



Calculation Example Rolling Bearings According to to DIN ISO 281



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Contents

0.1	Calculat	tion Examples: Rolling Bearing According to DIN ISO 281
	0.1.1	Start the Calculation Module
	0.1.2	First Calculation Example
	0.1.3	The Calculation
	0.1.4	Calculation Results
	0.1.5	Documentation: Calculation Report
	0.1.6	Save the Calculation
	0.1.7	Second Calculation Example
	0.1.8	The Calculation
	0.1.9	Calculation Results
	0.1.10	Documentation: Calculation Report
	0.1.11	Save the Calculation

0.1 Calculation Examples: Rolling Bearing According to DIN ISO 281

0.1.1 Start the Calculation Module

Please login with your username and your password. Select the module 'Rolling bearings calculation' through the tree structure of the project manager by double-clicking on the module or clicking on the button 'New calculation'.

eassistant - GWJ-	Technology - Rating life calculation DIN ISO 24	81 - Mozilla Firefox		<u>_ ×</u>
🎽 Open 🛛 🔊 Sav	e 🔽 Local 🔛 Calculate 🗠 Undo 🖓	Redo Report Opt	ions 🔗 Help	
General:	Number of bearings to calculate: 1	Current view:	learing No. 1 🗾	
Comment:				
Selection of manufa	acturer and kind	Adequate bearings in datab	jase:	
Manufacturer:	NSK GmbH	Bearing type: Please sel	ect a bearing kind !	•
Specification of bea	aring load	🗖 Use load collective	Input load collecti	Ve
Radial force Fr (N):	Axial force Fa [N]:	500.0	Speed n (1/min): 1000	0.0
Expanded modified	rating theory 🔽 Use expanded mod	dified rating theory		
Requisite reliability	S [%]:	90.0	Fr	
Operating temperati	ure T (°C):	70.0		
Cleanness eC:	Normal cleanness	<u> </u>	øD ød	
Colocted bearing]	.	
Description of antion	Nousing an available for the estantial beauti	na kind for the wieked menuf		
Dealing selection	The values are available for the selected bearing	ing kind for the wished manda	actorer.	
Results:				
Rating lifes:	L10 [h]: Lnm	[h]: Sta	tic identification no. S0:	-
Diagram of rating li	Te as function of Radial force Fr [N]			

Figure 1: Start the calculation module

0.1.2 First Calculation Example

Bearing for a Rope Sheave of a Pulley Block

The wrap angle for rope sheaves of pulley blocks is 180°. Therefore, the load on the bearing is twice the rope pull. The axial forces and the resulting moments are low. When the diagonal pull is 5°, then the axial forces have to be considered for the calculation of the rating life. Adequate bearing spread for load accommodation is achieved by mounting either two bearings or one double-row bearing. In the following example the rating life and expanded modified rating life are to be calculated.

We have taken this example from: J. Braendlein: Die Waelzlagerpraxis: Handbuch zur Berechnung und Gestaltung von Waelzlagern (1995, p. 466-470).

Please enter the following input values:

Bearing load	65 kN
Type of bearing	Tapered roller bearing (single row)
Speed n	30 min ⁻¹
Built-in bearing	Tapered roller bearing (100 x 150 x 67)
For-life lubrication	Grease with EP-additive

Illustration of a rope sheave of a pulley block including the tapered roller bearing. (The following figure: J. Braendlein: Die Waelzlagerpraxis, p. 467).



Figure 2: Rope sheave of a pulley block

0.1.3 The Calculation

Define Number of Bearings

In this example we would like to calculate one bearing of a tapered roller bearing pair. When you open the calculation module, usually one bearing is shown. So it is not necessary to change the number of the bearings. You can enter a description into the comment field, for example 'Bearing of the rope sheave'.

🥙 eassistant - GWJ-Te	echnology - Rating life calculation DIN ISO 281 - Mozilla Firefox	
🗳 Open 🛷 Save	F Local 📓 Calculate 🗠 Undo 🗠 Redo 🚺 Report 🚰 Options 🤣 Help	
General:	Number of bearings to calculate:	
Comment [_

Figure 3: Number of bearings

Select Manufacturer and Bearing Type

The extensive bearing database provides over 20.000 bearings from different manufacturers. Select the bearing manufacturer 'SKF 2007' from the listbox. Next, choose the bearing type 'Tapered roller bearing (single row)'.

ど eassistant - GW	'J-Technology - Rating life calculation DIN ISO 281 - Mozilla Firefox	
🗳 Open 🔊 S	ave 🗖 Local 📓 Calculate 🗠 Undo 🗠 Redo 💭 Report 🙀 Options 🥏 Help	
General:	Number of bearings to calculate: 1 Current view: Bearing No. 1	2
Comment:		
Selection of man	ifacturer and kind	
Sciection of main	Adequate bearings in database: [578	
Manufacturer:	SKF AG (2007) Bearing type: Tapered roller bearing (single row)	•

Figure 4: Select the manufacturer and bearing type

Specification of Bearing Load

Enter the values for the bearing load now. Please keep in mind that the values will be entered in 'kN'. Right-clicking allows you to change the unit of measurement.

🕙 eassistant - G¥	/J-Technology - Rating life calculation DIN I	50 281 - Mozilla Firefox	
🗳 Open 🔊 S	Gave 🗖 Local 📓 Calculate 🗠 Undo	🗠 Redo 🚺 Report 👔 Options 🥏 Help	
Specification of the	e middle radial force Fr at the existing applica	tion.	
General:	Number of bearings to calculate: 1	Current view: Bearing No. 1	
Comment:			
Selection of man	ufacturer and kind	Adequate bearings in database: 578	
Manufacturer:	SKF AG (2007)	Bearing type: Tapered roller bearing (single row)	•
Specification of I	pearing load	Use load collective	ve
Padial force Er IV	NI: 65.0 Avial force Fa I	KNI: 0.0 Sneed n [1/(min): 30.0	_

Figure 5: Values for the bearing load in kN

Bearing Selection

Click on the button 'Bearing selection' to open the bearing database.



Figure 6: Button 'Bearing selection'

There are '578' bearings in the database right now. Search filters have been developed to assist in searching this extensive amount of bearings and to quickly find the bearing you are looking for. You can filter the bearing types by the inner and outer diameter so that you can only see bearing types with this particular diameter. Enter the inner and outer diameter and click the button 'Search'.

Inner diameter of bearing	=	100 n	٨m
Outer diameter of bearing	=	150 n	nm

Select the bearing '32020 X/Q' and confirm with the button 'OK'.

ner diameter of bearing d [mm]: 100.0 100.0 Rating life L10 [h]: any any uter diameter of bearing D [mm]: 150.0 150.0 Expanded modified rating life Lnn [h]: any any earing width B [mm]: any any Max: speed for oil lubrication [1/min]: any any ound bearings (2): Description d D B L10 Lnn nOll nGreas 2020 X/Q 100.0 150.0 32.0 14237.9 1976.8 -	earing selection search		from	to			from	to
uter diameter of bearing D [mm]: 150.0 150.0 Expanded modified rating life Lnm [h]: any any any Max: speed for oil lubrication [1/min]: any any Max: speed for grease lubrication [1/min]: any any any Max: speed for grease lubrication [1/min]: any any any any Search Max: speed for grease lubrication [1/min]: any any any any Max speed for grease lubrication [1/min]: any any any any any Max speed for grease lubrication [1/min]: any any any any any Max speed for grease lubrication [1/min]: any	ner diameter of bearing d	[mm]:	100.0	100.0	Rating life L10 [I	n]:	any	any
earing width B [mm]: any any Max. speed for oil lubrication [l/min]: any any	uter diameter of bearing D	[mm]:	150.0	150.0	Expanded modi	fied rating life Lnm (h	i]: any	any
Search Max. speed for grease lubrication [1/min]: any any bund bearings (2):	earing width B [mm]:		any	any	Max, speed for c	iil lubrication [1/min]:	any	any
Description d D B L10 Lnm nOli nGrease 2020 X/Q 100.0 150.0 32.0 14237.9 1976.8 -			Sea	rch	Max, speed for <u>c</u>	rease lubrication [1/	min]: any	any
Description d D B L10 Lnm nOil nOreas 2020 X/Q 100.0 150.0 32.0 14237.9 1976.8 - - 3020/Q 100.0 150.0 39.0 34343.4 4970.0 - -	ound bearings (2):							
2020 X/Q 100.0 150.0 32.0 14237.9 1975.8 3020/Q 100.0 150.0 39.0 34343.4 4970.0	Description	d	D	В	L10	Lnm	nOil	nGrease
13020/Q 100.0 150.0 39.0 34343.4 4970.0	2020 X/Q	100.0	150.0	32.0	14237.9	1976.8	÷."	
	3020/Q	100.0	150.0	39.0	34343.4	4970.0		-

Figure 7: Found bearings

0.1.4 Calculation Results

Rating Life

All results will be calculated during every input and will be displayed in the result panel. A recalculation occurs after every data input. Any changes that are made to the user interface take effect immediately. First, you get the result for the rating life as well as the static identification number.

esults: ating lifes: L10 (h): iagram of rating life as function of	14237.9 Radian force Fr ⁱ (N)	Lnm [h]:	2027.5	Static identification no. S0: 4.3
--	---	----------	--------	-----------------------------------

Figure 8: Result for the rating life

The result of the rating life is $L_{10} = 14.237,9$ h

For rope sheaves, a rating life from 5.000 to 20.000 hours is required. The bearing is sufficiently dimensioned. You will find a note in the message window but you can ignore this message. When the pair is fitted together, then the correct axial clearance and the necessary axial force for the tapered roller bearing occur.

	The existing axial force Fa is smaller than the at least necessary axial force FaMin. (FaMin= 25039N)	
-		

Figure 9: Message window

Expanded Modified Rating Theory

After you get the result for the rating life, please have a look at the expanded modified rating life L_{nm} regarding the operating conditions (lubrication, clearance). The option 'Use expanded modified rating theory' is activated by default.

Expanded modifie	d rating theory	🔽 Use expanded m	odified rating theory	Fr
Requisite reliabilit	y S [%]:		90.0	E_
Operating tempera	ature T [°C]:		70.0	
Cleanness eC:	Normal cleanne	ss	0.6	
Lubricant	Oil: Standard IS	0 VG 220	•	

Figure 10: Expanded modified rating theory

Now you an define the requisite reliability and the cleanness as well as a lubricant. Please select the grease 'Klueber Kluebersynth BMQ 72-162 (094073)'. Select this lubricant directly from the listbox. If you need detailed information, please click on the button 'Lubricant'.

Expanded modifie	a rading theory	🔽 Use expanded modified	rating theory	Fr
Requisite reliabilit	y S [%]:		90.0	E2
Operating tempera	ature T [°C]:		70.0	
Cleanness eC:	Normal cleannes	s	0.6	
Lubricant	Grease: Klüber K	lübersynth BMQ 72-162 (094073)	•	

Figure 11: Lubricant selection

Clicking the button 'Lubricant' opens the lubricant database. Here you can see that the grease contains active EP additive.

lame:	Grease: Klübe	er Klübersynth B	MQ 72-162 (094073)	
omment:	High-tempera	ture and long-te	rm grease	
iscosity at 41	0°C (mm²/s):	160.0	with provable active EP-additives	
iscosity at 1	00°C (mm²/s):	27.0	Minimum operating temperature ["C]:	-40,0
ensity at 20'	"C [g/cm"]:	1.3	Maximum operating temperature [°C]:	200.0

Figure 12: Lubricant database

Next, you have to estimate the influence of possible impurities by using the cleanness factor. Actually, it is assumed that the 'highest cleanness' is used for sealed and greased bearings (for-life-lubrication). But during the entire operating time, a certain wear of the seals could occur which can let light impurities into the bearing. In this case you can assume light impurities. Therefore, choose 'Light impurities' from the listbox.

Expanded modifie	d rating theory	🔽 Use expanded m	odified rating theory	Fr
Requisite reliabilit	y S [%]:		90.0	E2
Operating tempera	ature T (°C):		70.0	
Cleanness eC:	Light impurities		0.4	
Lubricant	Grease: Klüber k	dübersynth BMQ 72-162 (0	94073)	

Figure 13: Light impurities

Now you get immediately the result for the expanded modified rating life.

Results:			r.		
Rating lifes:	L10 [h]:	14237.9	Lnm [h]	8911.8	Static identification no. S0: 4.3
Diagram of rating life as fu	Inction of	Radial force Fr IN	11 E		

Figure 14: Expanded modified rating life

The result of the expanded modified rating life is $\underline{L_{nm} = 8.911.8 \text{ h.}}$. Finally, the expanded modified rating life L_{nm} is in the range of the rating life L_{10} .

Hinweis: Press the 'Up' and 'Down' arrow to move through the listbox of cleanness parameters. Moving through the listbox changes the expanded modified rating life and the results will be displayed immediately in the result panel, making it very easy to compare the expanded modified rating life with different levels of cleanness. You can also navigate through the lubricant listbox.

0.1.5 Documentation: Calculation Report

After the completion of your calculation, you can create a calculation report. Click on the 'Report' button.

ite	🔊 Undo	CH R	edo	Report	ja⊈ Options	🤣 Help
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Figure 15: Button 'Report'

You can navigate through the report via the table of contents that provides links to the input values, results and figures. This calculation report contains all input data, the calculation method as well as all detailed results. The report is available in HTML and PDF format. The calculation report saved in HTML format, can be opened in a web browser or in Word for Windows.

Rep	ort - Rolling	bearings	calculatio	n according	to DIN I	50 281	- Mozilla Firefox	
atei	<u>B</u> earbeiten	Ansicht	⊆hronik	<u>L</u> esezeichen	E <u>x</u> tras	Hilfe		
	Boarin		4					
_	Dearm	y NO.	- -					
	Messa	ges						
	• The e	existing	axial forc	e Fa is sr	naller th	nan th	ne at least necessary axial force	
	FaMin.	(FaMin=	25039N)				
	<u>e</u>							
	Select	ed kin	d of bea	aring				
					Fr			
					i	Fa		
				e		ød	-	
	Bearing	ı manufa	acturer:				SKF AG (2007)	
	Bearing) descrip	tion:				32020 X/Q	
	Type of	bearing	1		т	apere	d roller bearing (single row)	
	X and Y	factors	calculate	d accordin	g to:		DIN	
	Rows o	f bearin	g(i):				1	
	Pitch di	ameter(D_w):				125.0 mm	
	Pacie d	vnamic l	nad rating	-(C):			170000 0 11	
	basic u	ynanne n	Jaaraani	3(~)			172000.0 N	

Figure 16: Calculation report

You may also print or save the calculation report:

- To save the report in the HTML format, please select 'File' \rightarrow 'Save as' from your browser menu bar. Select the file type 'Webpage complete', then just click on the button 'Save'.
- If you click on the symbol 'Print', then you can print the report very easily.
- When you click on the symbol 'PDF', then the report appears in the PDF format. If you right-click on the PDF symbol, you should see the 'Save Target As' option. Click on that option and you will see the dialog box for saving the report.

Diagrams

Click on the button 'Diagram' next to the listbox. The diagram includes the values for the rating life and for the expanded modified rating life. The exact values can be selected directly from the graphical representation. Clicking the 'Close' button leads you back to the main mask.

Results:					
Rating lifes:	L10 [h]:	14237.9	Lnm [h]:	8911.8	Static identification no. S0: 4.3
Diagram of rating life a	as function of	Radial force Er INI			

Figure 17: Button 'Diagram'

0.1.6 Save the Calculation

When the calculation is finished, you can save it to your computer or to the eAssistant server. Click on the button 'Save'.



Figure 18: Button 'Save'

Before you can save the calculation to your computer, you need to activate the checkbox 'Enable save data local' in the project manager and the option 'Local' in the calculation module. A standard Windows dialog for saving files will appear. Now you will be able to save the calculation to your computer.



Figure 19: Windows dialog for saving the file

In case you do not activate the option in order to save your files locally, then a new window is opened and you can save the calculation to the eAssistant server. Please enter a name into the input field 'Filename' and click on the button 'Save'. Then click on the button 'Refresh' in the project manager. Your saved calculation file is displayed in the window 'Files'.

10,0010	Files
efault	
roject 1	
OJECT 2	
lename	-

Figure 20: Save the calculation

Bearing of a Fan

The impeller of fans can be arranged either between two bearings or in an overhung position. The impeller of small and medium-sized fans is generally overhung. Two separated plummer block housings are suitable for supporting the fan drive shaft.

This calculation example we have taken from: J. Braendlein: Die Waelzlagerpraxis: Handbuch zur Berechnung und Gestaltung von Waelzlagern (1995, p. 516-520, figures: p. 517).



Figure 21: Bearing unit for fan

The unit (figure 6.66) contains a cylindrical roller bearing A and a deep groove ball bearing B in a common housing (figure 6.67). The bearing diameter is 70 mm.



Figure 22: Bearing of a fan

Input Values

The input values for bearing A (Cylindrical roller bearing NU 314 ECP)

Load Case No. 1

Load Case No. 2

Time slice q_1	= 50%	Time slice q_2	= 50%
Speed n_1	= 3.000 min-1	Speed n_2	= 4.500 min-1
Radial force F_{r1}	= 8.500 N	Radial force F_{r2}	= 11.000 N
Axial force F_{a1}	= 0 N	Axial force F_{a2}	= 0 N
Temperature T_1	$= 70^{\circ}$ C	Temperature T_2	$= 70^{\circ}C$

All input values for bearing B (deep groove ball bearing 6314)

Load Case No. 1		Load Case No. 2	
Time slice q_1	= 50%	Time slice q_2	= 50%
Speed n_1	= 3.000 min-1	${\sf Speed}\ n_2$	= 4.500 min-1
Radial force F_{r1}	= 2.000 N	Radial force F_{r2}	= 5.000 N
Axial force F_{a1}	= 5.000 N	Axial force F_{a2}	= 5.000 N
Temperature T_1	$= 70^{\circ}$ C	Temperature T_2	$= 70^{\circ}$ C

0.1.8The Calculation

Define the Number of Bearings

In this example we want to calculate the rating life of the cylindrical roller bearing and the deep groove ball bearing. We have to different bearings and we need to change the number of bearings. So enter '2' into the input field 'Number of bearings to calculate'. Please calculate the bearings one after another separately. The listbox 'Current view' allows you to switch between the two bearings.

🕗 eassistant - G	WJ-Technology - Rating life calculatio	n DIN I	50 281 - Mozilla Firefox	:	<u>_ ×</u>
🗳 Open 🔗	Save 🗖 Local 🔙 Calculate 🗠	Undo	🖙 Redo 🚺 Repor	t 🔐 Options 🤣 Help	
General:	Number of bearings to calculate	2	Current view:	Bearing No. 1	
Comment	ter			Bearing No. 1	

Figure 23: Number of bearings

Add a comment for the first bearing.

🕹 eassistant - G	WJ-Technology - Rating life calculation DIN ISO 281 - Mozilla Firefox	
🗳 Open 🔊	Save 🗆 Local 📓 Calculate 🗠 Undo 🖙 Redo 💭 Report 💱 Options 🤣 Help	
Free description	or comment to the current bearing.	
General:	Number of bearings to calculate: 2 Current view: Bearing No. 1	92
Comment:	Bearing Location (A) (Non-Locating Bearing)	

Figure 24: Add a comment

Select Manufacturer and Bearing Type

Now select the manufacturer 'SKF'. Choose the cylindrical roller bearing from the listbox.

🕹 eassistant - GV	/J-Technology - Rating life calculation DIN ISO 281 - Mozilla Firefox	
🗳 Open 🔊 S	Save 🗖 Local 📓 Calculate 🗠 Undo 🗠 Redo 🄀 Report 💱 Options 🤣 Help	
Selection of bearing	ng type.	
General:	Number of bearings to calculate: 2 Current view: Bearing No. 1	
Comment:	Bearing Location (A) (Non-Locating Bearing)	
Selection of man	ufacturer and kind Adequate bearings in database: 1306	5
Manufacturer:	SKF AG (2007) Bearing type: Cylindrical roller bearing (single row)	•



Specification of Bearing Load with Load Collectives

Define the load collective for the first bearing. Activate the option 'Use load collective'. The input options for the radial and axial force as well as for the speed will be deactivated.



Figure 26: Bearing load

Define two load cases for the bearing. Enter the time slice, the radial force, axial force, the temperature and cleanness for each load case. After you made all entries, click the button 'OK' to confirm your inputs.

lo.	of loading cas	es: 2				🗳 Op	en 🐼 Sav	е
	Time slice q [%]	Speed n (1/min)	Radial force Fr [N]	Axial force Fa [N]	Temperature T [°C]	Cleanness	eC	
	50.0	3000.0	5800.0	0.0	70.0	Normal cleanness	• 0.5	E
	50.0	4500.0	11000.0	0.0	70.0	Normal cleanness	0.5	
						User-defined	¥	
						User-defined		

Figure 27: Define the load collective

Bearing Selection

Click on the button 'Bearing selection'.

Selected bearing:
Bearing selection no bearing selected

Figure 28: Bearing selection

It is increasingly convenient to use the search filter to quickly find the bearing you are looking for. Enter '70 mm' for the inner diameter and click the button 'Search'. Now you can choose the cylindrical roller bearing 'NU 314 ECP' from the list. Clicking the button 'OK' confirms the bearing and leads you back to the main mask.

Bearing selection searc	ch r	from	to			from	to
nner diameter of bearin	g d (mm):	70.0	70.0	Rating life L10 [I	h]:	any	any
Outer diameter of bearin	ıg D (mm):	any	any	Expanded modified rating life Lnm (h):			any
Bearing width B (mm):		any	any	Max. speed for c	any	any	
		Sea	arch	Max, speed for <u>c</u>	rease lubrication [1	/min]: any	any
Found bearings (48):							
Found bearings (48): Description	d	D	B	L10	Lnm	nOil	nGrease
Found bearings (48): Description NU 314 BCJ	d 70.0	D 150.0	B 35.0	L10	Lnm 9419591.8	nOil –	nGrease
Found bearings (48): Description NU 314 BCJ NU 314 BCM	d 70.0 70.0	D 150.0 150.0	B 35.0 35.0	L10 188391.8 188391.8	Lnm 9419591.8 9419591.8	nOil	nGrease
Found bearings (48): Description NU 314 BCJ NU 314 BCM NU 314 BCP	d 70.0 70.0 70.0 70.0	D 150.0 150.0 150.0	B 35.0 35.0 35.0	L10 188391.8 188391.8 188391.8	Lnm 9419591.8 9419591.8 9419591.8	nOil - -	nGrease - - -
Found bearings (48): Description NU 314 ECJ NU 314 ECM NU 314 ECP NU 414	d 70.0 70.0 70.0 70.0 70.0	D 150.0 150.0 150.0 150.0	B 35.0 35.0 35.0 42.0	L10 188391.8 188391.8 188391.8 188391.8 170401.6	Lnm 9419591.8 9419591.8 9419591.8 9419591.8 8520080.2	nOil - - -	nGrease - - -
Found bearings (48): Description NU 314 ECJ NU 314 ECH NU 314 ECH NU 314 ECH NU 314 ECH NU 414 M	d 70.0 70.0 70.0 70.0 70.0 70.0	D 150.0 150.0 150.0 180.0 180.0	B 35.0 35.0 35.0 42.0 42.0 42.0	L10 188391.8 188391.8 188391.8 170401.6 170401.6	Lnm 9419591.8 9419591.8 9419591.8 8520080.2 8520080.2	n0il - - -	nGrease - - - -
Found bearings (48): Description NU 314 ECJ NU 314 ECM NU 314 ECP NU 314 CP NU 414 M NU 414 M NUP 214 ECM	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0	D 150.0 150.0 150.0 180.0 180.0 180.0 125.0	B 35.0 35.0 42.0 42.0 24.0	L10 188391.8 188391.8 188391.8 170401.6 170401.6 30743.8	Lnm 9419591.8 9419591.8 9419591.8 8520080.2 8520080.2 982175.8	n0il - - - - -	nGrease - - - -
Found bearings (48): Description NU 314 ECH NU 414 M NUP 214 ECH NUP 214 ECH	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0 70.	D 150.0 150.0 150.0 180.0 180.0 125.0 125.0	B 35.0 35.0 35.0 42.0 42.0 24.0 24.0	L10 188391.8 188391.8 170401.6 170401.6 30743.8 30743.8	Lnm 9419591.8 9419591.8 9419591.8 8520080.2 8520080.2 982175.8 982175.8	n0ii - - - -	nGrease - - - - -
Found bearings (48): Description NU 314 ECJ NU 314 ECP NU 414 M NUP 214 ECM NUP 214 ECP NUP 214 ECP	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0 70.	D 150.0 150.0 150.0 180.0 180.0 125.0 125.0 125.0	B 35.0 35.0 42.0 42.0 42.0 24.0 24.0 24.0 24.0	L10 188391.8 188391.8 170401.6 170401.6 30743.8 30743.8	Lnm 9419591.8 9419591.8 9419591.8 8520080.2 982175.8 982175.8 982175.8	n0ii - - - - - -	nGrease - - - - - - - -

Figure 29: Bearing selection

0.1.9 Calculation Results

Rating Life of the Cylindrical Roller Bearing (Bearing Location A)

All results will be calculated during every input and will be displayed in the result panel. A recalculation occurs after every data input. Any changes that are made to the user interface take effect immediately. First, you get the result for the rating life as well as the static identification number.

Results:	ſ				
Rating lifes:	L10 [h]:	188391.8	Lnm [h]:	9419591.8	Static identification no. S0: 20.7
Diagram of rating li	ife as function of	Banatione Fri	NI	T	

Figure 30: Rating life

The result of the rating life is $L_{10} = 188.391,8$ h

The cylindrical roller bearing is sufficiently dimensioned.

Rating Life for the Deep Groove Ball Bearing (Single Row) (Bearing Location B)

Calculate now the rating life for the deep groove ball bearing. Please pay attention that you select 'Bearing No. 2' from the listbox 'Current view'.

🕙 eassistant - G	WJ-Technology - Rating life calculation DIN I50 281 - Mozilla Firefox	<u>_ ×</u>
🗳 Open 🔗	Save 🗖 Local 📓 Calculate 🗠 Undo 🗠 Redo 🚺 Report 🙀 Options	i Help
Free description	or comment to the current bearing.	
General:	Number of bearings to calculate: 2 Current view: Bearing	ng No. 2
Comment:	Bearing Location (B) (Locating Bearing)	

Figure 31: Deep groove ball bearing

Select the manufacturer 'SKF' and the bearing type 'Deep groove ball bearing (single row)'.

eassistant - GWJ-Technology - Rating life calculation DIN ISO 281 - Mozilla Firefox								
🗳 Open 🔗	Save 🗖 Local 📓 Calculate 🕫 Undo 🕾 Redo 🚺 Report 🏂 Options 🤣 Help							
Selection of bear	election of bearing type.							
General:	Number of bearings to calculate: 2 Current view: Bearing No. 2							
Comment:	Bearing Location (B) (Locating Bearing)							
Selection of ma	Selection of manufacturer and kind Adequate bearings in database: 1572							
Manufacturer:	SKF AG (2007) Bearing type: Deep groove ball bearing (single row)	•						

Figure 32: Bearing selection

Activate the option 'Use load collective'.

Specification of bearing load	Use load collective	Input loa	d collective
Radial force Fr [N]: Collective Axia	al force Fa (N): Collective	Speed n [1/min]:	Collective

Figure 33: Button 'Load collective'

Define the load cases. Enter the time slice, the radial force, axial force, the temperature and cleanness for each load case. After you made all entries, click the button 'OK' to confirm your inputs.

0.	of loading cas	ses: 2				🗳 Open		Save
	Time slice q (%)	Speed n [1/min]	Radial force Fr [N]	Axial force Fa [N]	Temperature T [°C]	Cleanness eC		
	50.0	3000.0	2000.0	5000.0	70.0	Normal cleanness	0.5	<u>^</u>
	50.0	4500.0	5000.0	5000.0	70.0	Normal cleanness	0.5	_
						User-defined	-	_

Figure 34: Define the load collective

Click on the button 'Bearing selection'.

Selected bearing:	
Bearing selection	bearing selected

Figure 35: Button 'Bearing selection'

Choose the bearing '6314' from the list. It is increasingly convenient to use the search filter to quickly find the bearing you are looking for. Enter '70 mm' for the inner diameter and click the button 'Search'. Then you can select the bearing '6314' from the list. Clicking the button 'OK' confirms the bearing and leads you back to the main mask.

aring selection							
Bearing selection searc	:h	from	to			from	ı to
nner diameter of bearin	g d [mm]:	70.0	70.0	Rating life L10 (I	n]:	any	any
Outer diameter of bearin	ıg D [mm]: 🏼 🍟	any	-any	Expanded modif	fied rating life Lnm	[h]: any	any
Bearing width B [mm]:	j j	any	any	Max. speed for o	il lubrication (1/mir	nj; any	any
		Sea	arch	Max. speed for g	rease lubrication [1/min]: any	any
Found bearings (49):							
Found bearings (49): Description	d	D	B	L10	Lnm	nOil	nGrease
ound bearings (49): Description 52214-2RS1	d 70.0	D 125.0	B 31.0	L10 1280.5	Lnm 9569.6	nOil	nGrease -
Found bearings (49): Description 62214-2RS1 62314-2RS1	d 70.0 70.0	D 125.0 150.0	B 31.0 51.0	L10 1280.5 4826.4	Lnm 9569.6 61696.6	nOil	nGrease -
Found bearings (49): Description 62214-2R\$1 62314-2R\$1 6314	d 70.0 70.0 70.0	D 125.0 150.0 150.0	B 31.0 51.0 35.0	L10 1280.5 4826.4 5868.0	Lnm 9569.6 61696.6 75011.9	nOil - -	nGrease - -
Found bearings (49): Description 62214-2RS1 62314-2RS1 6314 6314-2RS1	d 70.0 70.0 70.0 70.0 70.0	D 125.0 150.0 150.0 150.0	B 31.0 51.0 35.0 35.0	L10 1280.5 4826.4 5868.0 5868.0	Lnm 9569.6 61696.6 75011.9 75011.9	n0il - - -	nGrease - - -
Found bearings (49): Description 62214-2RS1 62314-2RS1 6314 6314-2RS1 6314-22S1 6314-22S1	d 70.0 70.0 70.0 70.0 70.0 70.0	D 125.0 150.0 150.0 150.0 150.0	B 31.0 51.0 35.0 35.0 35.0	L10 1280.5 4826.4 5868.0 5868.0 5868.0	Lnm 9569.6 61696.6 75011.9 75011.9	n011 - - - -	nGrease - - -
Found bearings (49): Description 62214-2RS1 6214-2RS1 6314-2RS1 6314-2RS1 6314-RS1	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0	D 125.0 150.0 150.0 150.0 150.0 150.0	B 31.0 51.0 35.0 35.0 35.0 35.0	L10 1280.5 4826.4 5868.0 5868.0 5868.0 5868.0	Lnm 9569.6 61696.6 75011.9 75011.9 75011.9 75011.9	n0il - - -	nGrease - - - - -
Found bearings (49): Description 62214-2RS1 62314-2RS1 6314-2RS1 6314-2Z 6314-RS1 6314-7 6314-	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0	D 125.0 150.0 150.0 150.0 150.0 150.0 150.0 150.0	B 31.0 51.0 35.0 35.0 35.0 35.0 35.0	L10 1280.5 4826.4 5868.0 5868.0 5868.0 5868.0 5868.0 5868.0	Lnm 9569.6 61696.6 75011.9 75011.9 75011.9 75011.9	nOil - - -	nGrease - - - - - - -
Found bearings (49): Description 62214-2RS1 6314-2RS1 6314-2RS1 6314-22 6314-22 6314-2 6314-2 6414	d 70.0 70.0 70.0 70.0 70.0 70.0 70.0 70.	D 125.0 150.0 150.0 150.0 150.0 150.0 150.0 180.0	B 31.0 55.0 35.0 35.0 35.0 35.0 35.0 42.0	L10 1280.5 4826.4 5868.0 5868.0 5868.0 5868.0 5868.0 5868.0 9265.4	Lnm 9569.6 61696.6 7501.9 75011.9 75011.9 75011.9 75011.9 209591.1	n0il - - - - -	nGrease - - - - - - - - - -

Figure 36: Deep groove ball bearing

The result for the rating life is $L_{10} = 5.868 \text{ h}$

Results:					
Rating lifes:	L10 [h]:	5868.0	Lnm [h]:	112627.5	Static identification no. S0: 20.7
Diagram of rating life a	s function of	Radial lorce Fr [N]		▼ K	

Figure 37: Nominal rating life

The rating life of the deep groove ball bearing B is lower than the rating life of the cylindrical roller bearing A. This means that bearing B is subjected to higher stresses than bearing A. At least 22.0000 hours are required for the rating life of deep groove ball bearings. But with this result, the rating life is not sufficiently dimensioned. It is necessary to take a closer look at the expanded modified rating life L_{nm} of bearing B.

Expanded Modified Rating Life of the Deep Groove Ball Bearing

The next step is to determine the expanded modified rating life for the deep groove ball bearing. The option 'Use expanded modified rating theory' is activated by default. Select the grease 'Lubcon Turmogrease Highspeed L 252 (K HC P 2/3 K-50)' from the listbox or click on the button 'Lubricant' to open the lubricant selection. Choose the lubricant and confirm with the button 'OK'.

Expanded modifie	ed rating theory	Use expanded modified rating theory	
Requisite reliabili	ty S [%]:	90.0	Fr
Operating temper	ature T [°C]:		
Cleanness eC:	Normal cleannes	s 💽 0.6	
Lubricant	Grease: Lubcon	Turmogrease Highspeed L 252 (K HC P 2/3 K -50) 💌	øb ⊥.⊥ød

Figure 38: Expanded modified rating life

The result of the expanded modified rating life is $L_{nm} = 34.092,4$ h.

Results:			r		,
Rating lifes:	L10 [h]:	5868.0	Lnm [h]	48018.4	Static identification no. S0: 12.4
Diagram of rating life as function of		Lubcricant viscosity nu [mm?/s]			
				50. Li-	

Figure 39: Result for the expanded rating life

At least 22.000 hours are required and the bearing is sufficiently dimensioned. For the calculation with load collectives, you cannot open all diagrams. But you can open the diagram for the lubricant viscosity.

0.1.10 Documentation: Calculation Report

After the completion of your calculation, you can create a calculation report. Click on the 'Report' button. Click the button 'Options' and activate the diagram for the 'Lubricant viscosity'. This diagram will then appear in the calculation report.

🕹 Rep	ort - Rolling I	bearings	calculati	ion according	to DIN	150 281 - Mozil	la Firefox			
<u>D</u> atei	<u>B</u> earbeiten	Ansicht	<u>C</u> hronik	Lesezeichen	E <u>x</u> tras	<u>H</u> ilfe				
										-
	Lubrica	nt								
	Lubrican	it:				Lubcon Turn	nogrease (Highspeed L 2 K HC P 2/3 K -	252 50)	
	Hint:					Special grease for high speed high precision angular contact ball bearings				
	Density	at 20°C	(rho ₂₀)	:				0	.94 kg/cm ³	
	Provable	e active	EP-addi	tives:				is inclu	ded	
	Viscosity	/ at 40°	C (nu ₄₀):				2	5.0 mm²/s	
	Viscosity	at 100	C (nu	:00):					6.0 mm ² /s	
	Minimal	operatin	g temp	erature(T):			-5	0.0 °C	
	Maximal	operati	ng temp	perature(T):			12	0.0 °C	
	Bearing	g load	collec	tive						
	Requisit	e reliabi	lity (S):	90.0 %						
	Time slice	A	kial d	Radial load	Spee	d Or temp	perating perature	Cleann	ess factor C	
	q [%]	Fa	[N]	Fr [N]	n [1/min	1	[°C]		eC	
	50.0	500	0.0	2000.0	3000	.0	70.0	(0.6	-

Figure 40: Calculation report

You can navigate through the report via the table of contents that provides links to the input values, results and figures. This calculation report contains all input data, the calculation method as well as all detailed results. The report is available in HTML and PDF format. The calculation report saved in HTML format, can be opened in a web browser or in Word for Windows. You may also print or save the calculation report:

- To save the report in the HTML format, please select 'File' \rightarrow 'Save as' from your browser menu bar. Select the file type 'Webpage complete', then just click on the button 'Save'.
- If you click on the symbol 'Print', then you can print the report very easily.
- When you click on the symbol 'PDF', then the report appears in the PDF format. If you right-click on the PDF symbol, you should see the 'Save Target As' option. Click on that option and you will see the dialog box for saving the report.

0.1.11 Save the Calculation

When the calculation is finished, you can save it to your computer or to the eAssistant server. Click on the button 'Save'. Before you can save the calculation to your computer, you need to activate the checkbox 'Enable save data local' in the project manager and the option 'Local' in the calculation module. A standard Windows dialog for saving files will appear. Now you will be able to save the calculation to your computer.



Figure 41: Windows dialog for saving the file

In case you do not activate the option in order to save your files locally, then a new window is opened and you can save the calculation to the eAssistant server. Please enter a name into the input field 'Filename' and click on the button 'Save'. Then click on the button 'Refresh' in the project manager. Your saved calculation file is displayed in the window 'Files'.

iave file		×
Projects	Files	
Default		
Project 1		
Project 2		
	1	
Filename		
	Save	Cancel

Figure 42: Save the calculation

Our manual is improved continually. Of course we are always interested in your opinion, so we would like to know what you think. We appreciate your feedback and we are looking for ideas, suggestions or criticism. If you have anything to say or if you have any questions, please let us know via telephone +49 (0) 531 129 399-0 or email eAssistant@gwj.de.