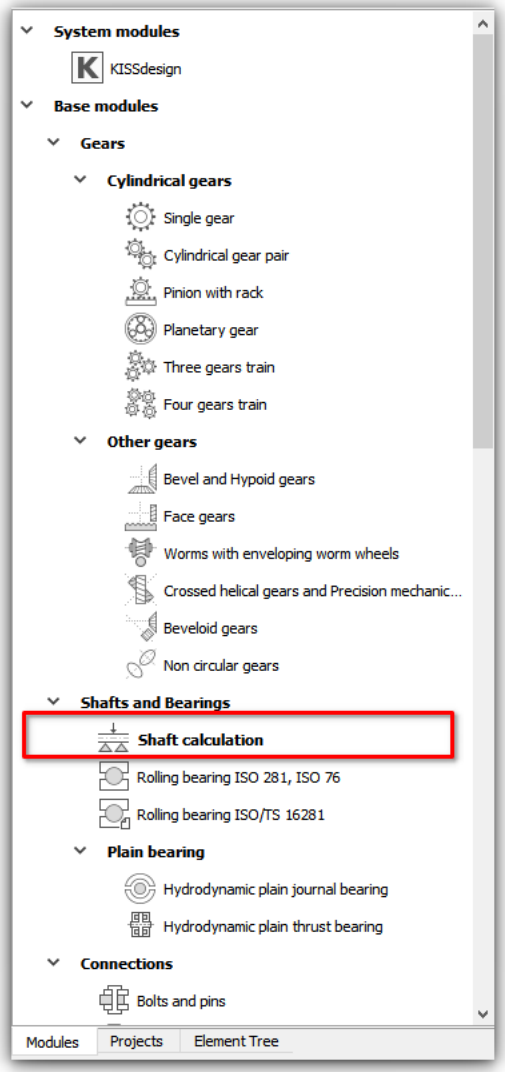


Basic Training

KISSsoft

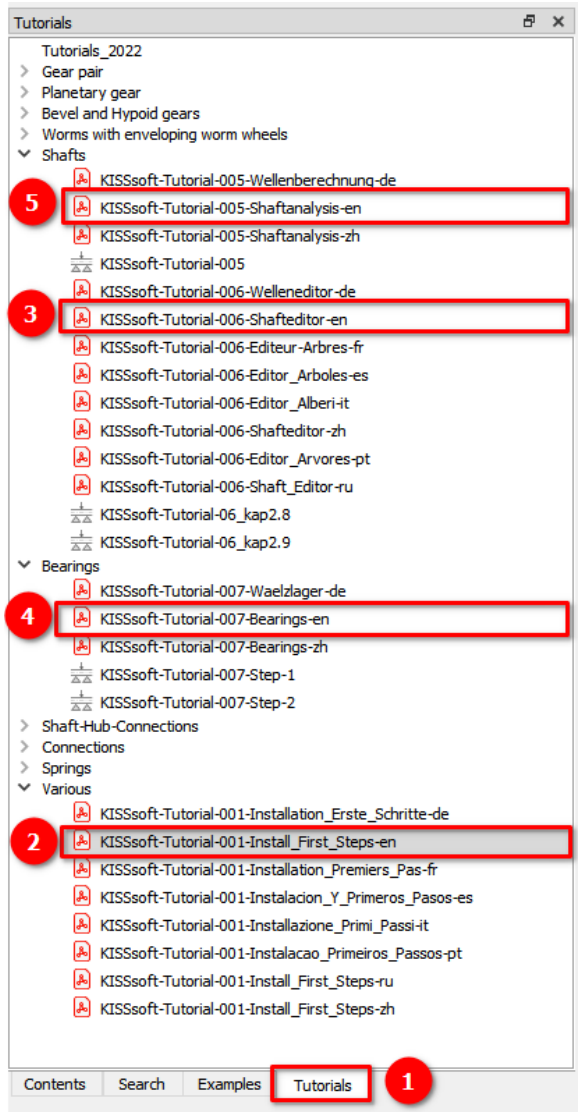
Introduction

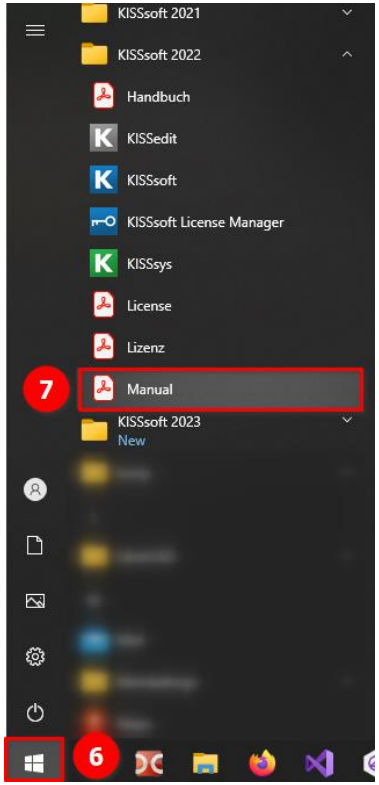
- KISSsoft® is a calculation program for the design, optimization and verification of machine elements according to international standards.
- Supports numerous machine elements.
- Has 3 modules where rolling bearings can be calculated.
- TIMKEN Cloud Services can be used within the Shaft calculation module.



Requirements

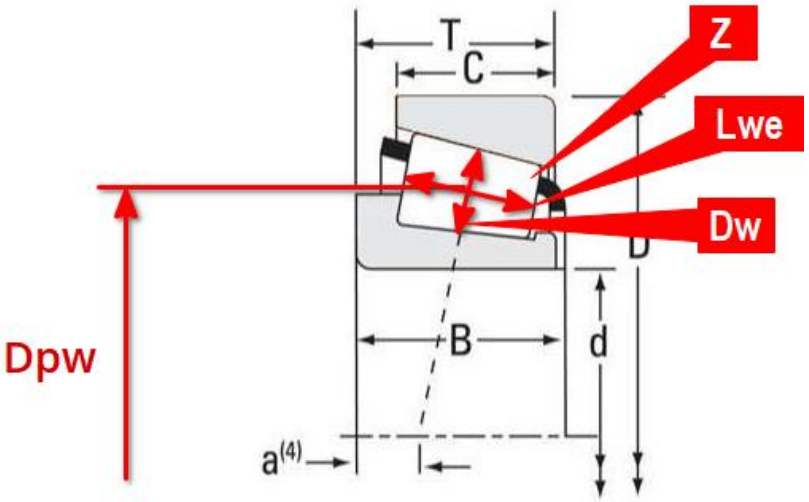
- KISSsoft release 2022
- Valid Timken account
- Basic knowledge about KISSsoft
  - Use tutorials (1-5)
  - Use manual (6, 7)





Why using TIMKEN cloud services

- When calculating bearings acc. to ISO/TS 16281 one must know internal geometry of the bearing (Z, Dw, Dpw, Lwe, etc.).
- Calculation is more precise if we have exact internal geometry → TIMKEN cloud services!
- Unknown internal geometry will be estimated by KISSsoft based on known external dimensions and bearing capacities C_0 and C.
- It has no effect on bearing calculation acc. to ISO 76/ISO 281.



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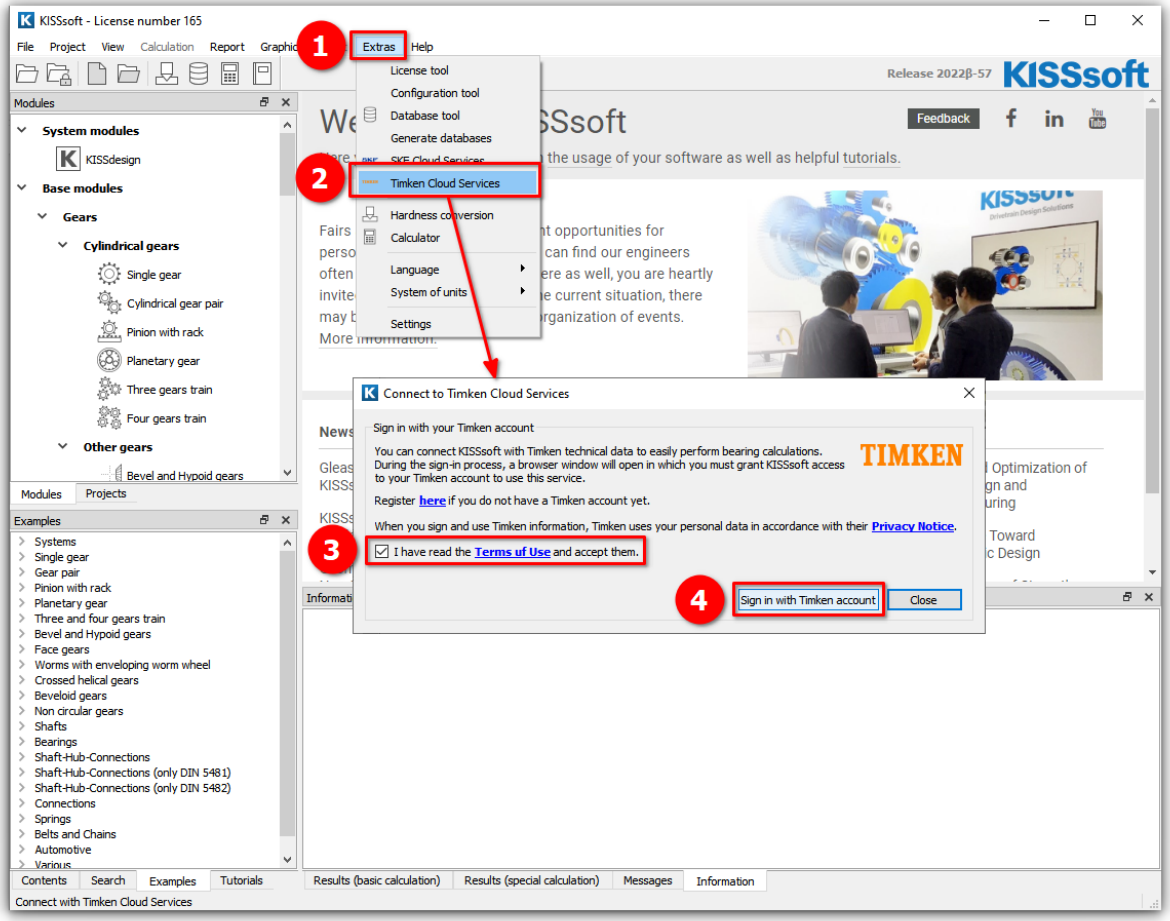
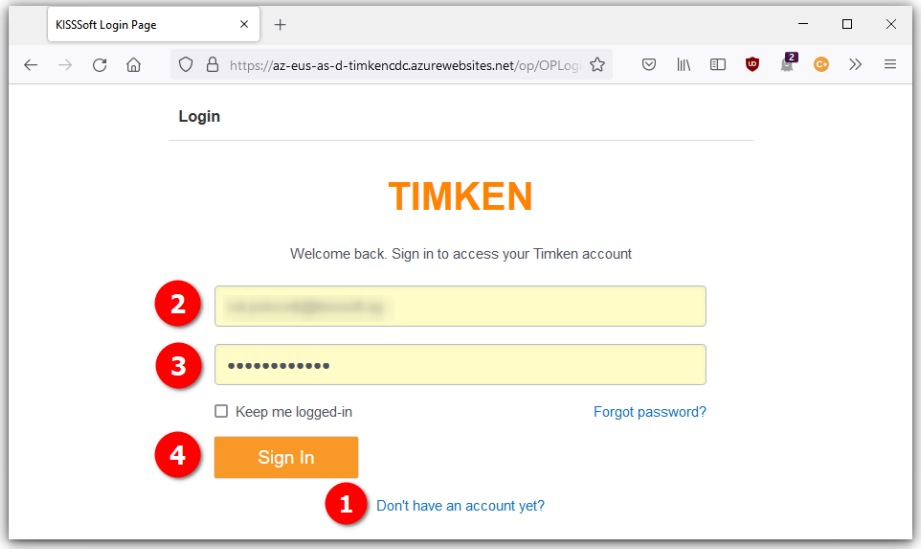
Enabling TIMKEN cloud services (1/4)

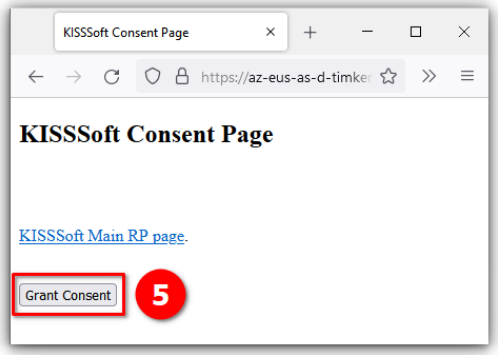
- You must have a valid TIMKEN account. If you don't have one, you can create it from the TIMKEN log-in page (see next slide).
- In KISSsoft main window go to Extras (1) and choose Timken Cloud Services (2).
- In a windows that appears confirm Terms of Use (3) and click Sign in with Timken (4) account.

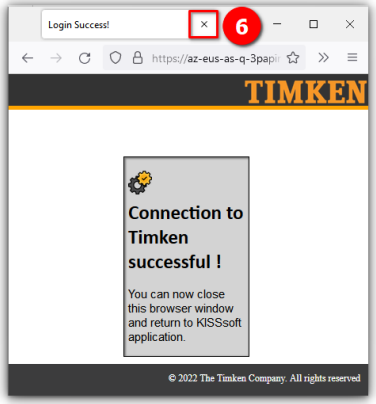


Enabling TIMKEN cloud services (2/4)

- A default web browser should open, and a login page should appear in it.
- If you don’t have a TIMKEN account yet, click on Don’t’ have an account yet? (1) and follow the procedure to create an account.
- Then enter username (2) and password (3) that you have selected when registering to Timken cloud services and click on Sign in (4) button.
- A new page should open where button Grant Consent (5) must be clicked.
- If signing in was successful a new page should appear which can be closed (6).

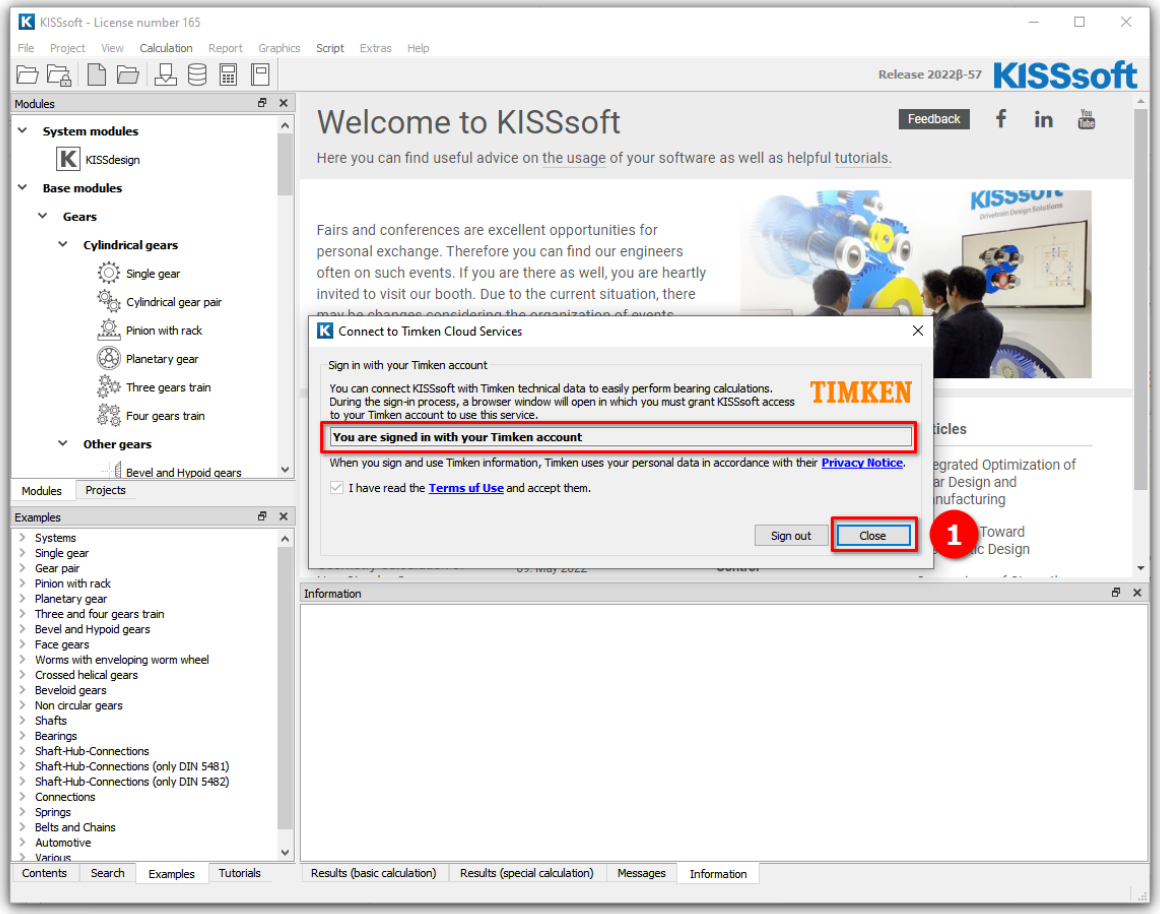






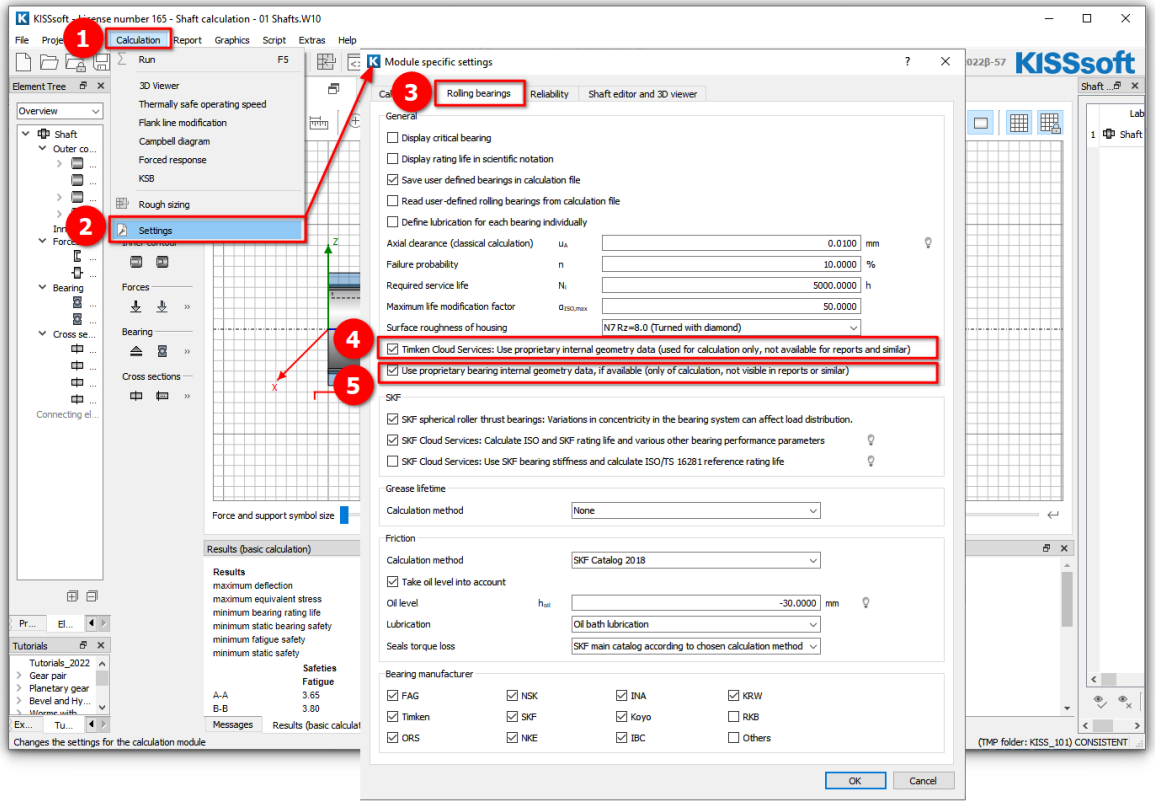
Enabling TIMKEN cloud services (3/4)

- Now go to KISSsoft where sign in window should says that you are signed in into Timken cloud services.
- Close the windows by clicking button Close (1).

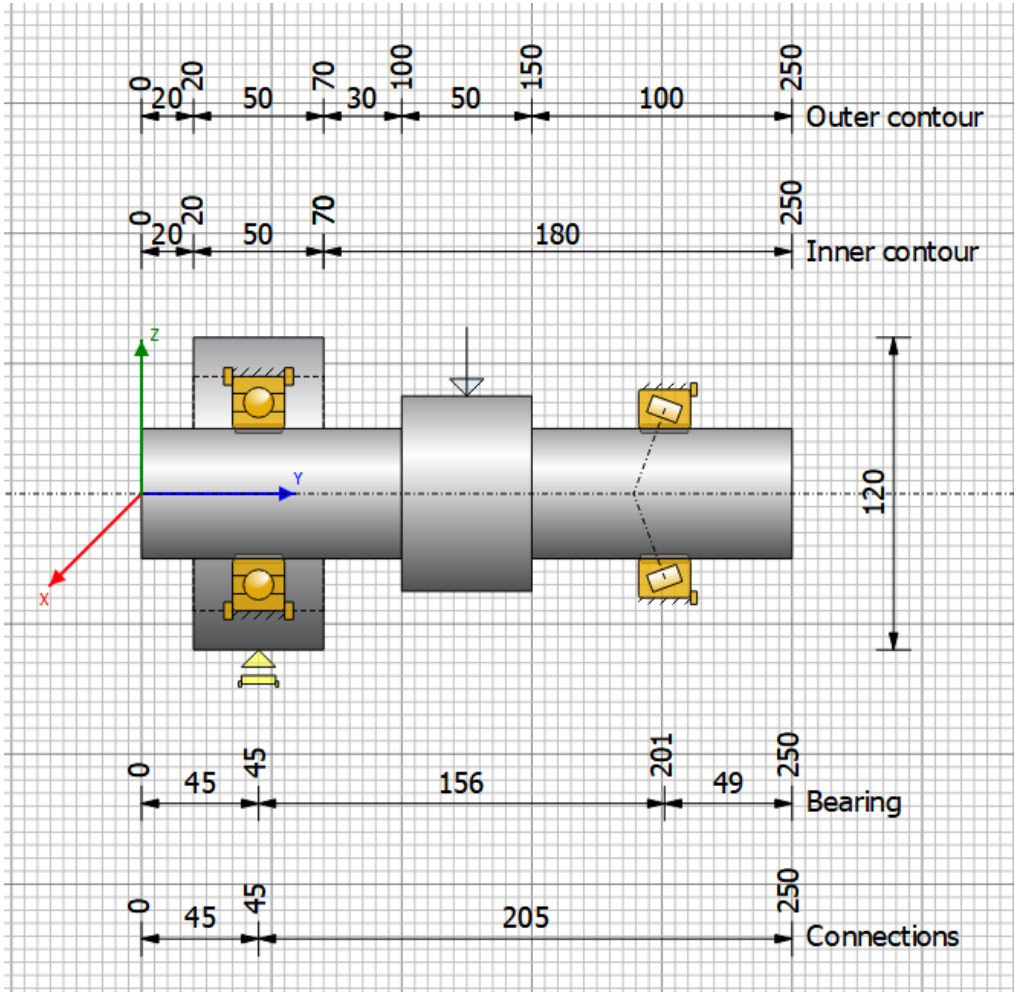


Enabling TIMKEN cloud services (4/4)

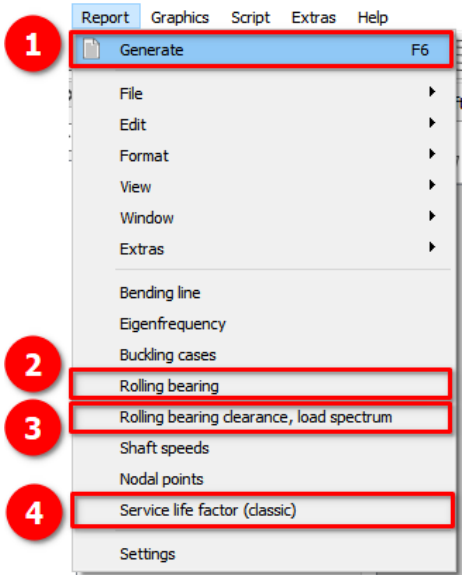
- Open Shaft module or choose an existing example.
- Select menu Calculation (1) and click on Settings (2).
- A window with Module specific settings will open. Select tab Rolling bearings (3).
- Enable Timken Cloud Services (4) and Use proprietary bearing internal geometry (5).



Calculation example



Several reports are available



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Calculation example

“Normal” rolling bearing

3.3 Bearing

3.3.1 Rolling bearing (TIMKEN 32010X-32010X)

Bearing inner geometry data provided by TIMKEN Cloud Services	
TIMKEN	• For further information, Please visit www.timken.com

Bearing type		Taper roller bearing (single row)
Bearing position (mm)	[y_{lokal}]	201.000
Bearing position (mm)	[y_{global}]	201.000
Attachment of external ring		Set fixed bearing right
Inner diameter (mm)	[d]	50.000
External diameter (mm)	[D]	80.000
Width (mm)	[b]	20.000
Corner radius (mm)	[r]	1.000

Calculation was peformed using real bearing internal geometry provided by bearing manufacturer. These values are however not available for reports.

The bearing pressure angle will be considered in the calculation

Contact angle (°)	[α]	15.732
Position (center of pressure) (mm)	[$y_{D,lokal}$]	189.000
Position (center of pressure) (mm)	[$y_{D,global}$]	189.000
Basic static load rating (kN)	[C_0]	92.700
Basic dynamic load rating (kN)	[C]	69.800
Fatigue load limit (kN)	[C_u]	0.000
Values for approximated geometry:		
Basic dynamic load rating (kN)	[C_{theo}]	58.367
Basic static load rating (kN)	[C_{0theo}]	80.563
Correction factor Basic dynamic load rating	[f_c]	1.000
Correction factor Basic static load rating	[f_{c0}]	1.000

“Connecting” rolling bearing

5 Connections

5.1 Connecting rolling bearing (TIMKEN 6210-2RS)

Bearing inner geometry data provided by TIMKEN Cloud Services	
TIMKEN	• For further information, Please visit www.timken.com

Bearing type		Deep groove ball bearing (single row)
Position (mm)		45.000
Shaft 'Shaft 1' <-> Shaft 'Shaft 2'		
Fixed bearing		
Inner diameter (mm)	[d]	50.000
External diameter (mm)	[D]	90.000
Width (mm)	[b]	20.000
Corner radius (mm)	[r]	1.100
Basic dynamic load rating (kN)	[C]	35.100
Basic static load rating (kN)	[C_0]	23.200
Fatigue load limit (kN)	[C_u]	0.000
Basic dynamic load rating (kN)	[C_{theo}]	35.074
Basic static load rating (kN)	[C_{0theo}]	23.180
Correction factor Basic dynamic load rating	[f_c]	1.000
Correction factor Basic static load rating	[f_{c0}]	1.000

Calculation was peformed using real bearing internal geometry provided by bearing manufacturer. These values are however not available for reports.

Nominal diametral clearance* (µm)	[Pd]	14.500
(*) ISO 5753-1:2009 C0		
Nominal axial clearance (µm)	[Pe]	191.363

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Calculation example

7.5 Rolling bearing 'Connecting rolling bearing'

Position (Y-coordinate)	[y]	45.00	mm
Dynamic equivalent load	[P]	7.05	kN
Static equivalent load	[P_0]	7.05	kN
Minimum EHL lubricant film thickness	[h_{min}]	0.186	µm
Spin to roll ratio	[ω_s/ω_roll]	0.049	
Life modification factor for reliability	[a_1]	1.000	

7.5.1 Results according to ISO 281

Lubricant	ISO-VG 220		
Lubricant with additive, effect on bearing lifetime confirmed in tests.			
Lubricant - service temperature	[T_B]	70.00	°C
Oil lubrication, on-line filtration, ISO 4406 -/19/16			
Load ratio	[C/P]	4.977	
Operating viscosity	[v]	48.884	mm²/s
Reference viscosity	[v_1]	13.887	mm²/s
Viscosity ratio	[κ]	3.520	
Life modification factor	[a_{ISO}]	1.502	
Fatigue load limit	[C_u]	1.055	kN
Basic bearing rating life	[L_{nh}]	1369.64	h
Modified bearing rating life	[L_{nmh}]	2057.22	h
Static safety factor	[S_0]	3.29	

7.5.2 Calculation with proprietary bearing internal geometry data (ISO/TS 16281)

Operating diametral clearance	[Pd]	14.500	µm
Fatigue load limit	[C_u]	1.176	kN
Reference rating life	[L_{nm}]	1338.98	h
Modified reference rating life	[L_{nmh}]	2242.43	h
Effective static safety factor	[S_{0w}]	3.94	
Static safety factor	[S_{0ref}]	3.12	
Static equivalent load	[P_{0ref}]	7.45	kN
Bearing reaction force	[F_x]	0.000	kN
Bearing reaction force	[F_y]	1.368	kN
Bearing reaction force	[F_z]	-7.053	kN
Bearing reaction force	[F_r]	7.053	kN
Inclination angle	[α_{Fr}]	-89.999	°
Bearing reaction moment	[M_x]	-39.254	Nm
Bearing reaction moment	[M_y]	0.000	Nm
Bearing reaction moment	[M_z]	-0.002	Nm
Bearing reaction moment	[M_r]	39.254	Nm
Inclination angle	[α_{Mr}]	-179.997	°
Displacement of bearing	[u_x]	0.002	µm
Displacement of bearing	[u_y]	-101.453	µm
Displacement of bearing	[u_z]	41.334	µm
Displacement of bearing	[u_r]	41.334	µm
Inclination angle	[α_{ur}]	89.998	°
Misalignment of bearing	[r_x]	0.171	mrad
Misalignment of bearing	[r_y]	-0.000	mrad
Misalignment of bearing	[r_z]	0.000	mrad
Misalignment of bearing	[r_r]	0.171	mrad
Oil level	[H]	0.000	mm
Rolling moment of friction	[M_{rr}]	0.235	Nm
Sliding moment of friction	[M_{sl}]	0.228	Nm
Moment of friction, seals	[M_{seal}]	0.000	Nm
Moment of friction for seals determined according to SKF main catalog 17000/1 EN:2018			
Moment of friction flow losses	[M_{drag}]	0.000	Nm
Torque of friction	[M_{loss}]	0.463	Nm
Power loss	[P_{loss}]	72.663	W
The moment of friction is calculated according to the details in SKF Catalog 2018.			
The calculation is always performed with a coefficient for additives in the lubricant µbl=0.15.			

(*) Note about roller bearings with an approximated bearing geometry:
The internal geometry of these bearings has not been input in the database.
The geometry is back-calculated as specified in ISO 281, from C and C0 (details in the manufacturer's catalog).
For this reason, the geometry may be different from the actual geometry.
This can lead to differences in the service life calculation and, more importantly, the roller bearing stiffness.

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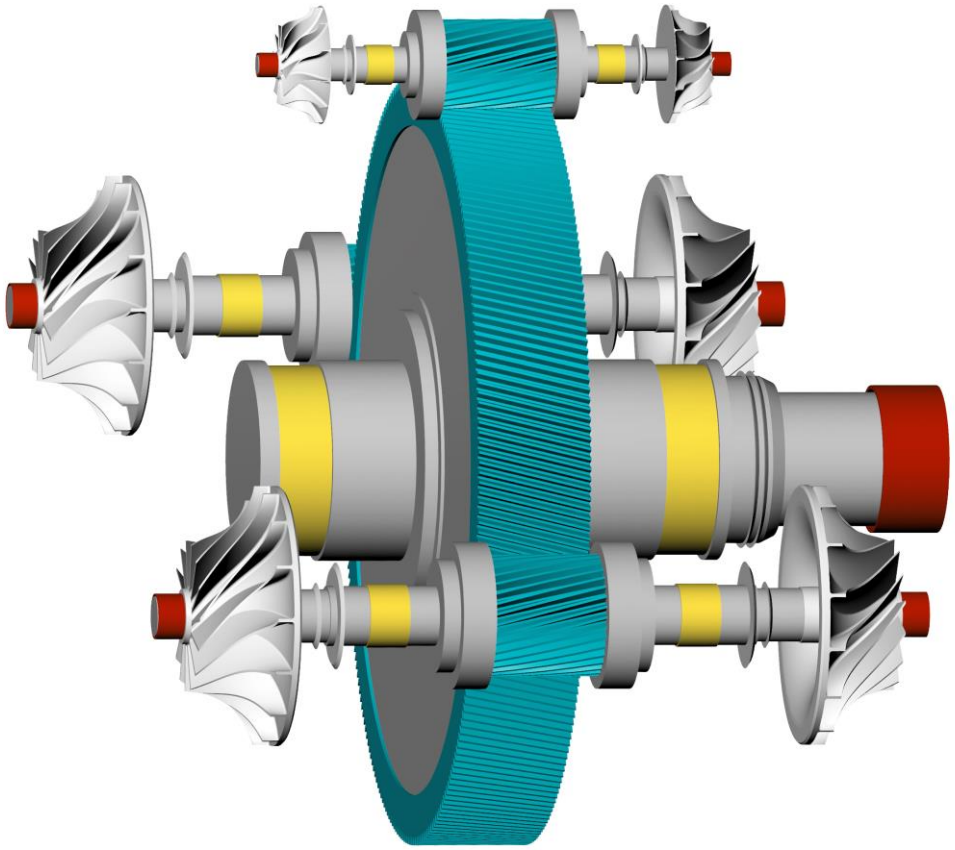
Some additional useful information

- Language and units
- Input fields
- Messages
- Restore points
- Navigating report and comparing results
- Use only desired bearing manufacturers
- Define custom bearings
- Load spectrum

Thank you for your attention!



Sharing Knowledge

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