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User Manual
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Telescopic Contact Thermometer

1 INTRODUCTION

The Contact Thermometer is a measurement tool, which is used to measure the shaft temperatures of kiln support rollers with high accuracy. The temperature on the different areas of the roller shafts, provides information about the condition of the bearing.
The temperature on the thrust collar, gives an indication of the axial load which is taken by the support roller. The method of comparing the temperature increase at the thrust collars can be used to distribute the axial kiln load evenly among the different support rollers.

The contact thermometer has the great advantage compared to infrared thermometers or thermal cameras, that it is not depending on emissivity factors nor being disturbed by the oil film.

2 SAFETY

Rotary kilns and dryers, where this tool is typically used, are huge rotating equipment with many pinch points and hot surfaces which can cause serious injuries. Therefore, only specialized and trained personnel shall work close to these machines. To use the tool, follow strictly the local safety rules given by the respective plant / factory / local authorities and discuss the application with the safety engineer in charge.
The tools provided by TomTom-Tools GmbH have proven their functionality in various applications; nevertheless TomTom-Tools GmbH does not take any responsibility for the application on site regarding safety. The plant is responsible for the safety, according to the local law, in a way that nobody can be hurt or injured. The application and safety instructions below are guidelines and not exhausted which include the experience from previous measurement campaigns and might need to be adapted to the local safety requirements.

Caution:

Pinch Points:
Do not put your hands nor any items close or into pinch points
(e.g. kiln tires / support rollers, girth gear / pinion,…)
Keep safe distance to avoid getting caught by moving parts.
Do not grab into the bearing housing
Be aware of the oil lifter scoops in the bearing housing and keep safe distance from them.

Gloves:
Wear proper gloves to protect your hands from hot or rough surfaces and sharp edges.

Hot Surface:
The kiln shell and the components around it might be very hot.
Do not touch them and keep safe distance.

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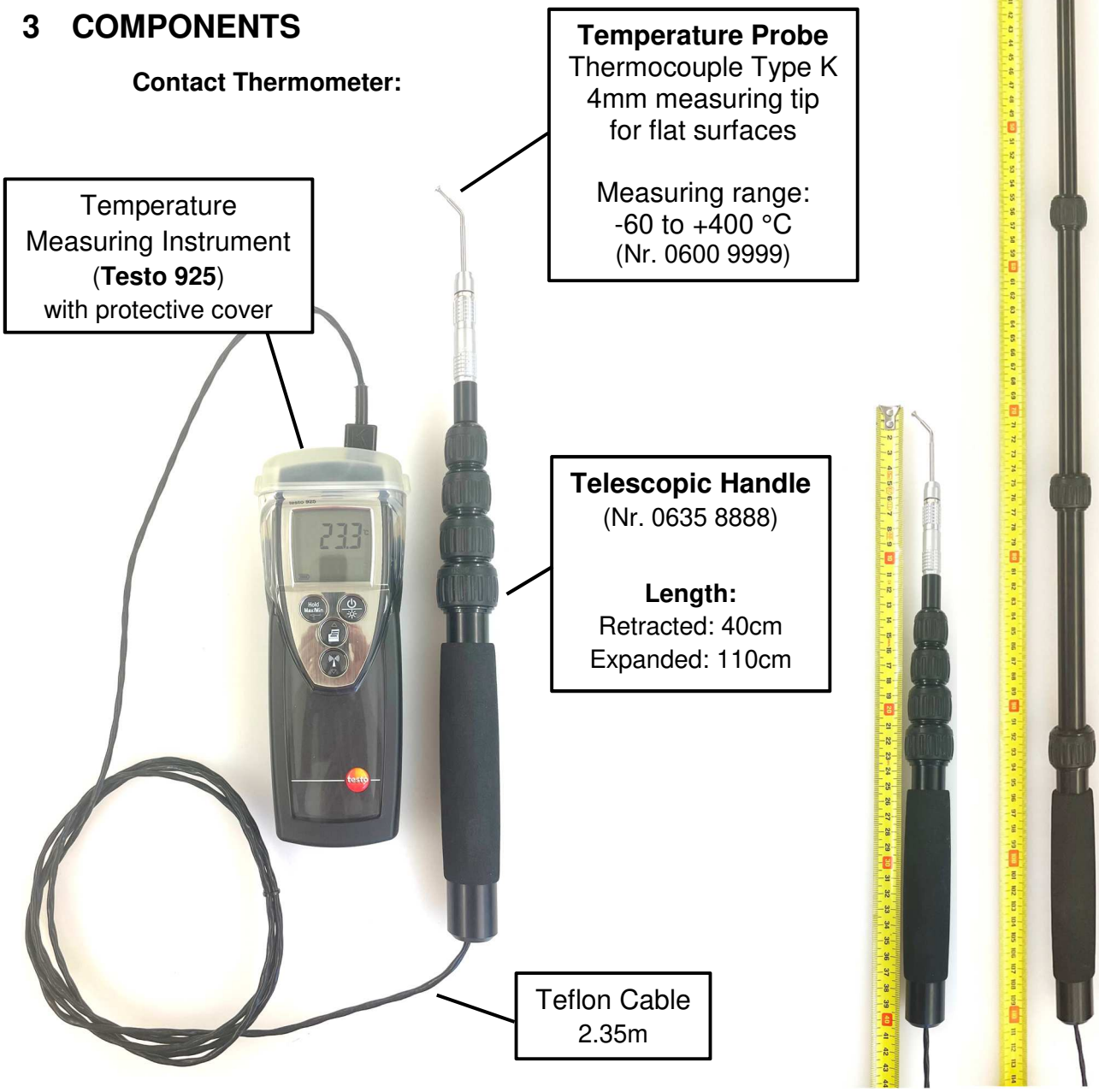
3 COMPONENTS

Contact Thermometer:



4 APPLICATION

4.1 General

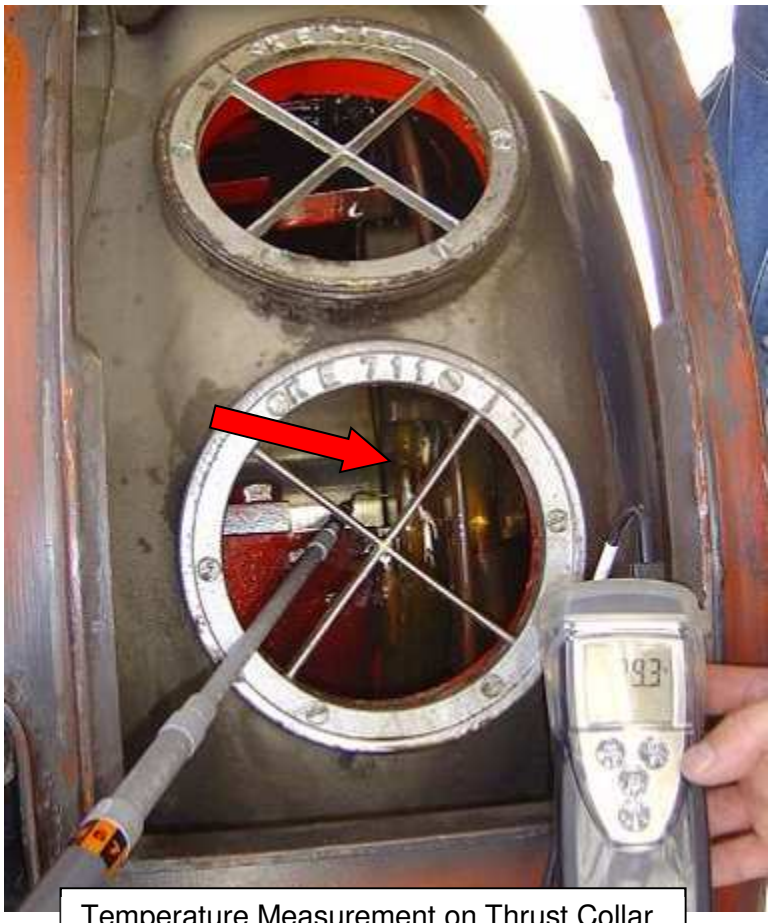
The temperatures might change during the axial movement of the kiln
Repeat the measurement on different days

The following points affect the functionality or the result of the measurement:

Roughness of Surface:
Moving surfaces need to be smooth and lubricated while measuring
(e.g. Roller Shafts).
Do not measure on Roller or Tire surfaces → the temperature probe will wear off.

Probe to Surface Contact:
Make sure, the probe has full contact to the surface, to allow the best possible heat transfer.
Do not press the probe with high pressure to the surface. This would create friction heat, which would affect the measurement result.

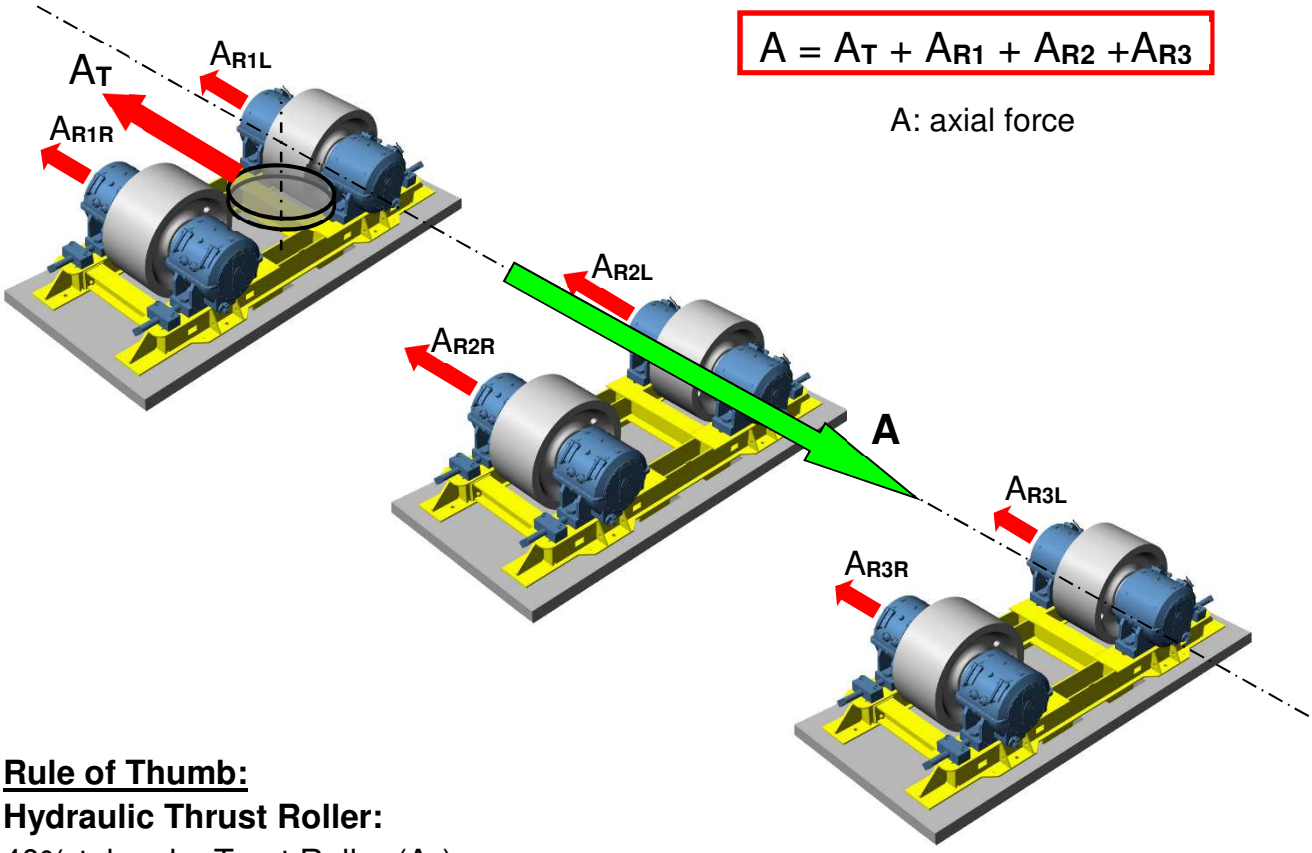
Shocks:
Avoid any shocks or hits on the Contact Thermometer, to prevent the probe from bending or breaking.



Temperature Measurement on Thrust Collar

4.2 Axial Load Distribution (Axial Balancing)

The axial load should be distributed among the thrust roller and the support rollers. The support rollers should be adjusted (skewed) in a way that they contribute to push the kiln slightly uphill (at least no roller shall push the kiln downhill). Normally the both kiln tires on the inlet and outlet are less loaded by the kiln weight; hence they also do contribute less on the axial load.



<u>Rule of Thumb:</u>

Hydraulic Thrust Roller:

40% taken by Trust Roller (A_T)

60% divided among the Support Rollers (A_R)

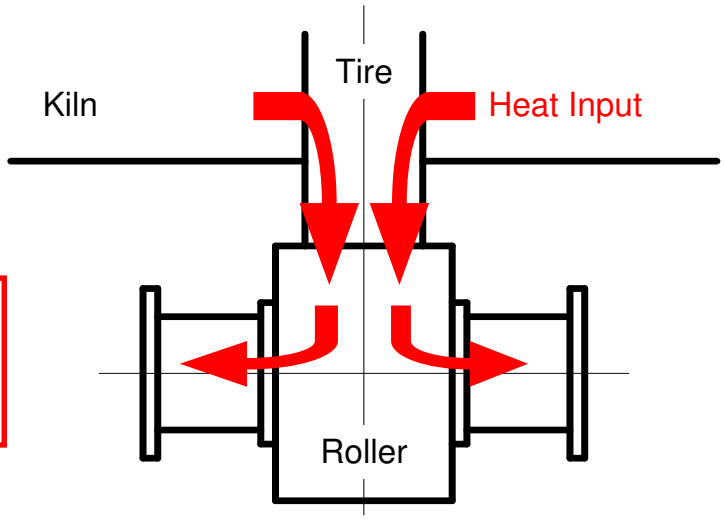
Fixed Thrust Roller:

100% divided among the Support Rollers (A_R)

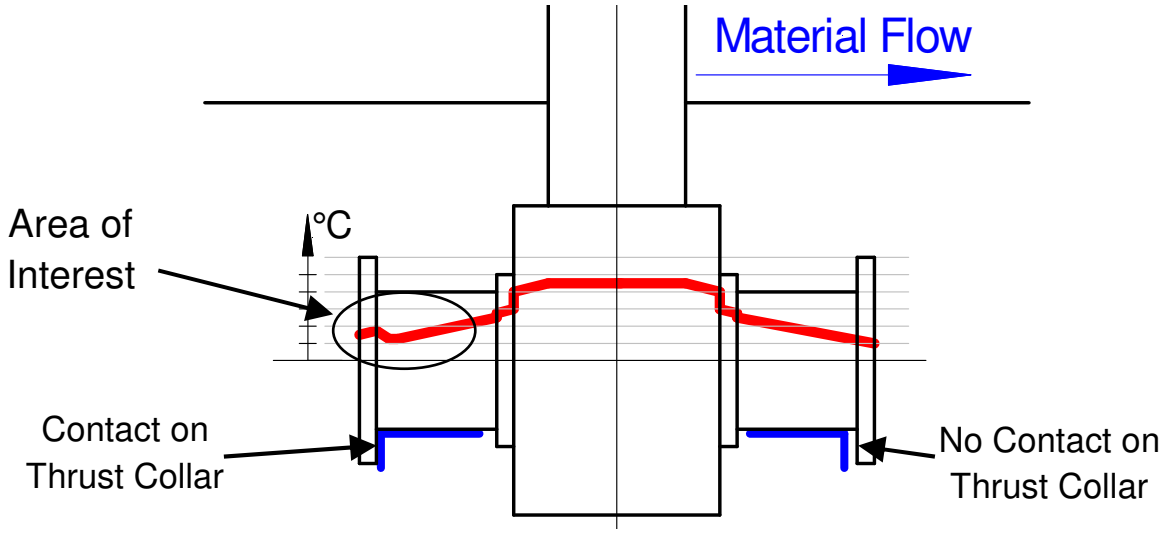
4.3 Heat Input into Shaft

During normal working operation, the main source of heat into the roller shaft is the heat coming from kiln. The temperature of the kiln shell gets transferred via tire into the roller and its shaft. If the bearings are working normally there is only a very little heat generated by the shear friction in the oil film between the roller shaft and the bearing (radial part). That means the oil film is strong enough to resist the high load and to separate the surfaces from the shaft and the bearing.

Identifying the sources of the heat is key



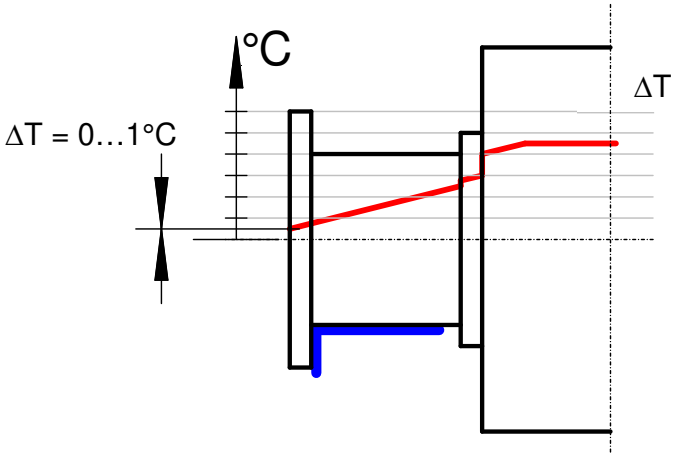
Axial load creates friction between the thrust collar and the axial bearing which increases the temperature on the thrust collar. This area is of interest.
The increase of the shaft temperature by the thrust bearing is an indication of the axial load.



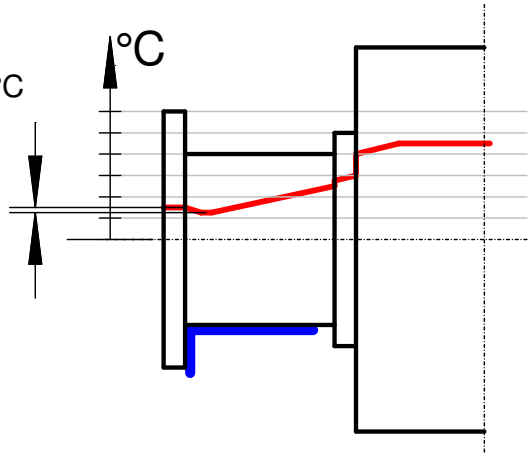
4.4 Measurement of Temperature Profile in Roller Shaft

To measure the temperature increase, caused by the axial force, it is important to compare the temperature of the lowest point and the thrust collar. Note: The point with the lowest temperature moves toward the roller body in case of high axial load (see sketches)

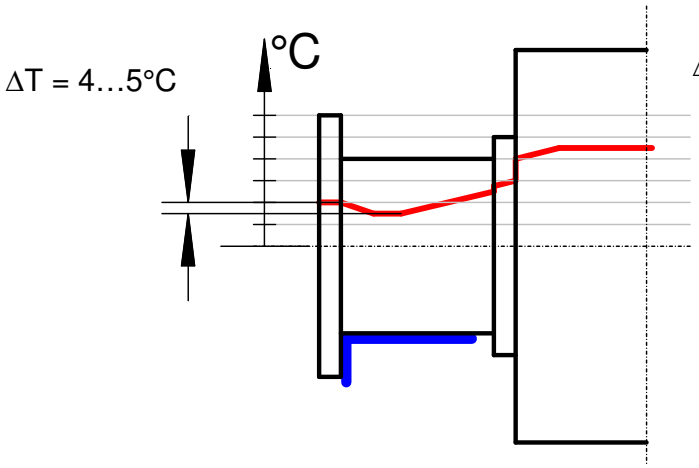
No or low load:



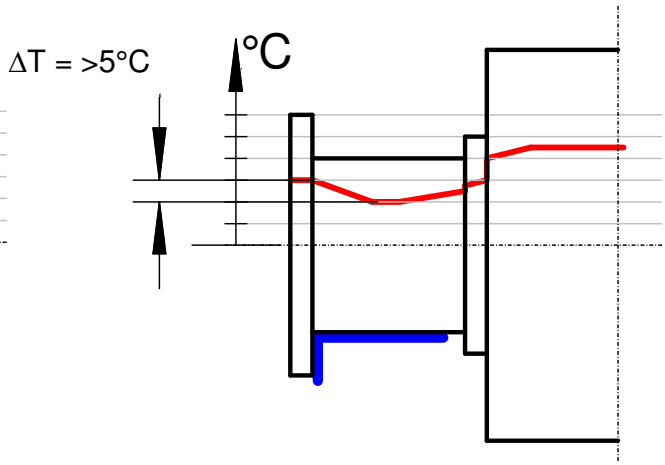
Normal load:



High load:

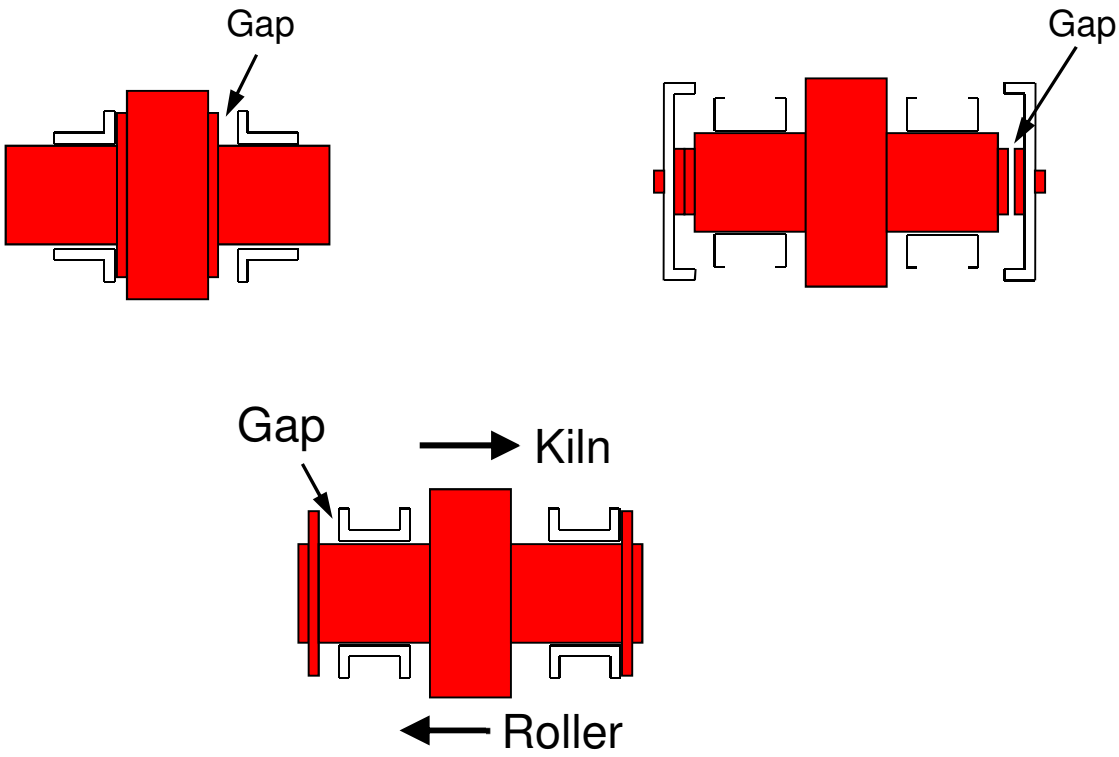


Overloaded:



4.5 Different Bearing Designs

On rotary kilns, different bearing designs can be found. The bearing type, as shown above, is one of the most common and the easiest to evaluate by the temperature method.
The following overview shows the main bearing types:



5 COUNTER MEASURES

- If a strong axial pushing support roller can be identified, adjust the skewing of the roller in a way to reduce the axial load.
- Additionally, identify the rollers with no axial load and skew them slightly to take some load
- If a roller was found, which pushes the kiln downhill, adjust the skewing as well.

Attention!

- Check the pressure of the hydraulic thrust roller system.
  Too low load on the thrust roller bears the risk that the kiln might move uncontrolled uphill, just by the skewing of the support roller.
  This can damage the kiln inlet seal.