| Technical Bulletin | | |
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| **No: TB064** | Rev: 0 | Date: 10 Jan 2009 |

# Description: EMI Gearbox Backlash & Bearing Pre-Load

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## BACKGROUND INFORMATION:

A requirement of gearbox assembly is to accurately set and record bearing preload and gear coupling backlash. Bearing preload is required to eliminate any free play in the assembly that would compromise the function of the rotating element. If bearing preload is applied excessively, Bearing Fatigue Life will be shortened, bearing starting and running torque will be high and raceway noise will increase. If the applied preload is insufficient, fretting corrosion can occur as a result of vibration.

In a pair of gears, backlash is the amount of clearance between mated gear teeth at the pitch diameter At large power outputs excessive backlash will send shocks through the whole system and can damage teeth and other components, while inadequate backlash will cause premature wear of the gear teeth.

## AFFECTED PRODUCT:

All EMI 400 Top Drive Gearboxes being rebuilt:

| Description | Part No. | Drawing No. |
|---|---|---|
| Gearbox. 12.47:1 Ratio,H&P,250-EMI-400 | 1130110 | I-1130110 |
| Gearbox. 12.47:1 Ratio, w/o PH,H&P,150-EMI-400 | 1130111 | I-1130111 |
| Gearbox, 10.96:1 Ratio, EMI-400 | 720752 | I-720752 |
| Gearbox, 10.96:1 Ratio, EMI-400, w/o PH | 720753 | I-720753 |
| Gearbox, 11.71:1 Ratio, EMI 400 (Use 720752) | 730690 | I-730690 |
| Gearbox, 11.71:1 Ratio, EMI 400, w/o PH (Use 720753) | 730926 | I-730926 |

## ACTION REQUIRED:

1. Refer to the latest revision of drawing for the gearbox being assembled and obtain preload and backlash acceptable range values
2. Obtain the latest revision of EMI Bearing Pre-Load & Backlash Checklist, document number 1080367 (TMF QA document obtainable through Projectwise)
3. Record gearbox information and backlash acceptable range (refer to drawing), on the checklist
4. Measure quill hub end play procedure and record the measurement on the checklist
5. Calculate bearing preload procedure and record values on the checklist
6. Measure gear backlash and record the measurements on the checklist
7. Check gear contact pattern, on the checklist and obtain the appropriate signature
8. File the checklist in accordance with local instructions

## CHECKING FOR QUILL HUB END PLAY:

1. Ensure that bull gear is 'blued' in four places prior to installing gearbox lid
2. Install the gearbox lid without sealing it and fasten with every second bolt; no Loctite is to be used at this stage
3. Install the outer races of the quill and pinion top bearings
4. Thread two ½" dowels into the retainer holes, these are used as alignment pins (see fig 1)

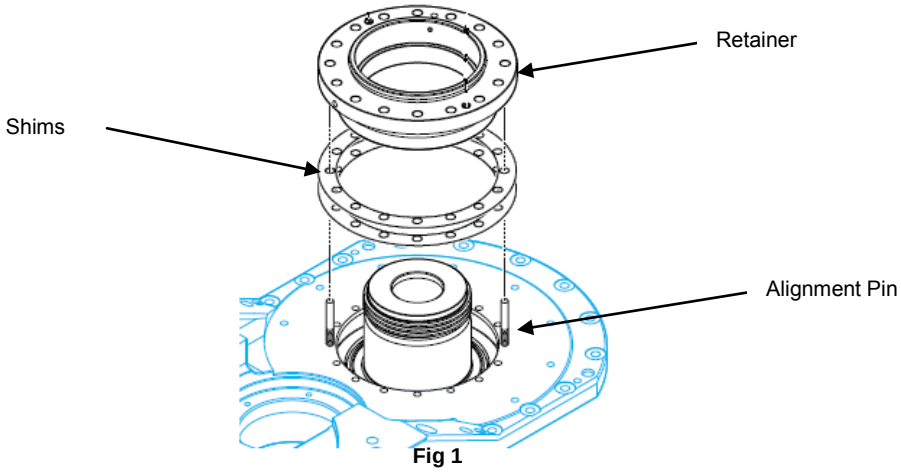


**Fig 1**

5. Place **all** provided quill shims (5 x 0.010", 2 x 0.005" and 2 x 0.002") over the locating dowels and on to the gearbox; record the initial shim thickness (0.064") on the checklist (see sample checklist attached to this bulletin)
6. Fit lifting eyes to the quill top retainer
7. Install the quill top retainer temporarily without seals and O-rings; remove the lifting eyes and fit bolts
8. Torque the quill top retainer bolts to 75 ft-lbs.
9. Install quill lifting nubbin (Part No. 17990) and connect to the overhead crane using an appropriate sling (see photo 1)
10. Place the Dial Test Indicator (DTI), on the gearbox lid and set the DTI tip on the lifting nubbin (see photo 2)

**Photo 1**

**Photo 2**

11. Measure the quill hub displacement (end play), by pulling up with the sling and noting the reading on the DTI. **Note:** maximum correctable quill hub displacement (end play) is 0.050"; if exceeded **consult TESCO Engineering**
12. Lower down the sling
13. To ensure accuracy, repeat step 11
14. Record the quill hub displacement on the checklist (see sample checklist attached to this bulletin)

## CALCULATING PRELOAD ADJUSTMENT:

If the previous procedure reveals any amount of quill end play, the quill hub preload must be adjusted. To decrease end play in the quill hub, preload must be increased by removing shims from the shim pack. Use the following calculation to determine the thickness of shims to be removed from the shim pack:

{QUILL END PLAY + MAX BEARING PRELOAD (see drawing)} = **THICKNESS OF SHIMS TO BE REMOVED**

**Note:** If the quill hub displacement (end play) measurement was greater than 0.010", remove the shims in two steps.

## ADJUSTING THE PRE-LOAD:

1. Remove sling and quill lifting nubbin
2. Remove all upper bearing retainer bolts
3. Install lifting eyes into threaded holes
4. Remove the quill retainer to allow access to the shim pack
5. Remove the required thickness of shims as previously calculated, always try to leave the thinnest shims fitted to help with future adjustments (e.g. remove one 0.010" shim instead of two 0.005" shims)
6. Measure removed shims with a micrometer to ensure accuracy
7. Measure remaining shims with a micrometer to ensure accuracy
8. Record removed shim thickness on the checklist (see sample checklist attached to this bulletin)
9. Refit the bearing retainer back into position
10. Replace upper bearing retainer bolts and torque to 75 ft-lbs
11. Check pre-load again according to the "Checking for Quill Hub End-Play" procedure and repeat steps as required to achieve the required end play measurement
12. Refit quill lifting nubbin and rotate 10 revolutions in each direction to check the gear pattern

## MEASURING GEAR BACKLASH (see fig 2):

1. Remove intermediate shaft upper retainer
2. Fit immobilizing blocks (manufactured locally) onto intermediate shaft hub (see photo 3)
3. Refit intermediate shaft upper retainer and bolts
4. Torque the retainer bolts until the intermediate shaft is clamped by the immobilizing blocks and upper retainer
5. Confirm that the intermediate gear is immobilized by attempting to turn the bull gear

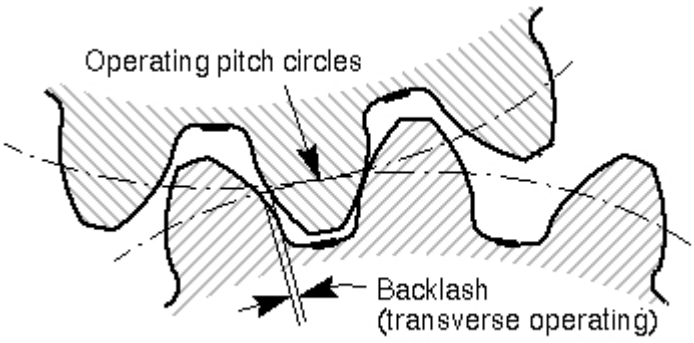


**Fig 2**

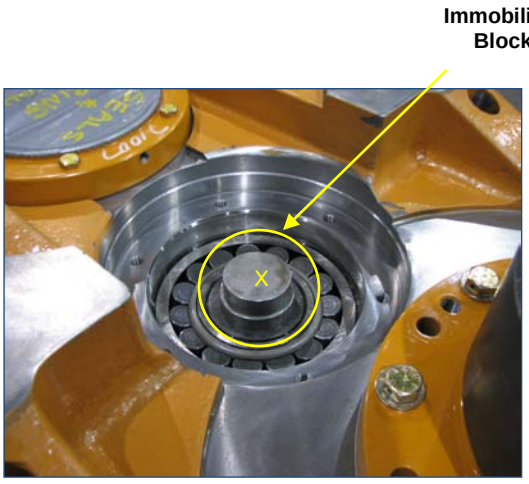


**Photo 3**

6. Fit a bar to the quill lifting nubbin, using clamps (see photo 4)

**Photo 4**

7. Mark a datum line on the bar over the centre of the shaft and then another 8 -1/2 inches from the first datum (see photo 5)

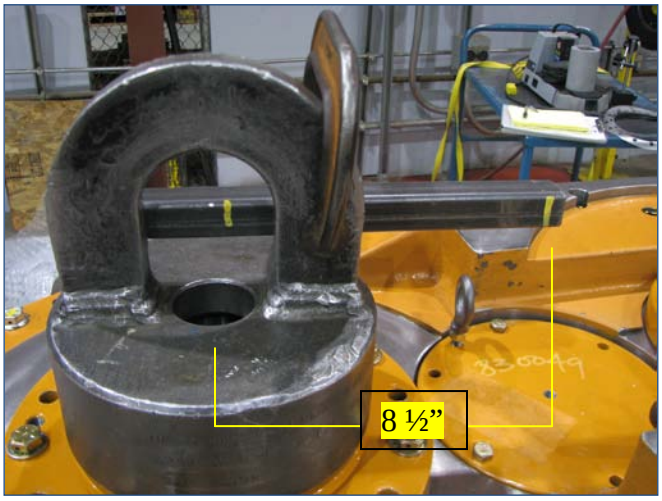


**Photo 5**

8. Fit the DTI onto the gearbox and align the DTI with the datum mark furthest from the centre of the quill shaft (see photo 6)

**Photo 6**

9. Turn the nubbin which will measure the backlash between the bull and intermediate gears
10. Note the measurement on the DTI and then turn the nubbin back until the DTI is reading zero
11. Repeat step 9 for accuracy and record the measurement on the checklist
12. If the backlash measurement is outside of the range indicated on the drawing, **consult TESCO Engineering**
13. Remove the intermediate shaft upper retainer and immobilizing blocks
14. Refit the intermediate shaft upper retainer and retainer bolts

**GEAR CONTACT PATTERN APPROVAL:**

1. Remove quill lifting nubbin
2. Remove quill top retainer
3. Remove the gearbox retaining bolts and gearbox lid
4. Check the gear contact pattern and sign the checklist if satisfactory
5. If there is insufficient gear contact, **consult TESCO Engineering**
6. File the checklist in accordance with local instructions
7. Continue assembly of the gearbox in accordance with relevant procedures

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**Contact your local TESCO Parts and Service Center for further information regarding this bulletin and or supply of affected components noted above.**

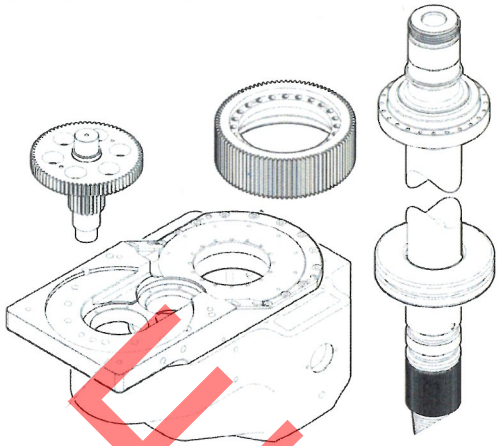
| TESCO | EMI Gearbox Bearing Pre-Load & Backlash Checklist | Document #1080367 | Section | Rev 1 |
|---|---|---|---|---|

| ASSEMBLY BY: BOB / BILL | DATE: Feb 18/09 | UNIT #: 761 | W/O #: 8358 |
|---|---|---|---|

## Gearbox Information

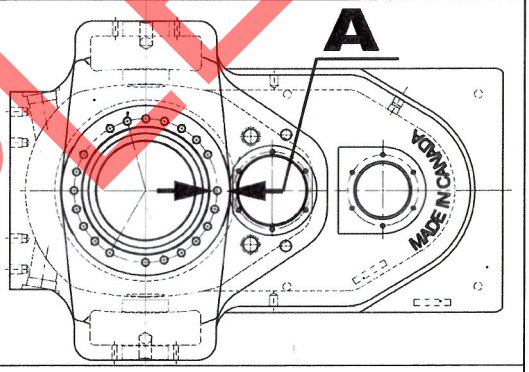
Ratio: 1080367

| Description | Serial # |
|---|---|
| GEARBOX | MFG0091571-1-810132-1 |
| QUILL | 5-017049-1-830044-13 |
| QUILL BULL GEAR | MFG005504-06-1410087-04 |
| INTERMEDIATE GEAR | MFG005504-04-1410088-08 |



## Backlash

| | MEASURED VALUE | ACCEPTABLE RANGE |
|---|---|---|
| QUILL BULL GEAR : INTERMEDIATE GEAR | 0.014" | 0.013" - 0.024" |




## Quill Bearing Preload

| SEQUENCE | SHIM MOVES +/- | SHIM MOVES THICKNESS | QUILL HUB DISPLACEMENT |
|---|---|---|---|
| INITIAL | | 0.064" | 0.008" |
| 1ST MODIFICATION | - | 0.017" | 0 |
| 2ND MODIFICATION | | | |
| 3RD MODIFICATION | | | |
| 4TH MODIFICATION | | | |
| 5TH MODIFICATION | | | |

PRELOAD 0.009"

## Shims used

| SHIM | TOTAL |
|---|---|
| 1 x .002 | 0.002" |
| 1 x .005 | 0.005" |
| 4 x .010 | 0.040" |
| TOTAL SHIMS ADDED: 0.047" | |

GEAR CONTACT PATTERN APPROVAL

A: 90% SIGNATURE SIGN HERE DATE FEB 18/09

NOTES: