ROTARY INDUCTOSYN® POSITION TRANSDUCER
INSTALLATION & ADJUSTMENT PROCEDURE

Revised
June 1986
ROTARY INDUCTOSYN® POSITION TRANSDUCERS

INITIAL ASSEMBLY PROCEDURE

See Adjustment Section For Parameters

1. Check INDUCTOSYN® mounting surfaces.
   Be certain they are properly prepared. These surfaces should be smooth and flat.

2. Mount the INDUCTOSYN® stator.

3. Rotate the shaft and check that it is perpendicular to the stator face.

4. Center the INDUCTOSYN® stator. Note: This is a preliminary adjustment.

5. After calculating clearances and being certain that some air gap will exist between
   the rotor and stator faces, INSTALL AND CENTER THE ROTOR. Note: this is a
   preliminary adjustment.

6. Being careful not to damage the faces of the discs, MEASURE THE AIR GAP AND
   SHIM AS MAY BE REQUIRED. The use of paper or plastic shim stock as feeler
   gages is called for.

7. Measure the wobble and shim as may be required.

8. Accurately center the plates, both rotor and stator.

9. Test for accuracy.
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ADJUSTMENT INFORMATION

READ ➤ Read and study all procedures before attempting any adjustment.

READ ➤ All rotary alignment and centering adjustments are interrelated, check all adjustments and parameters after making any changes.

READ ➤ The Air Gap Spacing and Parallelism adjustment should always be satisfied before starting any Centering procedures.

1. AIR GAP SPACING

The air gap between the rotor and stator should be .003” to .015 inches (0.127mm to 0.381mm). To adjust: add or remove shims* between the plates and their mounting surfaces.

NOTE: The .003” to .015” air gap is the full standard range of this adjustment. Other factors may change or skew the standard range, these other factors are: Externally used electronics, special pattern characteristics, number of poles and size of plates. Use the installation drawing as a reference or contact factory representative.

2. PARALLELISM

The parallelism (wobble) should be kept to less than 10% of the air gap. To adjust: add or remove shims* between the plates and their mounting surfaces.

* In all cases it is recommended that thicker shims be used in preference to many layers of thin shims. Sometimes buckling of the layers of thin shims occurs during subsequent adjustments. If available, one piece shims made to the exact dimension required are the best solution.

3. CENTERING

A. Unless otherwise specified the INDUCTOSYN® position transducer pattern is centered to the outside diameter of the discs. Use a dial indicator to align the outside diameter concentric to the axis of rotation to .0002 inches (.0051mm) total indicator reading (T.I.R.). To adjust: individually loosen each mounting screw and retighten
until friction tight. Using the special adjusting tool or a soft plastic mallet, move the plates as required until both are centered. Tighten screws and recheck centering.

B. On specially specified INDUCTOSYN® transducers where the pattern is centered to other than the outside diameter, proceed as follows:

**CENTERED TO THE INSIDE DIAMETER**

Use a dial indicator to align the inside diameter concentric to the axis of rotation to .0002 inches (.0051mm) total indicator readout (T.I.R.).

**CENTERED TO THE ECCENTRICITY MARKINGS STAMPED ON DISCS**

These markings are applied during the accuracy testing of the discs. The marks represent the eccentricity of the pattern to the outer diameter. To adjust, a dial indicator should be mounted so as to sweep the disc outside circumferences – the disc is moved transversely until the eccentricity marks duplicate the dial indicator readings to an accuracy of .0001 inch. A PLUS mark means disc is to move toward indicator.

**ELECTRICAL CENTERING**

*NOTE: Preliminary Adjustment – Before starting the electrical centering procedure, both rotor and stator should be mechanically centered to 0.002”.

1. The following equipment is required to perform the electrical centering.

   a. AC Voltmeter  
      – Sensitivity to .001 volts  
      – Frequency response to 10kHz
   
   b. Oscilloscope  
      – Sensitivity to 0.001 volts  
      – External synchronization  
      – Frequency response to 10kHz
   
   c. 2 Pole 5-Position Rotary Switch
   
   d. S.P.D.T. Switch
   
   e. Oscillator  
      – Sine wave output  
      – Frequency response to 10kHz  
      – Power –1 volt to a 1 ohm load
   
   f. Amplifier  
      – Gain –1000 from 1 ohm source  
      – Frequency response to 10kHZ
2. Wire one S.P.D.T. switch and one 2 pole 5 position rotary switch to the stator windings as shown in drawing 202296. The swingers of the rotary switch are connected to the input of an amplifier. The amplifier will provide a gain of at least 1000 from a one ohm source and a frequency response compatible with the oscillator used "usually 10kHz." The output of the amplifier should be terminated in a suitable load if required.

3. Connect all wiring as shown on drawing 202296. Apply power to all equipment to permit some warm up and stabilization time.

**CALIBRATION**

Using the AC voltmeter, observe the voltage of one sector of the divided stator winding (such as C-D). Set the rotary switch to position 2 and the S.P.D.T. switch to single. Move the plates to obtain a null. Using a local angle measuring standard or by attaching a tangent arm to the rotating shaft, rotate the shaft through a small angular displacement. Observe the AC voltmeter and record. The scale of volts per angle is now known.

**CENTERING**

1. Position Rotary Switch to Position "2" and the S.P.D.T. switch to SINGLE.

2. Rotate plates to a null.

3. Throw S.P.D.T. switch to DIFF. (This subtracts voltages of sectors CD and GH).

4. Record amplitude and phase of error voltage; the phase is measured in relation to the excitation signal. (Phase need only be + or – and can be observed by the use of the external sync on the oscilloscope).

5. Repeat 2 through 5 and record at eight points of the full rotation (approximately 45 degrees apart), insuring that each null point occurs on an even number of nulls from the starting point.

6. Plot the amplitudes and phase of these errors. If the rotor is off center, this plot will be a sine wave. (The bias of this sine wave is an indication of stator decentering).

7. Rotate the rotor to a position where this error is greatest.

8. Adjust rotor centering to decrease this error.
9. Repeat steps 1 through 8 until the sine wave is at a minimum amplitude (20 seconds for 12" size, 40 seconds for 7" size and 100 seconds for 3" size). The scale of volts per second was computed previously under calibration above.

**STATOR CENTERING**

This procedure is to be accomplished after rotor centering above. A small sine curve has been plotted during rotor centering, the peak-to-peak amplitude of which is a measure of the rotor decentering. Its bias, however, might be well displaced from zero, on the plot. (The bias is the horizontal centerline of the sine wave). The bias amplitude is a measure of the amount that the centerline of the CD-GH windings is displaced from the shaft center of rotation. A second plot must now be made to show the amount that the centerline of the EF-IF windings is displaced from the shaft center. This second plot will again show a small sine wave 90 degrees out of phase with that obtained under rotor centering, but equal in amplitude since its amplitude is again a measure of rotor decentering. The bias of this sine wave will be different, however, since its bias amplitude is a measure of the amount that the centerline of the EF-IJ windings is displaced from shaft center.

Since these bias readings indicate co-ordinate distances of the stator center form true center, the actual stator center displacement may be computed by finding the hypotenuse of these two right angle distances by taking the square root of the sum of their squares.

The procedure is as follows:

1. Set rotary switch to position 3 and S.P.D.T. switch to SINGLE.

2. Repeat steps 3 through 8 of rotor centering procedure. Plot the amplitude and phase of these errors. A sine wave equal in amplitude to that last plotted during rotor centering will be obtained, with a different bias point. This bias is a measure of the EF-IJ stator windings decentered position. The bias of the CD-GH error can be determined from the error curve of the last rotor centering procedure.

3. Adjust the stator centering to require both bias lines of the sine curves to intercept the zero axis. This may be accomplished at any null by switching the Rotary Switch back and forth from Position 2 and 3 while the S.P.D.T. switch is on DIFF.

Note: It is sometimes necessary to repeat the rotor and stator centering steps if the original errors were large relative to the desired amount. Due to the averaging
effect of the stator windings when they are wired to add, as in the continuous winding AB, the specifications for centering accuracies are a factor of 20 greater than the final accuracy of the INDUCTOSYN® transducers. Centering is accomplished when both sine waves lie between the + and – level of 20 seconds for 12" INDUCTOSYN® transducers, 40 seconds for 7" and 100 seconds for 3".
ROTOR & STATOR SPECIFICATIONS

\[
\begin{align*}
\frac{12''}{360} \pm 20 \text{ sec.} &= \pm 0.0001 \text{ IN.} \\
\frac{7''}{360} \pm 40 \text{ sec.} &= \pm 0.0004 \text{ In.} \\
\frac{3''}{360} \pm 60 \text{ sec.} &= \pm 0.0003 \text{ In.}
\end{align*}
\]

ROTAR AND STATOR MUST NOT ADD TO GREATER THAN THESE FIGURES.
Denotes a Mounting Hole

\[ \pm XXXX \] Denotes the Eccentricity of the pattern to the outer circumference

Pattern Side

Inductosyn Rotor

Side Opposite Pattern
Pattern Side

\[ \pm \text{XXX} \] Denotes the Eccentricity of the Pattern to the Outer Circumference

- Denotes a Mounting Hole

Side Opposite Pattern

Inductosyn Stator
CATALOG 202410 (FOR 12" ROTARY, AND STANDARD (WIDE) LINEAR INDUCTOSYNs)

CATALOG 205896 (FOR 7" AND 3" ROTARY, AND NARROW LINEAR INDUCTOSYNs)