

**SKF**

CONNECTION TO KISSSOFT

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Recently, the Swedish rolling bearing manufacturer SKF and the Swiss gearbox design software developer KISSsoft have incorporated SKF's bearing calculation service within



KISSsoft's software. With the so-called 'SKF Bearing Module' in KISSsoft, engineers will have direct access to SKF's bearing technology and bearing performance data. This connection allows for a seamless experience when working on a new gearbox design. Without noticing, an engineer designs a gearbox in KISSsoft 'as usual', but is actually connecting to the SKF cloud to retrieve the bearing performance results. These results are based on extremely fast, cloud-based calculation services by SKF in which the operating conditions of the full system are considered when calculating the performance of each individual bearing. As such, a gearbox design is verified more realistically and efficiently as it enables making appropriate bearing choices right from the start.

The user flow is quite simple: First, the user creates a full (gearbox) model in KISSsoft. Then, after registering once for the SKF Bearing Module (using the embedded "SKF Registration Tool"), SKF's calculation service is called, whenever the bearing performance is calculated according to the *modified rating life method according to ISO 281*. This method can be selected in KISSsoft in the 'basic data' window of the bearing and is mandatory if the effects of lubrication and contamination are to be considered.

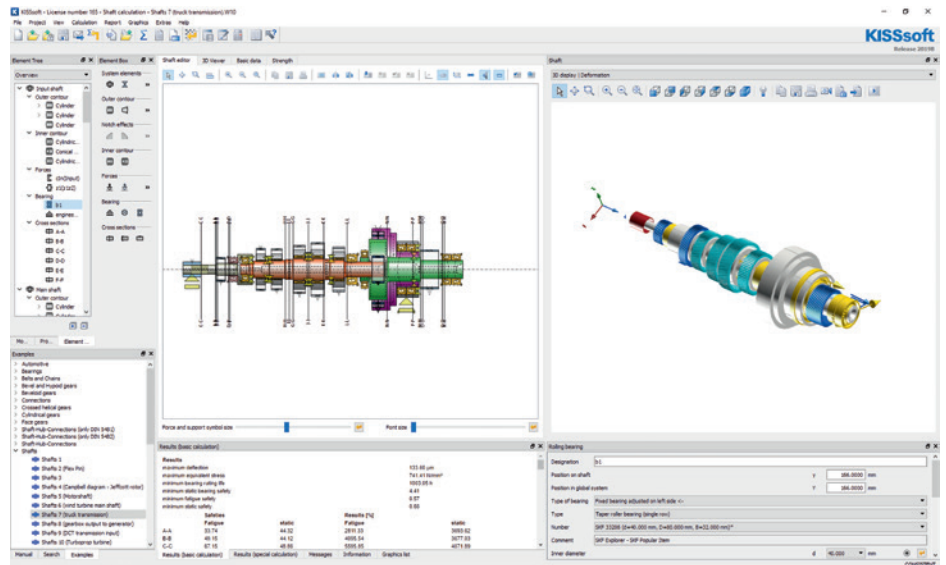
**Modified rating life according ISO 281**

If the modified rating life option is not selected, the ISO 281 basic rating life ( $L_{10}$ , here referred to as 'basic ISO 281') of the bearing is calculated which accounts for the load and speed only. For modern high-quality bearings, the calculated basic rating life can deviate significantly from the actual service life in a given application. Service life in a particular application depends not only on load and bearing size, but also on a variety of influencing factors including lubrication, degree of contamination, proper mounting and other environmental conditions. The ISO 281:2007 modified rating life method ( $L_{10m}$ , here referred to as

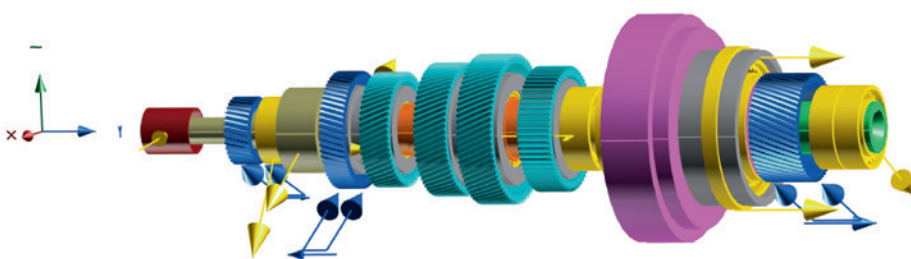
'modified ISO 281') uses a modified life factor ( $a_{ISO}$ ) to supplement the basic rating life. Similarly, for "SKF Rating Life", the life modification factor  $a_{SKF}$  applies the same concept of a fatigue load limit  $P_u$  as used in modified ISO 281. Just as in modified ISO 281, to reflect three of the important operating conditions, the life modification factor  $a_{SKF}$  takes the lubrication conditions, the load level in relation to the bearing fatigue load limit, and a factor  $\eta_c$  for the contamination level into consideration.

**SKF Rating Life instead of modified ISO 281**

The modified rating life according to ISO 281, considering lubrication and contamination conditions, can also be calculated without activating the SKF Bearing Module in KISSsoft. This ISO method may be necessary to use for design certification purposes, however it is not necessarily the most reliable method for bearing performance prediction. One can actually say that the SKF Rating Life is an enhanced version of modified ISO 281, where latest findings of tribology and materials in rolling bearings are taken into account. The difference between the two methods is in the calculation of the life modification factor ( $a_{ISO}$  vs  $a_{SKF}$ ) which can have a significant effect on calculated bearing rating life.



"SKF Bearing Module" integrated in the shaft calculation of KISSsoft.



Truck transmission model built in KISSsoft.



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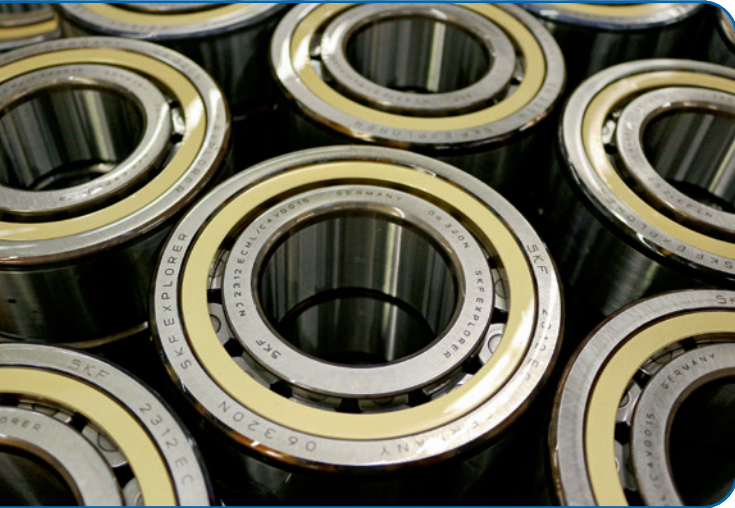


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### SKF Rating Life for an SKF Explorer bearing

The difference between SKF Rating Life and ISO 281 modified rating life is most significant for the SKF Explorer bearings. SKF Explorer rolling bearings accommodate higher load levels and provide extended service life. Their optimized internal geometry reduces friction, wear and heat generation, allowing heavier loads to be accommodated. Moreover, advanced surface finish reduces friction and enhances lubricating conditions.



SKF Explorer bearings.

SKF Rating Life fully accounts for the benefits of SKF Explorer bearings whereas they are only partly accounted for in the modified ISO 281 method. To fully utilize the improved performance of this bearing performance class, and therewith optimizing machine performance, the SKF Rating Life calculation by the SKF Bearing Module is needed. The two different life method results will both be displayed in a KISSsoft report and can thus be easily compared.

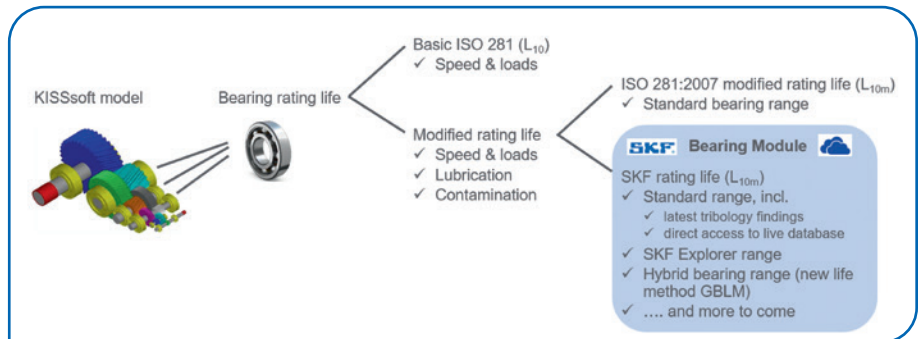
### Always connected to the latest bearing design

With the bearing module, a direct connection is established to SKF's core proprietary knowledge, the bearing internal geometry and manufacturing data. Only SKF has the full (internal) geometry description of the products they manufacture. Not all this data will be revealed to the user but its effect on bearing performance will always be accounted for in the calculation. Design and manufacturing updates as well as bearing assortment changes will be reflected almost instantly as the cloud-based service is constantly receiving updates from the bearing database. This gives the user access to the latest assortment with up-to-date geometry data, independent from the (static) bearing database in KISSsoft itself.

### Bearing performance parameters

The Bearing Module performs the calculation of the following bearing performance results: SKF rating life ( $L_{10m}$ ), ISO 281 basic rating life ( $L_{10}$ ), equivalent dynamic bearing load ( $P$ ), load ratio  $C/P$ , viscosity ratio ( $\kappa$ ), contamination factor ( $\eta_c$ ) and the life modification factor ( $a_{SKF}$ ). These output parameters are all related to bearing load and rating life under the applied operating conditions of the system.

The development of the Bearing Module does not end here, in fact more bearing performance parameters will be added in future versions of the module. Hereby one can think of bearing friction and power loss, grease life and grease re-lubrication interval, static safety, bearing excitation frequen-



Benefits of SKF Bearing Module.

Results of the calculation with the SKF Bearing Module			
Load ratio	[C/P]	6.070	
Operating viscosity	[v]	424.334	mm <sup>2</sup> /s
Reference viscosity	[v <sub>r</sub> ]	14.150	mm <sup>2</sup> /s
Viscosity ratio	[κ]	29.988	
Contamination characteristic quantity	[e <sub>c</sub> ]	0.470	
Life modification factor	[a <sub>SKF</sub> ]	4.360	
Basic rating life	[L <sub>10</sub> ]	6930.00	h
SKF rating life	[L <sub>10m</sub> ]	30200.00	h

Results according to ISO 281:

Load ratio	[C/P]	6.070	
Operating viscosity	[v]	425.092	mm <sup>2</sup> /s
Reference viscosity	[v <sub>r</sub> ]	18.367	mm <sup>2</sup> /s
Viscosity ratio	[κ]	23.144	
Contamination factor	[e <sub>c</sub> ]	0.436	
Life modification factor	[a <sub>ISO</sub> ]	2.207	
Basic bearing rating life	[L <sub>10</sub> ]	6936.70	h
Modified bearing rating life	[L <sub>10m</sub> ]	15310.93	h
Static safety factor	[S <sub>0</sub> ]	7.20	

Comparison of results from SKF Bearing Module and ISO 281 calculation methods in the KISSsoft report.

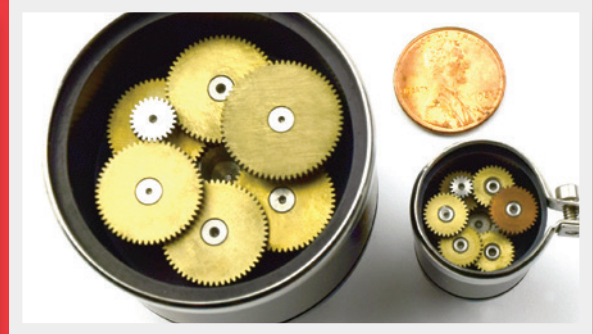
cies, etc. In addition to the technical evaluation, a design engineer can already from the beginning make a choice of selecting within so-called 'Popular items', i.e. bearing items that have a high availability level and thus provide an especially attractive cost-performance ratio.

The SKF Bearing Module is a fast and modern cloud service, easily accessible to design engineers and therefore step by step one will have access to the complete play-field of bearing engineering technology.

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**SKF's new life method (GBLM)**

Up-to-now, none of the common bearing rating life models, neither the ISO life models nor SKF Rating Life or more advanced methods, were able to fully quantify the benefit of hybrid bearings. Hybrid bearings have rings made of bearing steel and rolling elements made of bearing grade silicon nitride, which make the bearings electrically insulating. They can extend bearing service life by offering enhanced bearing performance, even under difficult operating conditions.

Based on the substantial progress made in the surface life modelling area, SKF has successfully integrated this knowledge into a new rolling bearing rating life calculation, called the SKF Generalized Bearing Life Model (GBLM), which currently is used for hybrid bearings only. This model effectively separates surface failure modes from sub-surface fail-



Hybrid bearings.

ure modes and therefore can capture in a better way the performance of hybrid bearings, which usually perform better in harsh lubrication and contaminated conditions or at high speeds. However, due to their higher stiffness, hybrid bearing can concentrate higher sub-surface stresses in high load conditions. GBLM is able to represent this behaviour well and is also accessible through the SKF Bearing Module in KISSsoft.

The KISSsoft Release 2019 offers the possibility to calculate bearing performance by SKF through a cloud calculation service. Bearing rating life and other performance parameters are calculated based on direct access to SKF bearing geometry data and SKF formulas which have been validated by extensive testing at SKF facilities. The results are separately displayed in KISSsoft, but can quickly be compared with ISO results. With the SKF bearing module in KISSsoft, a machine designer gets right into the heart of SKF, the world leading bearing supplier. As a result, the prediction of bearing performance becomes more realistic, especially for the SKF Explorer range and hybrid bearings.

For more info, please send an e-mail to [skfbearingmodule@skf.com](mailto:skfbearingmodule@skf.com) or [info@kisssoft.ag](http://info@kisssoft.ag).



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