Field Conversion of Harmonic Drive on DeZURIK Precision Electric Control Valves

Instruction D11013
June 2009

Instructions

These instructions are intended for personnel who are responsible for the installation, operation and maintenance of your Precision Electric Control Valves.

Safety Messages

All safety messages in the instructions are flagged with the word Caution, Warning or Danger. These messages must be followed exactly to avoid equipment damage, personal injury or death.

Safety label(s) on the product indicate hazards that can cause equipment damage, personal injury or death. If a safety label becomes difficult to see, or if a label has been removed, please contact DeZURIK for replacement label(s).

WARNING!

Personnel involved in the installation or maintenance of valves should be constantly alert to potential emission of process material and take appropriate safety precautions. Always wear suitable protection when dealing with hazardous process materials. Handle valves which have been removed from service with the assumption of process material within the valve.

Inspection

Your harmonic drive has been packaged to provide protection during shipment. Carefully inspect the unit for damage upon arrival and file a claim with the carrier if damage is apparent.

Parts

Recommended spare parts are listed on the assembly drawing. These parts should be stocked to minimize downtime.

Order parts from your DeZURIK sales representative, or directly from DeZURIK. When ordering parts, please include the 7-digit part number and 4-digit revision number (example: **9999999R000**) located on the data plate attached to the valve assembly. Also include the part name, the assembly drawing number, the balloon number and the quantity stated on the assembly drawing.

DeZURIK Service

DeZURIK Service personnel are available to install, maintain and repair all DeZURIK products. DeZURIK also offers customized training programs and consultation services. For more information, contact your local DeZURIK representative or visit our website at www.dezurik.com.

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Description

These instructions cover the steps required to replace an older Harmonic Drive with a newer, current, style on Precision Electric Control Valves. The hub of the new Wave Generator and the actual Wave Generator is different from that of previous styles. It is required that the old hub be removed by driving out the pin and sliding the hub off of the motor shaft. The Wave Generator hub from the new Harmonic Drive set needs to be drilled to allow it to be pinned onto the motor shaft. This information is included with this instruction.

DANGER!
Before beginning disassembly, turn off electric power to the actuator to prevent electric shock. Relieve pipeline pressure as the valve cannot control flow when the actuator is deactivated.

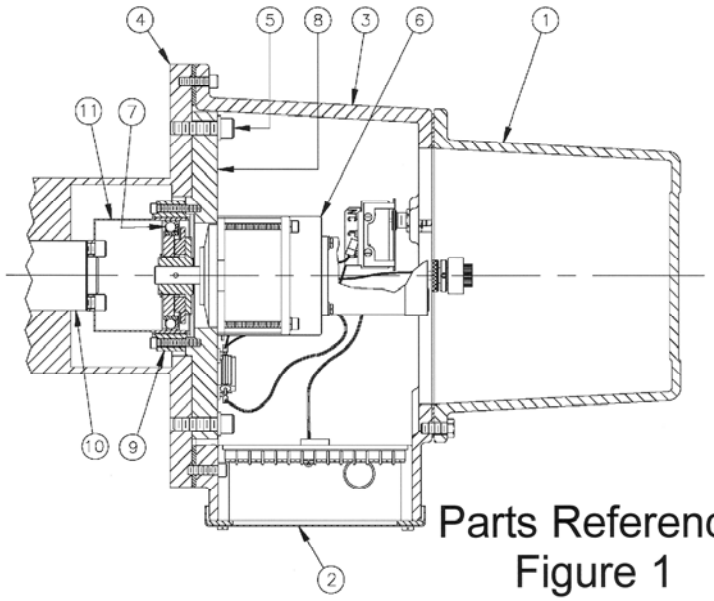
Disassembly

1. Before removing any drive components it is important to control the valve plug position so as not to create damage to other components. If the valve plug is horizontal, note the position of the valve seat. This location is marked on the outside of the valve body. If the valve seat is above the centerline of the valve, it will be necessary to hold and restrain the valve plug movement. Failure to do so will allow the plug to swing (turn) beyond its normal range of operation resulting in having the valve's limit switches and position potentiometers being moved beyond their normal operating range. If the valve plug is horizontal and the seat is on the bottom, move the valve plug to its lowest point of rotation. If moving it not feasible, restrain the plug until after the motor and Harmonic Drive has been removed. Then continue restraining the plug in this position or allow it to move slowly to its lowest position.
2. Relieve pipeline pressure.
3. Disconnect the Amphenol connector from the valve' control module.

For the following, see Figure 1 (Page 2) for parts reference.

4. Remove the 6 screws fastening the motor cover (1) to the motor housing (3) and remove the cover.
5. Remove the 4 screws fastening the junction box cover (2) to the motor housing (3) and remove the cover.
6. Disconnect the wires from Terminals 1, 2, 3 and 16. Move these wires in to the motor area. Detach the safety interlock switch from the motor housing.
7. Remove the 6 screws that fasten the motor housing (3) to the adaptor (4) and remove the motor housing complete with the conduit and Amphenol connector.
8. Remove the screws (5) fastening the motor plate to the adaptor (4).

Disassembly continued

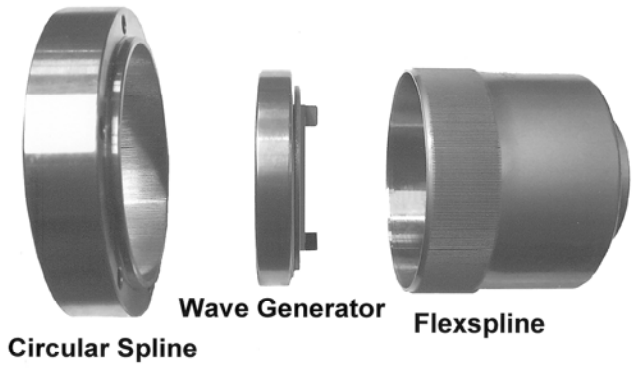


Parts Reference
Figure 1

9. Remove the motor plate (8) and motor (6) by: manually turning the motor shaft clockwise until the motor plate has moved about 5 degrees. Use two of the motor plate screws (5) that were removed in step 8 and install then into the reverse side of the adaptor (4). These two screws are to be installed 180° apart so that when they are tightened (in equal steps) they will push the motor plate off. The circular spline (9) and the wave generator (7) of the Harmonic Drive will come off with the motor plate.

NOTE: On some 14-inch and 16-inch valves, the circular spline (9) is attached to the adaptor (4) rather than the motor plate (8).

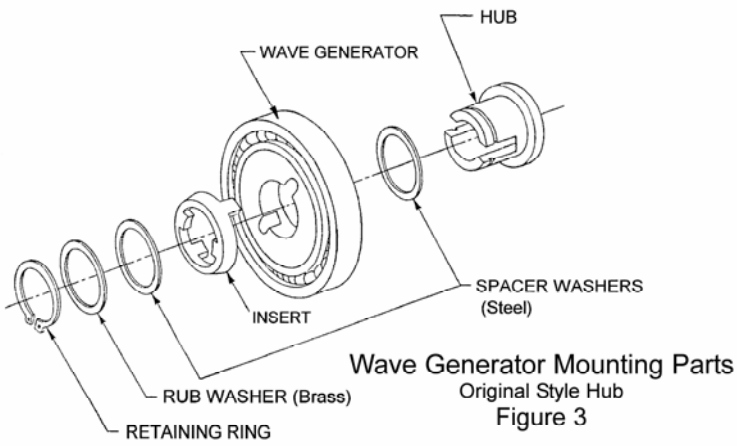
10. Remove the 6 screws that fasten the circular spline (9) to the motor plate (8); or the adaptor (4) if your valve is a 14-inch or 16-inch size. These screws are self-locking and must be removed carefully to avoid thread damage to the tapped holes in the motor plate or adaptor. Remove the circular spline.



Harmonic Drive Components
Figure 2

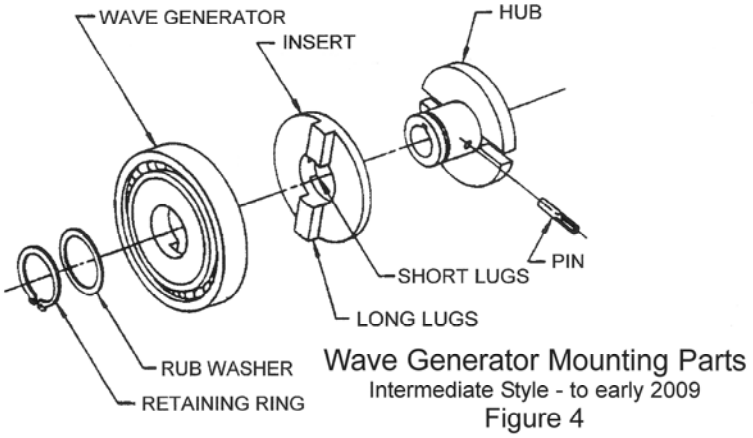
Disassembly continued

11. Remove the 6 screws that fasten the flexspline (11) to the plug stem (10). These screws are self-locking and must be removed carefully to avoid thread damage to the tapped holes in the plug stem. Remove the flexspline.



Wave Generator Mounting Parts
Original Style Hub
Figure 3

12. Remove the retaining ring, washers and spacers, wave generator and insert from the wave generator hub. There are three styles of hub/wave generator assemblies. **Figure 3** shows the original, **Figure 4** shows the model used to early 2009 and **Figure 5** shows the latest version.
13. Make note of the location of the wires connected to the capacitor, then disconnect them from so that the motor can be removed.



Wave Generator Mounting Parts
Intermediate Style - to early 2009
Figure 4

14. Remove the screws which fasten the motor (6) to the motor plate (8) and remove the motor.
15. Drive out the pin holding the existing hub to the motor shaft and remove it.

Reassembly

NOTE: Whenever replacing a Harmonic Drive set, it must be replaced as a set. They are not to be replaced by individual component parts.

The location of the hub and thereby the wave generator is critical in relation to alignment with the circular spline. This affects the operation and service life of this unit. Use care when measuring, drilling and pinning the hub to the motor shaft.

Due to the years of production and possible dimensional changes it is important to check your existing motor shaft against the dimension shown in Table A. If there are variances, adjustments to Dimension B are required.

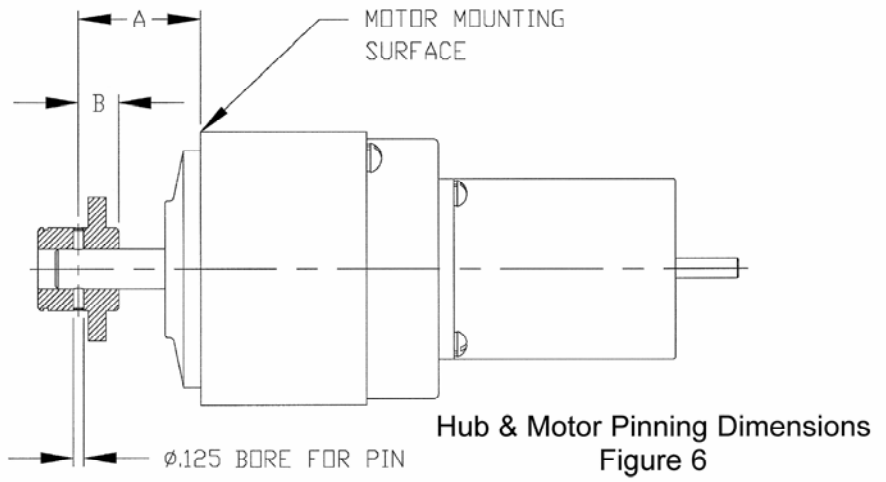
1. Check your motor to determine that Dimension 'A' matches that shown in Table A. If this dimension does not match, determine the difference and add it to or subtract it from Dimension 'B'. Example: If 'A' is 0.125 longer than shown, add this value to Dim. 'B'.
2. Using the dimensions in Table A for your valve size, drill a 0.125-inch diameter hole through one side of the new Harmonic Drive Hub, 'B' distance (ref. Figure 6) from the top (motor end) of the Hub. This hole must be straight and on center.

Table A
Hub & Pinning Dimensions

Valve Size inch / mm	A Inches	A mm	B Dimension			
			Original Hub	Model to 2/2009 2nd Hub	New Hub	
					Inches	mm
4 / 100	1.50	38.1	0.250	0.500	0.687	17.4
6 / 150 & 8 / 200	1.25	31.8	0.250	0.500	0.630	16.0
10 / 250 & 12 / 300	1.38	35.1	0.375	0.875	0.954	24.2
14 / 350 & 16 / 400	1.25	31.8	0.563	0.375	0.296	7.5
18 / 450 & 20 / 500	1.38	35.1	0.250	0.625	0.705	17.9

Note: If you have a 14 or 16-inch valve with a 7/8-inch thick motor plate, use the A & B dimensions from the 18-inch valve size.

3. Slide the new Hub onto the motor shaft until the hole that was drilled lines up with the hole in the motor shaft. Use the motor shaft hole and newly drilled hole as a guide and finish drilling through the other side of the new Hub.



Hub & Motor Pinning Dimensions
Figure 6

Reassembly continued

4. Clean all drilling debris from the components and place the new Hub on the motor shaft, lining up the drilled holes. Drive a 0.125-inch diameter pin into place holding the new Hub to the motor shaft. The pin length must be long enough to engage both sides of the Hub; however it cannot protrude beyond the surface of the Hub.
5. Clean the surface of the valve plug stem (10), especially around the inner corner where the new flexspline will mount.
6. Fasten the flexspline (11) to the plug stem (10). The screws must be installed dry and tightened to the torque listed in Table B.

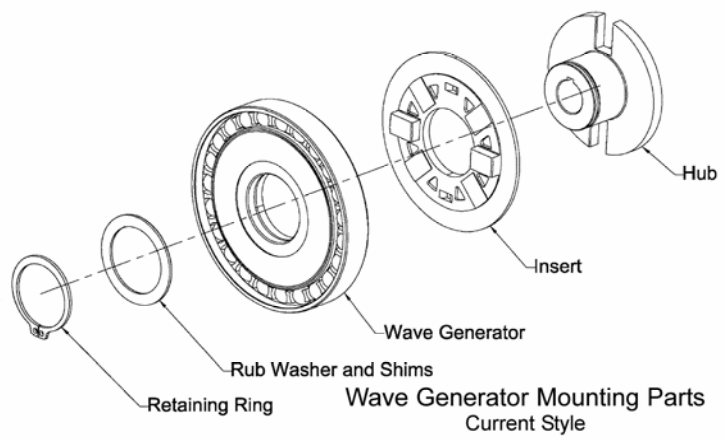
Table B
Fastener Torque Specifications

Valve Size Inches / mm	Flexspline			Rigid Spline		
	Screw Size	Torque Ft. Lbs	Torque Newton meters	Screw Size	Torque Ft. Lbs	Torque Newton meters
4 / 100	#10 - 32	5 - 6	7 - 8	#8 - 32	3 - 4	4 - 5
6 / 150 & 8 / 200	5/16 - 18	23 - 24	31 - 33	#10 - 32	5 - 6	7 - 8
10 / 250 & 12 / 300	⅜ - 16	41 - 42	56 - 57	¼ - 20	13 - 14	18 - 19
14 / 350 - 20 / 500	⅜ - 16	41 - 42	56 - 57	⅜ - 16	41 - 42	56 - 57

NOTE: These screws are self-locking to prevent loosening under vibration. New screws are provided in the parts kit. It is recommended that these screws be used. Do not reuse the old screws as they are not the correct length for the new flexspline.

7. Fasten the circular spline (9) to the motor plate (8) or to the adaptor (4), dependent upon valve size and construction.
8. Mount the motor (6) on the motor plate (8) and reconnect the wires to the capacitor.
9. Apply a coat of Beacon #325, Andok B or Shell Aeroshell #5 grease to the wave generator ball bearings (7), the outer surface of the wave generator where it contacts the flexspline (11), the contact area between the wave generator and the insert, the teeth on the circular spline (9) and to the flexspline teeth.
10. Install the wave generator parts (See Figure 5) onto the motor shaft and hub in the following order.
    Insert
    Wave Generator
    Rub Washer and Shims
    Retaining ring
11. Carefully line up and install the motor/wave generator/motor plate/circular spline assembly on the adaptor. This assembly engages the teeth on both the flexspline and the circular spline. If the parts of the Harmonic Drive do not mesh, do not force then together. Manually turn the motor shaft one or two revolutions and try again.

Reassembly continued



Wave Generator Mounting Parts
Current Style
Figure 5

NOTE: In order to gain long operational life of this assembly it is necessary to test the assembly to determine that the wave generator is centered in the circular spline. It will require the use of a dial indicator capable of measuring motions with ± 0.001-inch / 0.025-mm.

12. Check for correct wave generator alignment as follows:
    Reference: Figure 1
    a. Remove the pipe plug (12) from the adaptor.
    b. Insert the indicator rod from the dial indicator into the pipe plug hole until it rests against the flexspline (11). Turn the motor shaft manually. The motor shaft needs to be turned enough to gain two rises in indicator reading. This may require as many as 25 turns of the motor shaft – depending on the run time of the unit.
    c. If the rises measure by the indicator exceed 0.002-inch / 0.050-mm, remove the motor/ motor plate assembly, and manually turn the motor shaft one or two turns. Replace the assembly and perform Step 'b' again to check for wave generator alignment.
    d. When the correct alignment has been obtained, replace the pipe plug (12) into the adaptor to seal it from the environment.
13. Fasten the motor housing (3) to the adaptor (4).
14. Bring the motor wires out and connect them to Terminals 1, 2, 3, &16.
15. Attach the safety interlock switch to the motor housing.
16. Put the junction box cover back in place and fasten the screws uniformly.
17. Put the motor cover (1) back on the motor housing (3) and fasten the six screws.
18. Reconnect the Amphenol back onto the control module.
19. At this point all adjustments involved in replacing the Harmonic Drive set are complete.
20. Electrical power may be reconnected at this time
21. It is recommended that the open and close position switches be checked by electrically operating the valve open and closed, noting that the switches stop valve motion just before the stop lever contacts the mechanical closed position stop. If the switches do not trip as required, they must be reset. See the **ADJUSTMENT** section of the full valve instruction for this procedure.