Key PMR's

Girth Gear Radial Run out measurement Procedure

1. PURPOSE

The radial run out on girth gears has to be kept within the acceptable values in order to avoid an uneven contact between pinion and girth gear, which might damage their running surfaces.

The Holcim preferred method uses non-contact **inductive sensors** connected to an Analog/Digital (A/D) converter. The data is then transferred via USB port to a laptop. This set up allows immediate results in the field and, more importantly, the measurement is performed **while the equipment is running** (see picture above)

HGRS/MER Department can assist plants on buying their own measurement instruments.

The traditional method will be also described, but it requires the equipment (kiln or mill) to be down.

2. SAFETY

As mentioned before, the **inductive sensor method** is performed with the equipment running. Therefore, care has to be taken that neither instruments nor personnel come in contact with running surfaces of the gear.

Especially for mills, it is recommended to install the sensors during a planned stop of the equipment and to let them in place until the measurement is done.

For the **traditional method,** the equipment (kiln, mill) must be properly de-energized. Use the local lock-out/tag-out/try-out procedure on the main drive. Since the equipment has to be turned with the auxiliary drive (spotting), a perfect coordination among all personnel involved in the measurement must be assured.

3. RESULTS AND ACCEPTABLE VALUES

The result from this measurement is a numerical value, the radial runout. The allowable radial runout is a function of the gear diameter and is presented in Figure # 1. It is rare when a flange-mounted gear will not be within the limit indicated on Figure # 1.

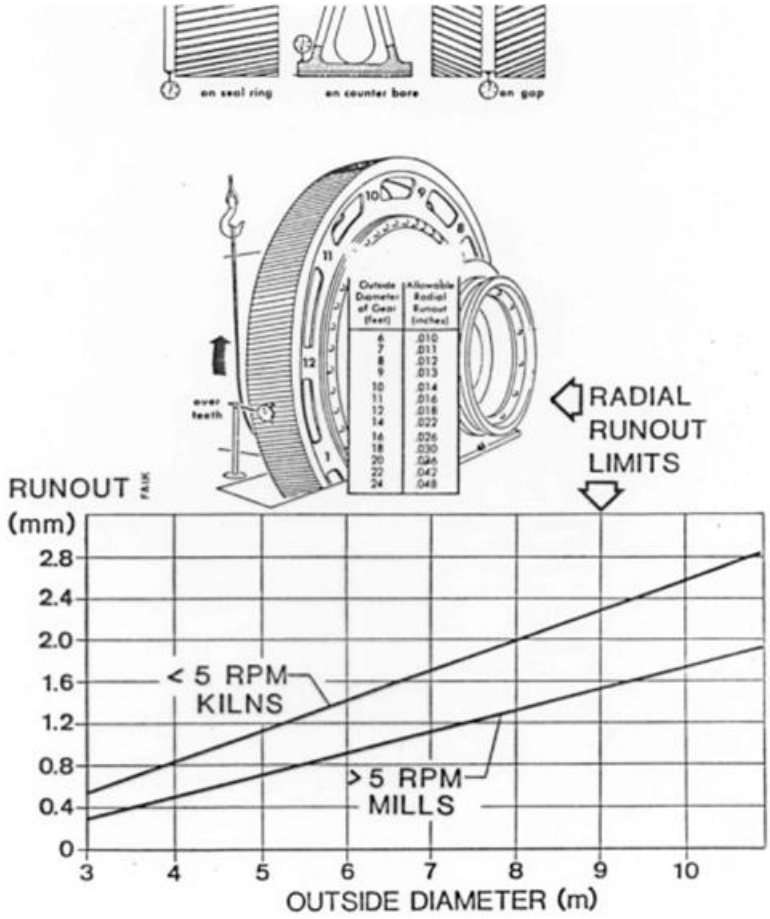

Figure #1. Maximum allowable radial run out for girth gears

4. FREQUENCY OF REALIZATION

The radial runout should be measured on a yearly basis.

5. STEP BY STEP PROCEDURE

5.1 Steps: Inductive sensor method (equipment running)

1. Take the required instrumentation to the field. The following picture shows the different components:

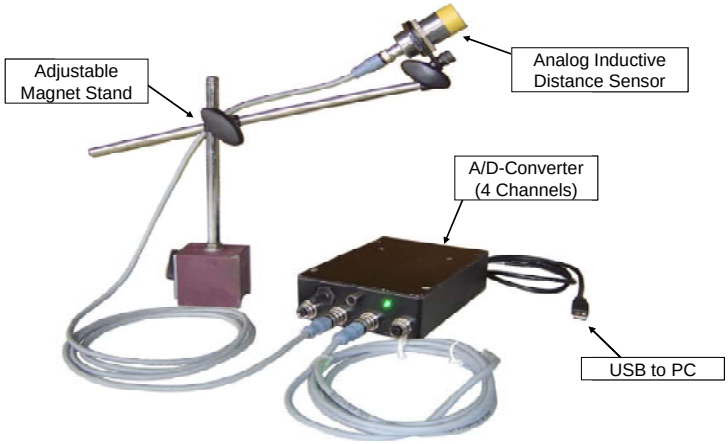

Figure #2. Measurement device required for the inductive sensor method

2. Place the inductive sensor as close as possible to the gear teeth (see Figure #3). Plug the inductive sensor to the converter and connect the converter to the laptop.

Figure #3. Measurement device placed for radial run out measurement.

Note: look for a stable support for the magnetic stand; otherwise equipment vibration will distort the measurement!

An additional sensor can be used to pick-up the kiln (or mill) turning speed (see Key PMR Axial Run out Measurement Procedure)

3. Double check on the laptop software that the signal from the sensor is being read
4. Let the equipment run for several revolutions and determine the runout value from the signal peaks (see an example on Figure #5)

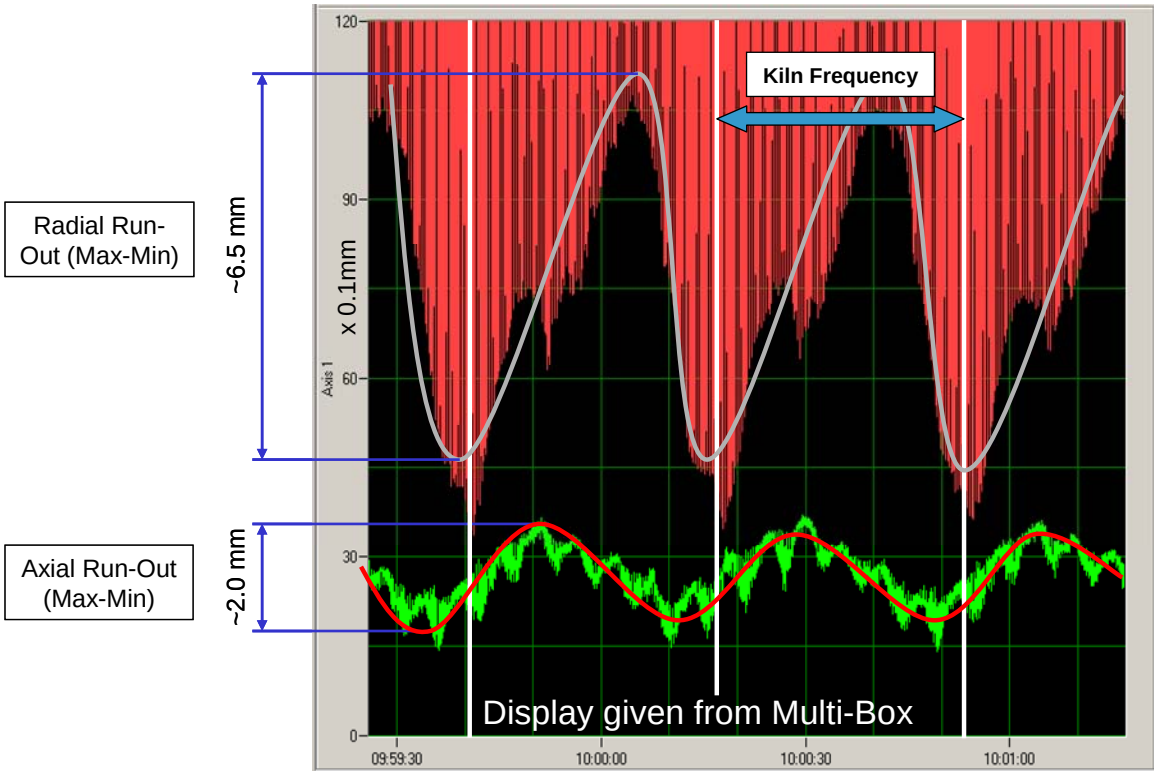

Figure #4. Run out signal as seen on the software. According to the set scale, the run out value can be calculated as the peak-to-peak value of the sinus wave and the gear revolution as the frequency

5. Compare measured value against the recommended ones. In the case shown in Figure #4, the allowable axial run out for this particular gear was of 1.3 mm and since the actual value is of 1.1 mm, no actions need to be taken (other than yearly run out measurements).
6. Once the measurement is finished, retrieve all the instruments. Be extra careful when handling the inductive sensor, to avoid injuries and/or material damages.

5.2 Steps: Traditional method

1. Select a number of at least 8 or better 12 points, which are equally spaced around the rim of the gear and mark them.
2. Place a dial indicator fitted with button shoes against and perpendicular to the teeth head, making contact with them (or on a machined surface on the rim).
3. Set the dial readings at zero. Write down values on the table on the Holcim Work Sheet (See attached file Radial run out).

Radial Run out.xls

4. Rotate the gear with the auxiliary drive until the indicator is in contact with the second point (Position 2). Write down results.
5. Repeat step 4 until the gear has turned a full revolution.
6. Measure again with the indicators on their starting positions (1 and 7) and compare against values from the first reading.

Note: The indicator will rarely indicate zero when the gear returns to the starting points. If their indications are within 0.10mm (0.004 inch) of each other the readings are acceptable, but if they exceed this amount, repeat the procedure. Occasionally an indicator slips, resulting in an erroneous set of readings.

The run out is calculated as (max value – min value) (result from cell D37 on the Excel sheet)

7. Repeat the whole procedure to obtain a second run out result . This should not deviate more than 0.5 mm from the first run out result obtained.

8. Compare the obtained run out values against the recommended one (see Figure #1)

6. OTHER ADVICE

For the **traditional method:**

The shell temperature of the machine must be uniform while performing run out measurements. The proximity of other heat-producing elements may have to be considered.

To ensure a stable measurement procedure the mill should be rotated several times before starting the measurement campaign.

7. CORRECTIVE ACTIONS IN CASE OF DEVIATIONS

If the allowable run out is exceeded, the mating faces of the flange and the gear should be rechecked for burrs or other protrusions. If there are none, shims should be placed between the mill flange and the gear at appropriate locations and the run out measurement repeated.