Revision 0.1

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TECH NOTE 3

ROTALIGN®

Single-Bearing MTBM's with Pedestal Bearings

For Firmware ver. 2.04

Introduction

This Tech Note shows you how to align single-bearing machines whose bearing is housed in a separate pedestal or pillow block and whose shaft is supported at the front end only by the rigid coupling. Generators or exciters of this sort cannot be aligned by shimming or moving the feet of the stator since this would only affect the air gap between the rotor and stator but would not move the rotor. Therefore, if any adjustments of the pedestal are made, the air gaps should subsequently be checked and the stator housing adjusted by shimming and/or moving as needed. This procedure is covered in the section entitled "Air Gap Correction." For alignment purposes, the pedestal bearing is considered the MTBM (Machine To Be Moved).

Since this machine setup typically uses a solid (rigid) coupling, the coupling bolts must normally be loosened prior to taking alignment readings in order to allow the misalignment between shaft centerlines to be measured. The faces of the coupling should be separated by about 10 to 15 mils (using a feeler gage) but without allowing the rabbet to disengage its seat. If the rabbet is tapered so the shaft drops a bit as you separate the hubs, it does not matter since this offset will go away again when you tighten the coupling back up.

After completing the alignment, a "swing check" may be performed using the ROTALIGN to monitor undesirable shaft movement which may occur when retightening the coupling bolts to their proper torque. See the last page for details.

Install the Laser on the Stationary Machine shaft, and the Receiver on the MTBM shaft.

Overview

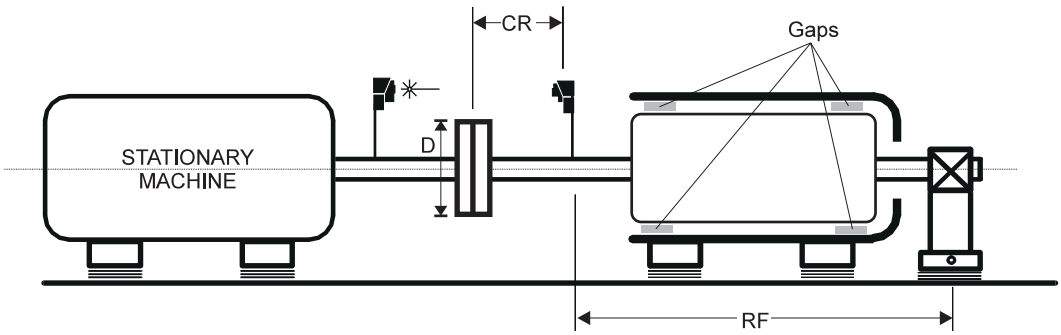
Alignment

1) Make your MTBM a Single-Bearing Machine through your Dimensions screen options, or through Machine Setup from the main Menu.
2) Enter dimensions as follows:
   - Diameter = 10 inches.
   - Coupling center to Receiver
   - Receiver to MTBM foot = Receiver to pedestal bearing centerline.
3) Take alignment readings.
4) View results. If the misalignment is out of tolerance, perform the alignment by moving the pedestal by the indicated amount. (Use the Move Function for this.)
5) Recheck the alignment, and proceed to air gap correction.

Air Gap Correction

If the desired gap between rotor and stator is known for a particular location, then measure the actual gap at that location and move the stator as needed to achieve that gap. If the desired gap is not known, compare actual gaps top and bottom, and side to side, and move half the difference toward the larger gap. For more detail see the procedures.

The dimensions used in this procedure are shown in the sketch.



Alignment Procedure

Loosen the coupling bolts and allow 10 to 15 mils of gap between the hubs, without allowing the rabbet to disengage. Mount Laser on the Stationary Shaft. Mount Receiver on the Single-Bearing shaft (the MTBM).

1) Turn ROTALIGN on. [ON OFF]
2) Select Horizontal Machine Alignment [ ].
3) Press [NEW MACH]. Press [ESC] to *not* save existing file.
4) Press [OPTION]
5) Using the arrow keys [↓] [↑] select the Right Machine to be a Single Bearing type and press [OK].
6) Enter machine dimensions as follows:

   D = 10"

   CR = Coupling center to Receiver

   RF = Receiver to center of pedestal bearing.
7) Press [M], adjust the beam and take alignment readings.
8) Press [ ] to obtain results. Compare the displayed misalignment to tolerances. The foot position is the pedestal bearing's position relative to the Stationary Machine's centerline.
9) If measured alignment is not in tolerance, move the pedestal bearing by the amount indicated.
10) Recheck the alignment. If OK, retighten coupling bolts to the proper torque. A "swing check" of the shaft may be performed while tightening if desired (see last page for details).
11) Proceed to correct the air gaps.

In the Rotalign, the dimensions are shown in the status line as:
D = Coupling diameter
CR = Coupling center to Receiver
RF = Receiver to front foot, right machine.

Be sure to enter them correctly, as described at right.

Tip:
Use the Tolerance Function here. ☺

Tip:
Use the Move Function here.

Air Gap Correction

If desired target gaps are not known (The Equal Gap Method):

1) Measure the actual gaps between rotor and stator* in the 12 and 6 o'clock positions at the location of the front feet. These will be the Front Top Gap (**FTG**) and Front Bottom Gap (**FBG**).

   ** Caution: This method only works if the gaps are measured approximately at the locations of the feet. Measuring gaps can be tricky as rotor surfaces are uneven and varnish thicknesses may vary. Measure the gaps at least four times with the rotor turned to a different position each time, and average your gap readings .*
2) Measure the actual gaps between rotor and stator in the 12 and 6 o'clock positions at the back feet. These will be the Back Top Gap (**BTG**) and Back Bottom Gap (**BBG**).
3) Measure the actual gaps between rotor and stator in the 3 and 9 o'clock positions at the front feet. These will be the Front Right Gap (**FRG**) and Front Left Gap (**FLG**).
4) Measure the actual gaps between rotor and stator in the 3 and 9 o'clock positions at the back feet. These will be the Back Right Gap (**BRG**) and Back Left Gap (**BLG**).
5) Calculate corrections as follows:

   Front Foot Shim = ½ (**FBG – FTG**)
   Back Foot Shim = ½ (**BBG – BTG**)
   Front Foot Move = ½ (**FLG – FRG**)
   Back Foot Move = ½ (**BLG – BRG**)

If the vertical correction results are positive, add shims. If the horizontal correction results are positive, move stator toward 3 o'clock. Clock positions are determined by looking from the MTBM toward the stationary machine.

Use dial indicators to monitor the stator move, and recheck the gaps when finished.

If desired target gaps are known (The Specific Gap Method):

The vertical target gap at the front foot location is VTFG (Vertical Target Front Gap). At the back foot it is VTBG. The Horizontal Target Front Gap is HTFG. At the back foot it is HTBG.

Caution: Measuring gaps can be tricky as rotor surfaces are uneven and varnish thicknesses may vary. Measure the gaps at least four times with the rotor turned to a different position each time, and average your gap readings .

1) Measure the gap between rotor and stator at 12 or 6 o'clock (but in the same position as that specified for the target gap), at the front foot location. This is the Vertical Front Gap (VFG).
2) Measure the gap between rotor and stator at 12 or 6 o'clock (but in the same position as that specified for the target gap), at the back foot location. This is the Vertical Back Gap (VBG).
3) Measure the gap between rotor and stator in the 3 or 9 o'clock position (but in the same position as that specified for the target gap), at the front foot location. This is the Horizontal Front Gap (HFG).
4) Measure the gap between rotor and stator in the 3 or 9 o'clock position (but in the same position as that specified for the target gap), at the back foot location. This is the Horizontal Back Gap (HBG).
5) Calculate corrections as follows:

For target gaps that were specified at 6 or 9 o'clock:

Front Foot Shim = VFG – VTFG
Back Foot Shim = VBG – VTBG
Front Foot Move = HFG – HTFG
Back Foot Move = HBG – HTBG

If the vertical correction results are positive, add shims. If the horizontal correction results are positive, move stator toward 3 o'clock.

For target gaps that were specified at 12 or 3 o'clock:

Front Foot Shim = VTFG – VFG
Back Foot Shim = VTBG – VBG
Front Foot Move = HTFG – HFG
Back Foot Move = HTBG – HBG

If the vertical correction results are positive, add shims. If the horizontal correction results are positive, move stator toward 3 o'clock. Clock positions are determined by looking from the MTBM toward the stationary machine.

Use dial indicators to monitor the stator move, and recheck the gaps when finished.

"Swing Check"

It is possible that machining imperfections in the coupling hubs, or differences in the torque values applied to the coupling bolts may strain the rotor shaft when tightening the coupling bolts, resulting in slight bending of the rotor shaft. It may therefore be desirable to monitor if such a strain is being imposed by monitoring if any movement of the shaft occurs when tightening the bolts. Traditionally, this is done by rolling out the bearing after suspending the rotor shaft from a cable, subsequent to alignment. The tensioning, stretching, and plumbness of the cable is adjusted so that two radial dial indicators mounted against the shaft near the location of the bearing read zero vertical and horizontal movement. Then the coupling bolts are torqued and further movement is monitored, with the tolerance for allowable movement usually set at about 3 mils.

All of these movements can instead be monitored simultaneously with the ROTALIGN's Move Function, (using "both" view), with exactly the same setup as used for the shaft alignment. Prepare for monitoring by taking a set of reference alignment readings using the 0,3,6,9 Measure Mode, with averaging set to at least 128 or 256, and *without turning the shafts.* Obtain results (which should all read zero since the shafts were not turned), and begin the Move function. Tighten the coupling bolts and observe movement.▣