M.I. 317 *REV. C

Maintenance Instruction

Technical Publications

ELECTRO-MOTIVE

UPPER DECK BORING BAR FIXTURE FOR 567 AND 645 ENGINES

INTRODUCTION

During normal operation, wear of the cylinder head retainer seat ring contact area can be kept to a minimum by in-service tightness checks, or periodic retorquing of crab nuts – *if recommended in the Scheduled Maintenance Program* – and by applying the correct torque when a power assembly is installed.

Head retainer wear should be measured whenever the power assemblies are removed from an engine. Engines with head retainer wear steps greater than the maximum specified in the Service Data, should be machined to resurface the head retainer.

This M.I. provides the information necessary to measure the head retainer wear step and to perform the resurfacing operation using tools available from Electro-Motive.

TOOL DESCRIPTION

The upper deck boring fixture, Fig. 1, is a tool designed to remove metal from the cylinder head retainer. It is of rigid construction and fits into the cylinder bore with the cylinder head, piston, connecting rod, and liner removed. The upper portion of the tool is a circular rotating table on which is mounted a sliding cutting head assembly that can be moved horizontally by a handwheel or automatically while cutting across the cylinder head ring seat by contacting a feed pawl, (I) Fig. 1, mounted on the retainer wall.

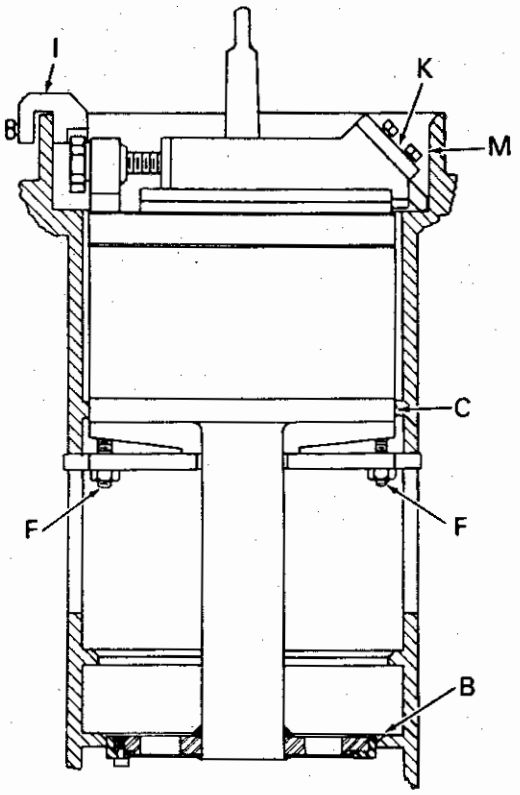
Two cutting tool assemblies are used with the boring fixture. One is mounted on the rotating plate for cutting horizontally across the retainer seat, (K) Fig. 1. The other, a vertical cutting assembly, Fig. 2, is mounted on the horizontal assembly by four socket head cap screws and is used for vertical cuts on the retainer wall, (M) Fig. 1. The tool bits used with these assemblies are: 8116829 (3/4″ x 3/4″ x 4-3/4″) used for making horizontal cuts across the retainer seat. 8122418 (1/2″ x 1/2″ x 2″) is used for vertical cuts on the retainer wall, and 8122419 (1/2″ x 1/2″ x 2″) for forming the radius on the retainer shoulder.

The rotating table is driven by a multivane type air motor which fits on the No. 4 Morse taper drive shank. The speed is reduced through reduction gears in the gear box of the boring bar.

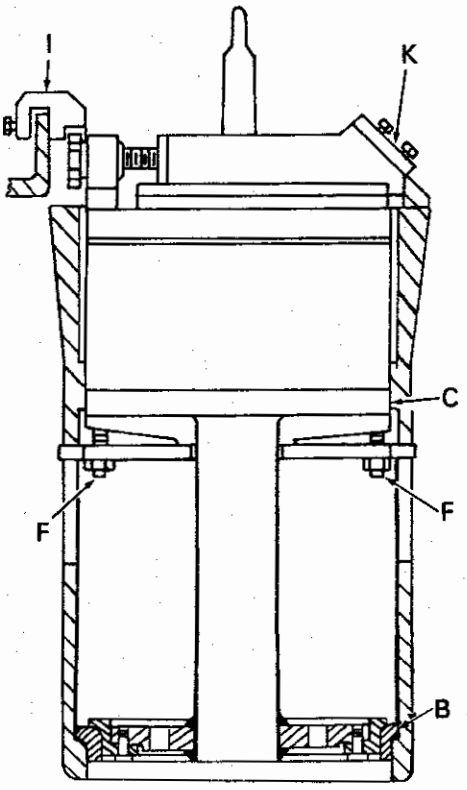
The boring fixture is held in the crankcase by a special seat ring, Fig. 3, that positions it in the lower liner insert or circular locating ring in the lower manifold plate, and clamps which are applied at the bottom of the fixture gear case to draw up tight under the front and rear stress plates, Fig. 1.

*This publication supersedes M.I. 2101, Rev. D, dated May, 1952, and previous issues of M.I. 317.

Areas of change are indicated by vertical bars.



A = 567A, B, And BC Crankcases



D = 567C, D, And 645 Crankcases

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Fig.1 – Upper Deck Boring Fixture

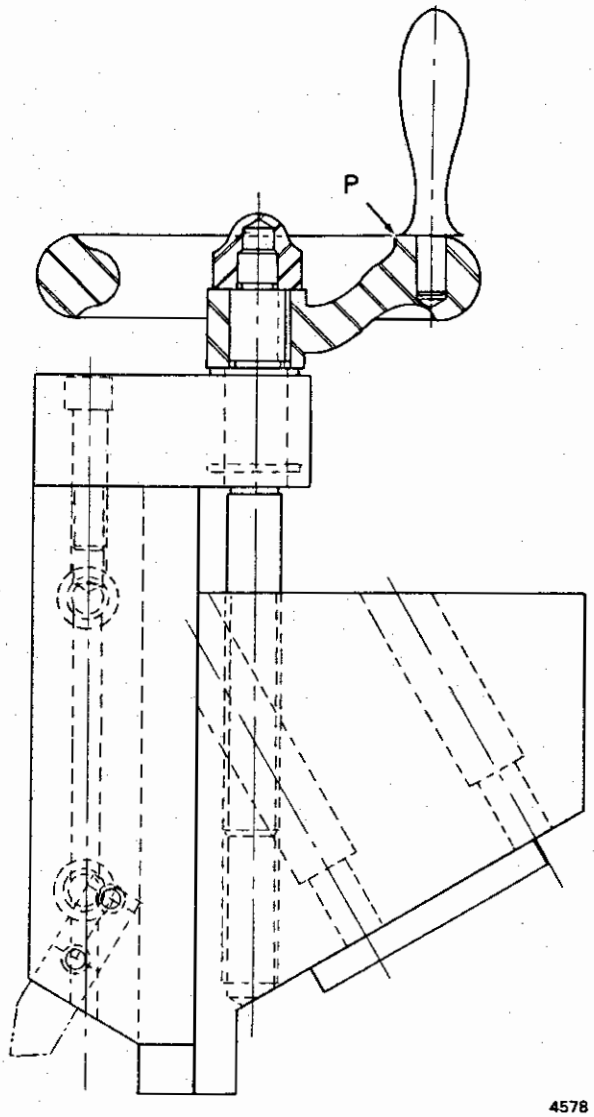
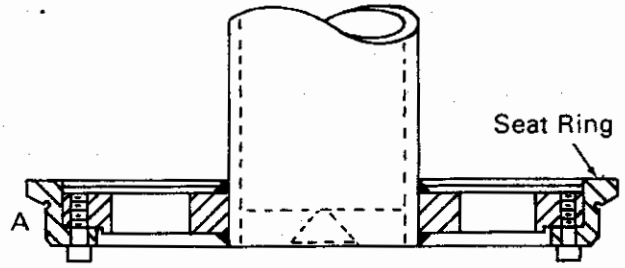
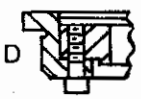


Fig.2 – Vertical Boring Feed





A = 567A, B, And BC Crankcases
D = 567C, D, And 645 Crankcases

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Fig.3 – Seat Ring Installation

Aligning clamps fit across two bosses located at the bottom of the fixture gear case and are drawn up to the crankcase stress plates by 1/2" studs and nuts, Fig. 1. Four shimming areas are also provided above this point on the fixture gear case for accurate alignment to prevent cocking and taper bore, (C) Fig. 1.

Special gauges are provided with the boring bar fixture for measuring the inside diameter of the bore after cutting, and master gauges are supplied for calibrating these gauges.

HEAD RETAINER INSPECTION

The action of the cylinder head seat ring on the head retainer causes a wear step to be formed on the head retainer surface. This wear step can be measured using the gauge shown in Fig. 4.

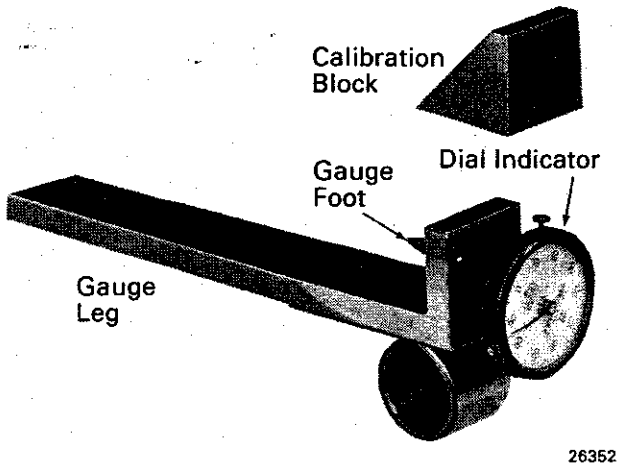

Fig.4 – Head Retainer Wear Step Gauge, Shown With Dial Indicator (Not Included)

PREPARATION

To ensure proper wear step measurement, the entire upper cylinder pilot bore and head retainer surface must be clean and free of any carbon deposits. A flexible scraper and wire brush are recommended.

WEAR STEP MEASUREMENT

The following procedure should be followed for each cylinder. All dial indicator readings for each cylinder should be recorded for later reference.

1. Place calibration block on gauge leg as shown in Fig. 5. Slide calibration block toward dial indicator until block comes in contact with gauge feet. Dial indicator should read "0". If indicator does not read "0" loosen set screw, zero indicator, and retighten set screw.

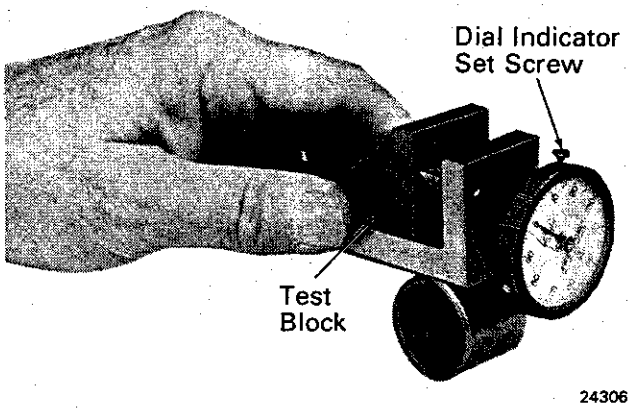

Fig.5 – Checking Head Retainer Wear Step Gauge Calibration

2. Measure head retainer wear step by placing the wear step gauge leg firmly against upper cylinder pilot bore and lowering gauge until feet contact head retainer surface, Fig. 6. Make certain that gauge feet make contact with the machined but unworn portion of the head retainer surface. In some cases this is not possible due to uneven upper pilot bore wall thickness. In this case measure only the area of the head retainer surface where the gauge feet make contact with the unworn surface.

   Measure head retainer wear step at the 10, 11, 12, 1, and 2 o'clock positions. Head retainer wear steps are most prominent at these positions. To eliminate false indicator readings due to isolated fretting, move gauge slightly to the right and left of each o'clock position.

   Record readings obtained.

INSTALLATION OF BORING BAR INTO CYLINDER BORE

1. Drain engine cooling water, and oil from engine oil pan. Remove power assembly of cylinder bore to be worked on.
2. Clean area around air box and cylinder head retainer.
3. Install boring fixture lifting hooks by removing plate anchor setscrews, (E) Fig. 7, so hooks can be bolted to the tool.

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Fig.6 – Measuring Head Retainer Wear Step

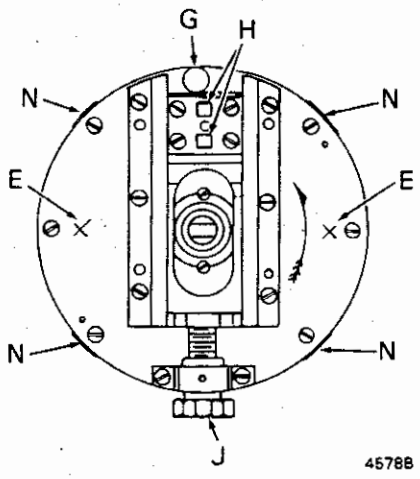

Fig.7 – Top View Of Boring Fixture

4. As applicable to the crankcase being bored, install seat ring (A) or (D), Fig. 3, on the lower flange of the fixture.

NOTE

The special seat ring is fitted to the bar with which it is shipped, therefore, it is not interchangeable from one boring bar to another.

5. Set the fixture in the crankcase. The top of the rotating table will be slightly below the ring seat surface when fixture is completely down and seated.

6. Use an 0.20 mm (.008″) feeler gauge, to check around lower liner insert or circular locating ring at lower water manifold plate, (B) Fig. 1. Shim this locator at four points, if necessary, to maintain center of cylinder bore.

7. Employing the same method as in Step 6 check the top locator at bottom of fixture gear case, (C) Fig. 1. Note that this locator has clearance to allow for any out-of-round due to heat from

the exhaust ports, and has four checking points. Check these points, (N) Fig. 7, to prevent cocking of the fixture and taper boring.

8. To ensure proper location of fixture, install two dial indicators with clamps and extensions. Locate them on the rotating plate 180° apart at points, (E) Fig. 7.

9. Depress dial indicators to give about a .050″ reading, and set dials to zero.

10. Install clamps and nuts, (F) Fig. 1. Tighten clamps until both indicators read .005″ minus.

11. Check both indicators without changing their position to see that they read the same. If not adjust at clamps (F) until they do. Add necessary shims to secure solid positioning of boring bar in crankcase.

12. Remove the dial indicators and extensions. After the bar has been properly aligned and secured in the crankcase, the vertical or the horizontal boring operation may be performed.

BORING OPERATION OF CYLINDER HEAD SEAT RING SURFACE (HORIZONTAL)

The following procedure is used for facing the cylinder head seat ring surface for application of a .038″ oversize (.230″ thick) seat ring where it replaces either an original narrow seat ring or a standard size (.192″ thick) seat ring.

1. Set the .105″ tool setting gauge, provided with the fixture, on the gauge button of the rotating plate, (G) Fig. 7. Bring cutting edge of the horizontal tool bit down snug on top of the .105″ gauge, then tighten tool. Remove the gauge. The cutting tool will then be set for the rough cut.

2. Run the cutting tool sliding assembly out manually by using the ratchet on the adjusting screw, (J) Fig. 7, until tool just clears the metal to be removed.

3. Set the automatic feed pawl, (I) Fig. 1, on the retainer shoulder and rotate the turning plate which carries the cutting tool, by hand, to see if the feed pawl contacts the adjusting screw in the proper relation.

4. Set the air motor on the fixture drive shank being certain the motor is completely down on the shank.

5. Place the air motor stop post on adjacent crab bolt and bring the motor arm in contact with the post to absorb the motor torque.

6. Place the sheet metal chute in the air box under the fixture to direct the cutting chips outside the engine.

7. Start the motor and take a rough cut across the retainer cylinder head seat to the outer diameter of the original seat surface, or almost to the retainer wall, (M) Fig. 1, until the 347.35 mm (13.675″) I.D. gauge slips in.

8. After stopping the rough cut at the 347.35 mm (13.675″) dimension, move the cutting tool toward the center of the rotating plate to prepare for another cut.

9. Set the .085″ cutting tool gauge on the gauge button, (G) Fig. 7, of the rotating plate and bring the cutting tool down snug on this gauge. This will allow the cutting tool 0.51 mm (.020″) for the finish cut. Make sure that the edge of cutting tool is sharp.

10. With the cutting tool set to the .085″ gauge, tighten tool, take this finish cut and check again to the 347.35 mm (13.675″) dimension.

11. The cut mentioned in Step 10 finishes this machining operation and boring tool may be removed. Clean cylinder and bore of all cutting chips.

APPLICATION OF RETAINER STEEL INSERT RING

In crankcases which have a wall, (M) Fig. 1, around the retainer ring that exhibits excessive corrosion and pitting of the surface, the application of a steel insert ring 9319218 to the wall may be necessary. In such cases follow Steps 1 to 16 that follow.

1. Apply the vertical feed attachment 8081135 to the boring fixture. This attachment is shown in Fig. 2. It is applied to the fixture by four socket head capscrews 138244 supplied with boring bar.

2. Apply the vertical cutting tool 8122418 to the vertical feed assembly.

3. Raise the cutting tool with the vertical feed until it is at the top of the wall to be cut. Set the cross feed with the horizontal adjusting screw, (J) Fig. 7, to allow a moderate cut. Lower the tool bit with the vertical adjusting wheel, (P) Fig. 2.

4. Apply air motor to driving shank and apply air motor stop post to crab bolt. Bring motor arm in contact with post to absorb motor torque. Make provision in the air box under fixture to divert cutting chips outside of crankcase.

5. Start the motor and take a light cut. If satisfactory, continue with boring operation.

6. Cut the vertical bore down until even with the cylinder head retainer seat, exercising care not to cut too deeply into the corner.

7. Continue boring operation by taking at least three cuts until a finished diameter of 351.79 mm ± 0.08 (13.850″ ± .003″) is reached. Check bore diameter frequently using gauges provided with the bar.

8. When boring is finished remove vertical feed attachment from boring fixture. Remove fixture and clean away all chips.

NOTE

After boring the cylinder head retainer, but before actually applying the insert, each retainer should be magnetic particle inspected for any possible cracks or porosity. The reason for this is that cooling water can leak from the upper manifold through a cracked or porous retainer into the space between the retainer and insert, and this will result in water contamination of the lube oil. Any fault found should be ground out and welded using E-6012 electrodes before applying the insert to the retainer.

9. Apply the insert to the bore by tapping in place with a rawhide or wooden mallet, without collapsing the insert.

10. Be sure to line up the water outlet holes of the insert evenly with the outlet holes in the retainer, leaving equal welding area around each outlet.

11. After application, grind notches in the insert to retainer junction in at least 8 evenly spaced places, beginning above the center of the water outlet holes, on the top edge of the insert. These notches should be about 1/4″ wide x 1/4″ deep x 1/2″ long. Fill these ground out portions by skip welding, one on one side then one opposite, with 3/32″ AWS Class E-6012 welding electrode. If stainless steel insert is installed, use 3/32″ stabilized stainless steel AWS type 308 electrodes.

12. Weld around edge of each water outlet hole to retainer. Minimize distortion by welding partly on one then on another. Avoid slag pockets on the water outlet welds, as these must be water tight. After welding around the outlet holes, grind out the center portion of the insert between outlet holes and weld the top and bottom edges.

13. After welding application of the insert, peen the welds and the entire inner area of the insert with a one pound hammer. Peening is necessary to ensure the retainer insert will be tight against the cylinder head retainer shoulder. Install the boring bar again and bore to an inside diameter of 347.65 mm +0.00 -0.13 (13.687″ +.000″ -.005″).

14. With radius forming tool, blend top shoulder of retainer to original radius. This is to allow the cylinder head water seal ring to slip into retainer without restriction. The entire insert may be polished with fine emery cloth to remove tool marks.

15. Remove boring fixture and clean up.

16. Water test all inserts and water jackets at one application to at least 414 kPa (60 psi). Provide fittings and blanks for water inlets and outlets having an air bleed-off line in the top of the system and a gauge in the system to determine pressure. Blank fittings are available: 8081034 for cylinder head retainer water ports, and 8190189 for the lower water deck.

PRECAUTIONS TO BE TAKEN IN USE OF BORING FIXTURE

1. Use the proper special seat ring, Fig. 3, for the crankcase model being worked.

2. The boring fixture must enter crankcase without having to be driven or forced as this may cock it, causing taper cutting.

3. Take care not to put hands below fixture gear case while lowering tool into the crankcase.

4. Always have the motor arm in contact against crab bolt extension, provided with the fixture, before starting motor.

5. Be sure drive motor is completely down on drive shank before starting motor.

6. Make certain that no loose clothing, personal apparel, or loose cleaning cloths are caught in the tool.

7. Always stop boring operations before removing cutting chips.

8. Run cutting tool assembly in on the tool slide before handling fixture, so tool will not protrude beyond rotating plate.

9. To obtain best results, use moderate cutting and feeding speeds and a cutting lubricant.

MAINTENANCE

The only boring bar maintenance necessary is cleaning and oiling of exposed parts. Oil feed screw and vertical feed attachment slide. For boring bar shipment or storage, coat all machined surfaces with a rust preventive.

SERVICE DATA

SPECIFICATIONS

Head Retainer Wear Step - Max.	0.25 mm (.010″)
Head Retainer Surface Finish	5.08μ m (200μ in.)

EQUIPMENT

Cylinder Head Retainer Water Port Blank	8081034
Retainer Steel Insert Ring	9319218
Lower Water Deck Blank	8190189
Dial Indicator With Attachments (Universal Mount, 0.001″ to 0.100″)	8255423
Head Retainer Wear Step Gauge (Less Dial Indicator)	9320750
Wear Step Gauge Calibration Block	9320756
Head Seat Rings (Aluminum Bronze)	
Standard (0.192″ Thick)	9509180
0.018″ O.S. (0.210″ Thick)	9516094
0.038″ O.S. (0.230″ Thick)	9509803

SUPPLIED WITH FIXTURE

QTY.	DESCRIPTION	PART NUMBER
1	Upper deck boring bar	8048353
1	Attachment for upper deck boring bar	8081135
1	Index clamp	8088281
1	Ratchet wrench	8122412
1	Lifting hook	8122415
1	Gauge for cylinder head ring seat .085″	8173380
1	Gauge for cylinder head ring seat .105″	8220320
1	Gauge for cylinder head ring seat 13.675″	8173384
1	Gauge for stainless steel retainer 13.687″	8122417
1	Gauge for stainless steel retainer 13.853″	8122416
2	Clamps for boring bar	8122414

EQUIPMENT - (CONT'D)

SUPPLIED WITH FIXTURE (CONT'D)

QTY.	DESCRIPTION	PART NUMBER
1	Top plate	8122413
3	Radius forming tools 1/2" x 1/2" x 2-1/2" long	8122419
3	Boring tool 1/2" x 1/2" x 2" long	8122418
3	Facing tool bit	8116829
1	Master gauge 13.675" x .005	8173383
1	Master gauge 13.682" x .005"	8126175
1	Master gauge 13.848" x .005"	8126174
1	Taper shank No. 4 male to female	8122420
1	Special seat ring for boring bar 567A, B, and BC cases	8122411
1	Special seat ring for boring bar 567C, D, and 645 cases	8318730
1	Button	8220319
1	Button puller	8220318
1	Gauge assembly	8220320
2	Pinion	8084039
1	Gear, 40 teeth	8084040
1	Wrench, locknut	8220812
1	Gear, 40 teeth	8084042
1	Gear, 30 teeth	8084041
1	Internal ring gear	8084038
1	Air motor stop	8214958
1	Pilot ring	8215554
1	Pilot ring	8215553

TO BE ORDERED SEPARATELY

1	Reversible multivane air motor	8359402