FAQ • 09/2016

Monitoring of Double Bearings

SIPLUS CMS1200, SIPLUS CMS2000

https://support.industry.siemens.com/cs/ww/en/view/109736550

Security information

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1 Introduction

In practice it may happen, that mechanically caused (force) a shaft needs a double bearing. In this case the bearings are often different (type and manufacturer).

This FAQ shows how an active monitoring of both bearings is possible with only one sensor.

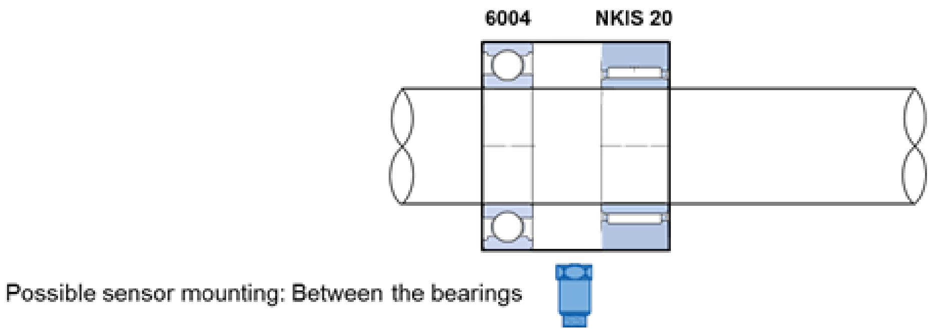
This example is only applicable for **different** bearing types.

2 Prerequisite

If both bearings are identical, neither CMS1200 (SM 1281) nor CMS2000 can distinguish, which of the two bearings is damaged. Thus the bearing types **have to be different**.

3 Solution

- One of the bearing types has to be set in the bearing database.
  (Only one can be set)
- The bearing damage frequencies of the other bearing have to be assigned to the set bearing type.
- The following bearing types by the manufacturer SKF
  are used in this example:



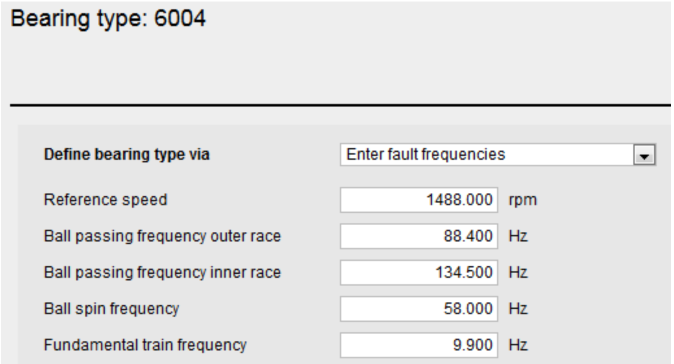
Outside diameter D: 42mm

Inside diameter d: 20mm

Width is different.

4 Proceeding

4.1 Setting of the bearing 6004



Based on the speed captured during operation the system calculates the rotation frequency, which is automatically repositioned.

So the system can always monitor the current damage frequency.

For the set bearing are for the four damage types respectively five variables automatically defined (example outer race):

1. Outer race defect 1st order
2. Outer race defect 2nd order
3. Outer race defect 3rd order
4. Outer race defect 4th order
5. Outer race defect 5th order

The corresponding damage frequencies are automatically determined in relation to the captured speed and assigned to the variables.

4.2 Explanation of the function on the example outer race – fault frequency

For a speed of 1488 min^{-1} this is valid:

- Rotation frequency f_{Rot} [s^{-1} = Hz] = speed [min^{-1}] / 60 = 24.8 Hz
- Outer race – fault frequency of 1st order = f_A = 88.4 Hz

$$f_A\ current\ speed = \frac{f_A\ reference\ speed}{f_{Rot}\ reference\ speed} \times \mathbf{f_{Rot}}\ \mathbf{current\ speed}$$

It is recognizable, that at a current speed, which is equal to the reference speed, the outer race – fault frequency must be: f_A = 88.4 Hz

At a speed of 1000 min^{-1}, by following the equation above, results a outer race – fault frequency of 59.4 Hz.

The damage frequencies of the 2nd to 5th order are the corresponding multiples of the 1st order.

Example

Fault frequency of the 2nd order = Fault frequency of the 1st order * 2

The system integrated bearing calculator, with which the bearing frequencies for every speed can be calculated, if a bearing is once set correctly, works equally.

Bearing type: 6004

Define bearing type via	Enter fault frequencies	
Reference speed	1488.000	rpm
Ball passing frequency outer race	88.400	Hz
Ball passing frequency inner race	134.500	Hz
Ball spin frequency	58.000	Hz
Fundamental train frequency	9.900	Hz

Calculate fault frequencies for this bearing type

Speed for fault frequencies	1000	rpm
Ball passing frequency outer race	59.4	Hz
Ball passing frequency inner race	90.4	Hz
Ball spin frequency	39.0	Hz
Fundamental train frequency	6.7	Hz

4.3 Determining the speed factors

At the monitoring band of the envelope curve spectrum, the bearing damage frequencies have to be set with a speed factor.

If the bearing type is set in the system, the values are preset with e.g. Outer race defect 1st order.

For the second bearing user defined message texts have to be entered.

Therefor **user defined** has to be selected at message text.

		Limits [m/s²]		
Message text	Speed factor	Warning	Alarm	Save trend as
Outer race defect	1st order	0.008	0.010	
Outer race defect	2nd order	0.007	0.009	
User defined				

Now, the speed factor must be calculated, therefor this is valid:

$$f_A\ current\ speed = \boxed{\frac{f_A\ reference\ speed}{f_{Rot}\ reference\ speed}} \times f_{Rot}\ current\ speed$$

Speed factor ➔ The speed factor is a constant.

Now the fault frequencies as well as the speed factors of every damage type must be determined for the second bearing.

Step 1

Select the appropriate bearing at the bearing calculator of the manufacturer (internet), set the reference speed and note down the damage frequencies

Please Note: The reference speed can be different to the one of the set bearing.

In this example the identical reference speed was chosen.

Step 2

Calculating the speed factor:

$$speed\ factor = \frac{f_{Damage\ type}\ reference\ speed}{f_{Rot}\ reference\ speed}$$

For the bearing in this example it is valid:

Characteristic value	NKIS 20	Speed factor
Reference speed 1488 min^{-1}	24,8 Hz	
Outer race – fault frequency	160,2 Hz	6,46
Inner race – fault frequency	211,8 Hz	8,54
Rolling element rotation frequency	87,8 Hz	3,54
Cage rotation frequency	10,7 Hz	0,43

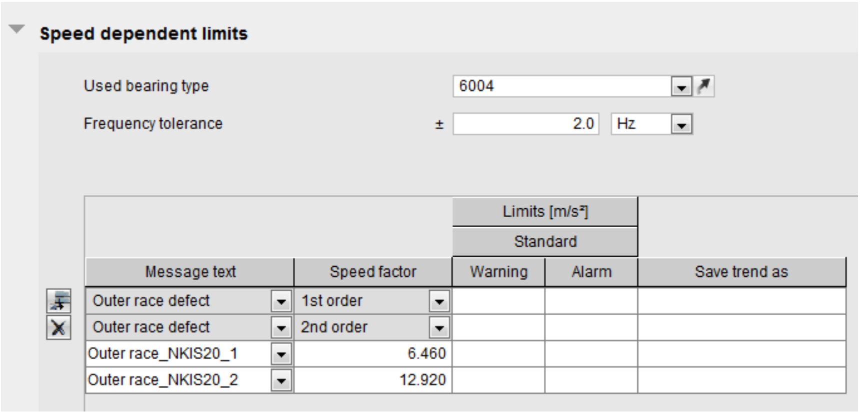
NOTE The speed factor has to be calculated for each damage type separately.

4.4 Setting the parameters for the envelope curve monitoring

To enter the user-defined bearing data, at the limit band of the envelope curve spectrum has to be chosen the entry **user defined**.

The text **user defined** can be edited by the user.

It is also possible, to enter your own text for the outer race – fault frequencies, like in this example up to the second order.



Example for the naming for the user-defined bearing here: damage type_bearing type_order.

NOTE

- The input of the user-defined bearing – damage frequencies have to be assigned to the set bearing type (here type 6004).
- The speed factor, calculated before, has to be entered here.
- The specification of the limits for warning and alarm is oriented at the local and constructive conditions.
- There are no damage-cursors shown for the user-defined bearing.