



MAINTENANCE INSTRUCTION

CRANKCASE LOWER DECK REPAIR

INTRODUCTION

The procedures in this Maintenance Instruction will ensure satisfactory field repair of engines which have damaged lower crankcase bores. These areas are built up with weld and rebored to original dimensions. This repair can be made with the engine in place unless other damage requires removal of the crankcase from the oil pan.

PREPARATION FOR REPAIR

1. Remove the complete cylinder assemblies from the damaged bore and from both adjacent bores in that bank. Remove the cylinder assembly in the bank directly opposite the damaged bore and any other damaged liners or connecting rods.
2. Clean engine and oil pan throughout.
3. A check of the two adjacent main bearings should be made before and after welding operation, using Plastigage. This is to determine if there is main bearing "A" frame distortion. If so, a line boring operation is necessary and the engine will have to be removed.

Remove the main bearing caps and lower bearings from the "A" frames adjacent to the damaged cylinder.

NOTE: If serviceable, identify the lower shells so they will not be reversed in their caps when reassembled.

NOTE: Information contained herein is applicable to equipment being produced as of the date of publication.

Install lower bearing shells in the two caps and place two .004"-.009" Plastigage strips circumferentially close to the outer edge of each shell. The engine should be shut down long enough so that its temperature will not affect the strips. Reapply the bearing caps and lower shells to their respective "A" frames using the recommended torque. Again remove the caps and record the Plastigage strip readings. The difference between readings of the two strips on the same bearing should be within the limit specified in the Maintenance Data. Reapply the bearing caps and shells, without the strips, to their "A" frame using the recommended torque.

4. Make light gauge sheet metal covers for rear stress plate inspection holes and for liner deck plate holes where assemblies have been removed.
5. Mask off area so that no foreign material can get into adjoining liner ports of cylinder assemblies remaining in the engine.
6. Be sure crankshaft journals of all removed cylinder assemblies are protected from weld spatter and chip damage by wrapping them with clean towels and covering them with sheet metal.
7. Make a sheet metal chute to go under the liner plates where welding and boring will be done.

WELDING PROCEDURE

It is suggested that all the persons concerned with the procedures given in this instruction be familiar with general engine crankcase welding and repair.

1. Build up the damaged areas by electric welding, using Type 7016 or 7018 electrode, 1/8" diameter only, with straight polarity DC or AC.
2. If any scarfing is necessary, it should be done by grinding or chipping. Use of a cutting torch is not recommended. Nicks in the "A" frame or stress plates should be dimpled out with a grinding wheel. Care should be taken to smooth out all sharp edges.
3. Pack area adjacent to repair area with wet rags to conduct heat, but do not allow them to contact the weld. The rags should not be so wet that water will come in contact with weld material. Every effort should be taken to minimize the heat of welding. After each weld, cool area with water. With the exception of the first bead, following weld buildup should be peened to relieve stresses.
4. Be sure the welding ground is placed on the engine as near the welding area as possible.
5. Weld repair of the cylinder lower pilot bores or insert bores of the crankcase due to wear or minor damage does not require furnace stress relief. However, furnace stress relief is required for multiple power assembly failure damage with damaged stress plates and/or base rails. Crankcases requiring furnace stress relief should be returned to Electro-Motive for remanufacture. After repairing the damaged area, weld buildup for rebore requires only three

5/16" weld beads. The weld bead should be applied at the upper and lower edges of the pilot bore and around the center of the bore.

6. The very first weld metal applied around the circumference of the repair area is the metal that will be bored for the finished job. If there is any question of the quality of weld deposit, it should be removed immediately and rewelded. This will eliminate removal of the boring bar to reweld later.
7. After welding, again check for "A" frame distortion with Plastigage strips, and record.

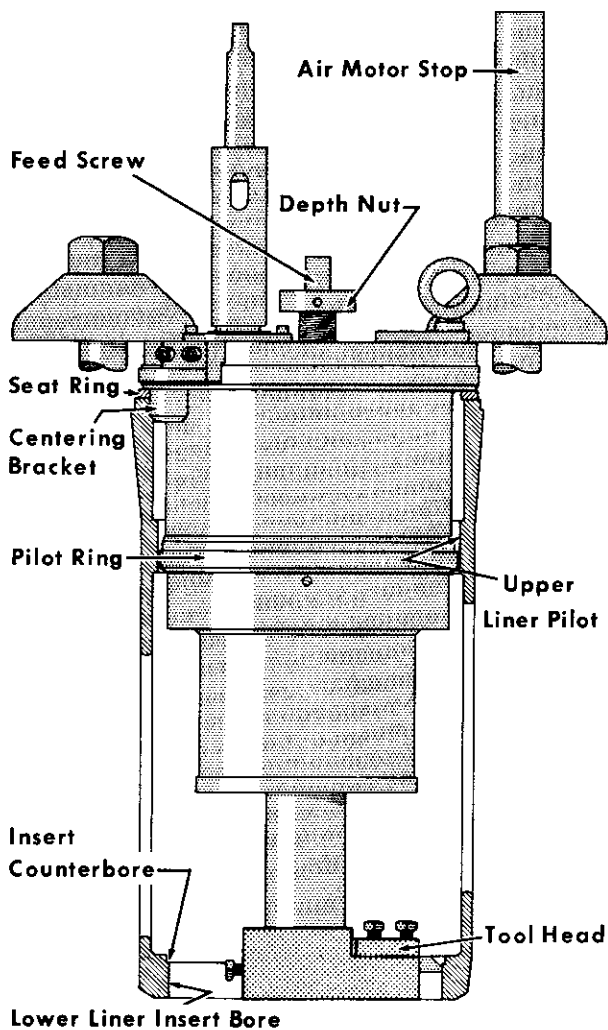
BORING BAR APPLICATION

Before placing the boring fixture in the cylinder, clean the cylinder head retainer thoroughly. Wire brush the interior to remove any loose carbon and clean the cylinder head seat ring seating surface.

The boring bar is designed to be used with a cylinder head seat ring. A new seat ring should be used, since a worn seat ring would lower the horizontal cuts to the extent of the reduction of seat ring thickness.

When using boring bar assembly, check to see that the pilot ring is applied to the bar. Also check that the centering bracket fixture is applied to the head of the bar. When the centering bracket is properly entered in the water hole, and the fixture torqued, the bar will seat correctly on the seat ring.

Lift the fixture by the eye bolts provided, and lower fixture into cylinder bore. Be sure the fixture is properly seated in the retainer before applying the cylinder head crabs. A special machined thin crab nut, is furnished for the right-hand crab to allow enough crab bolt threads to protrude through it to apply the air motor stop, Fig. 1. This stop acts as an anchor for



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Fig. 1 - Boring Bar Application

the air motor, preventing it from revolving. Tighten each crab nut to a torque value of 100 ft-lbs.

Fig. 2 shows the feed screw depth nut gauge and its application. This gauge is used to check the location of the feed screw depth nut in relation to the top of the feed screw and is furnished as a means of checking setup of the fixture. The feed screw depth nut adjustment should not change, as it is pinned to the feed screw, but should be checked.

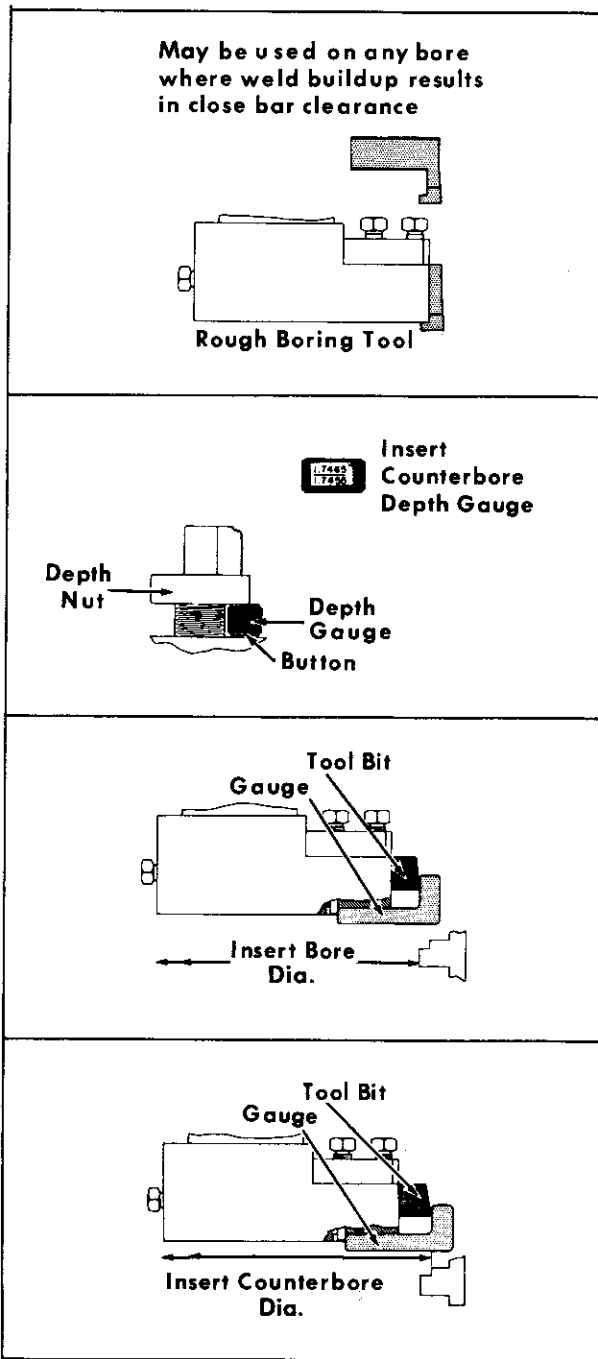
It is imperative that a multivane non-reversible air motor be used for this work. Never use a piston type motor, because the pulsation between each power stroke will make the cutting tool chatter.

NOTE: When lubrication of the boring bar is required, apply Texaco Marfax

Heavy Duty #3 grease to all gears and bearings. (Boring bars are available from EMD on a rental basis.)

REBORING PROCEDURE

Before attempting to machine out the bore diameters, be sure the bore circumference has not been reduced by weld buildup so that the tool bit holder strikes the added metal.



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Fig. 2 - Lower Deck Boring Bar Machining Details

A rough bore cutting tool, Fig. 2, has been developed for the purpose of cutting out this excess metal so the tool holder will clear it. Insert the cleanup cutter into the tool holder as far as it will go. It may be necessary to back off the tool bit feed screw to allow the tool bit to rest against the body of the tool holder. After the excess metal has been cut out, remove the rough bore cutting tool.

A rough or first cut should be made on each cutting application being sure to leave .015" for finish cut. After all rough cuts are made, a thorough inspection must be made of the machined surface. If any defects are found, remove the boring bar and completely grind out the defect. Re-weld the affected area and re-install the boring bar to make the finish cuts.

NOTE: All defects must be patched before the finish cut is made as welding after the finish cut will draw the holes out of round.

Three sets each of the bore diameter and seat tool bits are standard equipment with the boring bar. However, as in any good machining operation, it is highly recommended that the rough cuts be made with one of these tool bits and finish cuts be made with another bit. This procedure, in conjunction with the use of a coolant while boring, will ensure a smooth and proper finish. See tool bit minimum re-grind limits in Maintenance Data at the back of this instruction.

ENGINE MACHINING

First machine the insert vertical bore and then the insert counterbore. Tool bits and gauges used for these bores are identical.

LOWER LINER INSERT BORE

1. After making a cleanup pass through the bore, make sufficient rough cuts to leave approximately .015" for the finish cut.

2. To set the tool bit for the finish bore, apply an unused tool bit to the holder. Insert gauge in place in the slot at the bottom of the tool holder so the end contacts the locating pin as shown in Fig. 2. Carefully slide the tool bit out until it just contacts the radius of the inner face of the gauge. Tighten tool bit holding screws securely. This sets the tool bit for the finish diameter.
3. Make a trial finish cut slightly into the bore. This can be done since the counterbore is yet to be machined. Check the bore with an inside micrometer. If the diameter is correct, continue the finish bore, or reset the tool bit if required to obtain a finish diameter as specified in the Maintenance Data.

INSERT COUNTERBORE

1. The insert counterbore is machined to the diameter specified in Maintenance Data.
2. Depth of the counterbore is limited by using the depth gauge under the feed screw depth nut as shown in Fig. 2.
3. Make sufficient rough cuts on the diameter and depth to allow about .015" for the finish cut. To permit the .015" depth finish cut, place the depth gauge on the gauge button of the tool head, and using a .015" feeler gauge between the gauge button and depth gauge, feed down for the cut until the depth nut is just snug on the feeler gauge.
4. The finish cut is then made by feeding down until the depth nut contacts the depth gauge. For the finish diameter, the tool bit gauge is placed in the tool holder as shown in Fig. 2, and the tool bit is brought out to just contact the radius of the inner face of the gauge.

NOTE: The tool bit has the bottom of the shank ground flush with the cutting

edge, to maintain correct depth when using the depth gauge.

PREPARING ENGINE FOR SERVICE

STRESS PLATE INSPECTION

Cleaning up damaged stress plates is very important but an attempt should never be made to straighten bent stress plates. All ragged or torn metal and all sharp edges must be removed and all nicks must be dimpled out. Be sure stress plate inspection holes have a smooth airflow contour. Any of these defects left uncorrected can eventually cause cracks to occur in the stress plates.

CLEANING, ASSEMBLY, AND RUN IN

1. Clean engine thoroughly. It is imperative that all steel and carborundum residue be removed.
2. Spray wash and wipe engine.
3. Flush engine lubricating system, in accordance with Maintenance Instruction 1757, using procedures given for flushing after excessive water contamination and parts failure.
4. Install cylinder assemblies according to Engine Maintenance Manual recommendations.
5. Charge engine with recommended lube oil.
6. Run engine unloaded for 10 minutes at 275 RPM with top deck covers open to make certain that valve mechanism is operating properly and that there is sufficient lubrication. Shut engine down and inspect all main bearing caps for excessive heat by feel. Run engine loaded for 30 minutes at 350 RPM and once again shut down and inspect main bearings for overheating.

Run with proper governor setting and at rated horsepower for 30 minutes at each of the following speeds: 575 RPM, 650 RPM, 725 RPM, and full speed. Shut engine down and check main bearing temperatures.
7. Run engine one hour at full engine speed and rated load.
8. Inspect and clean lube oil suction screens and change filters.
9. Check governor settings, injector racks, injector timing, and engine speeds.

MAINTENANCE DATA

SPECIFICATIONS

Differential reading between Plastigage strips, lower bearing shells to "A" frame - Max.....	.0035"
Lower liner insert bore — Finish diameter	11.062"-11.065"
Lower liner insert counterbore — Preferred diameter.....	11.311"-11.314"
Nominal diameter.....	11.302"-11.322"
Minimum grind length for tool bits	
8089561.....	3-1/32"
8089562.....	2-29/32"
8102657.....	2-5/8"

EQUIPMENT

	<u>Part No.</u>
Tool bit (1" × 1" × 3-1/2") for 11.311" bore	8089561
Tool bit (1" × 1" × 3-1/16") for 11.062" bore	8089562
Tool bit for clean-up boring	8102657
Air motor stop	8152217
Crab nut	8190454
Lower deck boring bar assembly (complete).....	8215546
Lower deck boring bar	8215547
Depth gauge (1.7465"-1.7455") for insert counterbore	8215548
Tool bit gauge for 11.314" insert counterbore.	8215550
Tool bit gauge for 11.065" insert bore.	8215552
Pilot ring for 12.090" upper pilot bore	8215554
Eye bolt.	8239466
Plastigage strips (.004"- .009") - carton of 12.	8247907
Air motor, non-reversible, multivane.....	8359402

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