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MANDATORY

SERVICE BULLETIN

DATE: January 15, 1960

Service Bulletin No. 271A
(Supersedes Service Bulletin No. 271)
Approved by FAA

SUBJECT: Cylinder Painting

MODELS AFFECTED: All Lycoming Engines Incorporating Cylinder Hold Down Plates

TIME OF COMPLIANCE: At Overhaul

This bulletin is being issued to alert overhaul activities to the extreme caution necessary when painting the cylinder base flange of the subject engines. Any excessive amount of paint between the cylinder hold down plate and the cylinder flange will lead to loss of torque on the cylinder nuts, and eventual stud and/or cylinder failure. (See step c. below.)

The following procedure should be followed when painting a cylinder:

a. Remove all old paint from the cylinder. A vapor degreaser is best suited for this purpose.

b. Mask off the following parts of the cylinder:

1. Rocker box section including the rocker box flange.
2. Both valve ports and flanges.
3. Thermocouple hole.
4. Spark plug holes.
5. Rocker box drain tube hole.
6. Push rod shroud tube holes.
7. Valve rocker shaft cover flange.
8. All other exposed threaded surfaces in which paint might accumulate.

NOTE

Masking tape, corks, plugs, metal covers, etc. are acceptable for masking purposes.

c. Spray a very light coat of zinc chromate primer (.0005 max. thickness) on the cylinder flange (figure 1). If the correct amount of paint has been applied the color of the paint will be green with a yellowish tint and the metal will show through. If the paint is too thick the color will be a zinc chromate yellow.

NOTE

It is imperative that the paint thickness on the flange be held to .0005 maximum. To measure the thickness of the paint layer one of two methods must be used. A Tinsley thickness gauge which incorporates a magnetic needle and is scaled in tenths of thousandths is the most satisfactory method. If this type equipment is not available, use a micrometer to measure the thickness of the flange before and after painting. If the paint is too thick it must be removed and repainted.

d. Mask off the flange area shown in figure 1 and proceed to paint the cylinder with a black phthalate resin type paint, properly thinned with Toluol or equivalent. Avoid paint "pockets" or "runs".

e. Use a cloth dipped in thinner to clean paint from all surfaces where paint may have accidentally accumulated.

f. The best finish will result if the cylinder is air dried for fifteen minutes and then baked in an oven until completely dry.

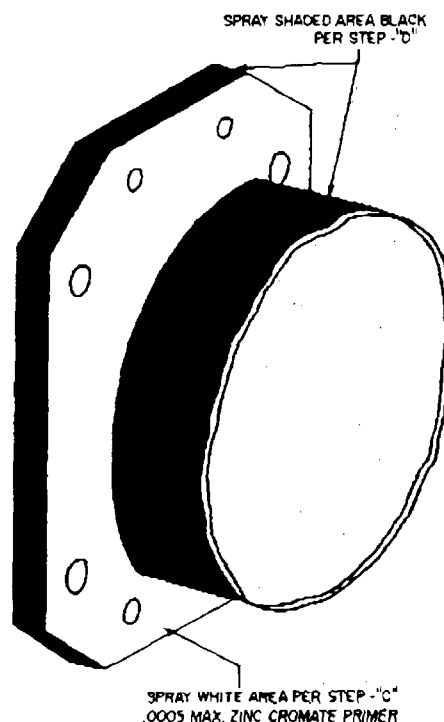


Figure 1. Cylinder Flange Area

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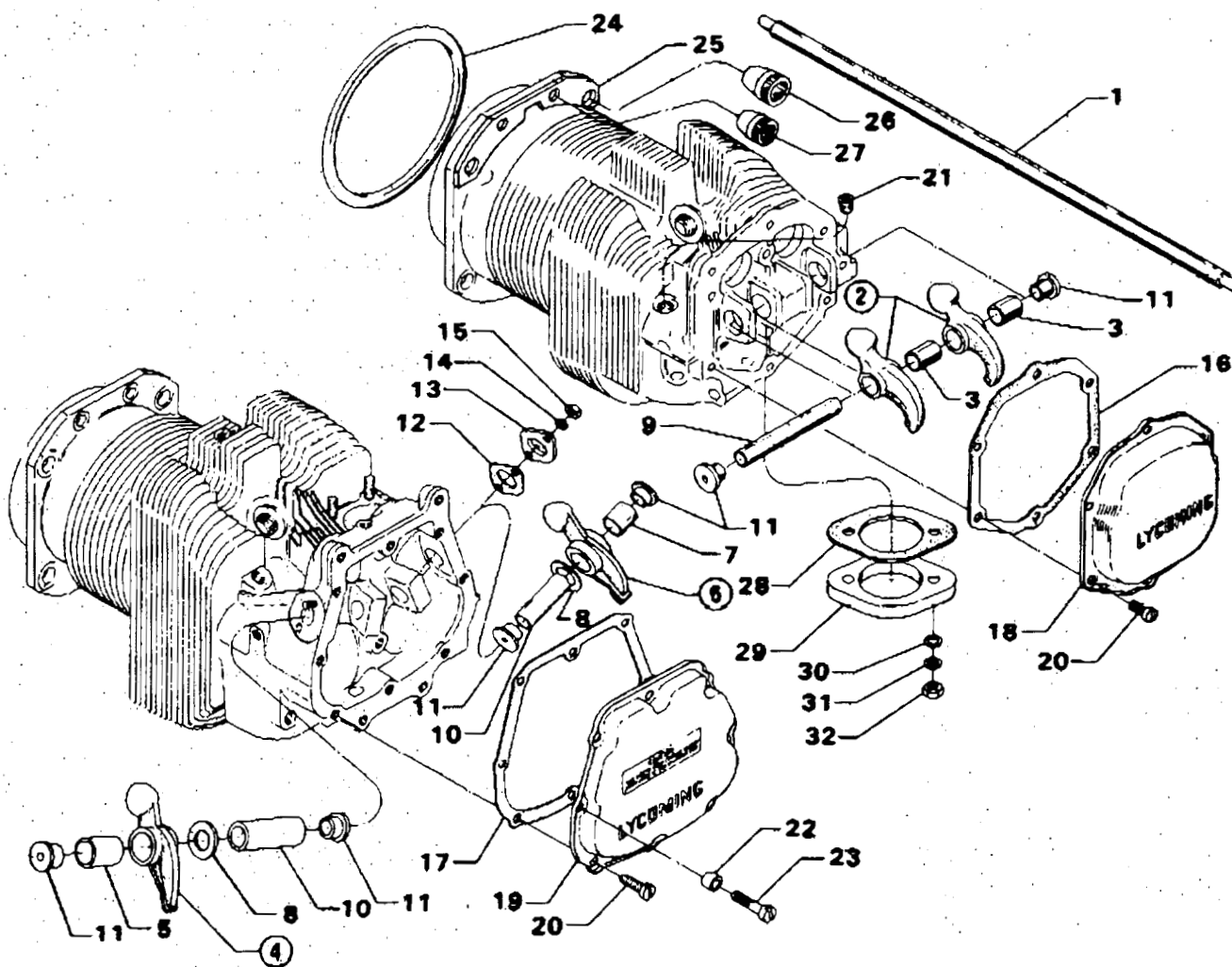
O, IO, HO, HIO-360 PARTS CATALOG
STANDARD CYLINDER FLANGE CRANKCASE MODEL ENGINESCYLINDER, PISTON AND VALVE TRAIN
CYLINDER RELATED PARTS

FIG. REF.	PART NUMBER	DESCRIPTION	O N A L L	QUANTITY PER ASSEMBLY																		
				O-360								IO-360				HO-360						
				A 1 A	A 2 A	A 3 A	A 1 C	A 1 D	A 2 D	A 2 E	B 2 A	C 2 A	C 2 C	C 2 D	D 2 A	D 2 B	A 1 A	B 1 A	B 1 B	B 1 A	B 1 B	A 1 A
18																						
1	73434*	ROD ASSEMBLY, Push (A total of 8 required)		AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR		AR	AR	AR	AR		AR
	73435*	ROD ASSEMBLY, Push (A total of 8 required)		AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR		AR	AR	AR	AR		AR
	73436*	ROD ASSEMBLY, Push (A total of 8 required)		AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR	AR		AR	AR	AR	AR		AR
	73455*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73456*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73457*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73458*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73555*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73556*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73557*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
	73558*	ROD ASSEMBLY, Push (A total of 8 required)														AR					AR	
2	LW-18790	ROCKER ASSY., Valve		8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8		8
3	74637	BUSHING, Valve rocker		8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8		8
4	71268	ROCKER ASSY., Intake valve														4					4	
5	67114	BUSHING, Valve rocker														4					4	
6	71265	ROCKER ASSY., Exhaust valve														4					4	
7	67114	BUSHING, Valve rocker														4					4	
8	71549	WASHER, Valve rocker thrust														8					8	
9	LW-13790	SHAFT, Valve rocker		4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4		4
10	72626	SHAFT, Valve rocker														8					8	
11	LW-12892	THRUST BUTTON, Rocker shaft		8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8		8
12	66732	GASKET, Valve rocker shaft cover														8					8	
13	72710	COVER, Valve rocker shaft														8					8	
14	STD-160	WASHER, 1/4 Internal lock														16					16	
15	STD-1411	NUT, 1/4-20 plain														16					16	
16	75906	GASKET, Rocker box cover		4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4		4
17	67193	GASKET, Rocker box cover														4					4	
18	61247	COVER, Rocker box		4	4	4	4	4	4	4	4	4	4	4	4		4	4	4	4		4
19	68795	COVER ASSY., Rocker box														4					4	
20	STD-1925	SCREW, 1/4-20 x 5/8 long, pan. hd., self-locking		24	24	24	24	24	24	24	24	24	24	24	24	32	24	24	24	24	32	24
	STD-1925	SCREW, 1/4-20 x 5/8 long, pan. hd., self-locking																				21
21	1102	PLUG, 1/8-27 NPT, Allen		4	4	4	4	4	4	4	4	4	4	4	4		4	4				
22	73966	SPACER, Fuel manifold																				3
23	STD-1916	SCREW, 1/4-20 x 1-1/8 long, fill hd., self-locking																				3
24	71481	RING, Oil seal, 3/32 dia. section x 4-27/32 I.D.	4																			
25	69531	PLATE, Cylinder hold-down nut		8	8	8	8	8	8	8	8	8	8	8	8		8	8	8	8		8
	69531	PLATE, Cylinder hold-down nut														7		7				
	74327**	PLATE, Cylinder hold-down nut														1		1				
26	71133	NUT, 1/2-20 NF-3 cylinder hold-down	16																			

LYCOMING**O, IO, HO, HIO-360 PARTS CATALOG****STANDARD CYLINDER FLANGE CRANKCASE MODEL ENGINES****CYLINDER, PISTON AND VALVE TRAIN****CYLINDER RELATED PARTS (Cont.)**

FIG. REF.	PART NUMBER	DESCRIPTION	O N A L L	QUANTITY PER ASSEMBLY																	
				O-300												IO-300		HO-300		HIO-300	
				A 1 A	A 2 A	A 3 A	A 1 C	A 1 D	A 2 D	A 2 E	B 2 A	C 2 A	C 2 C	C 2 D	D 2 A	D 2 B	A 1 A	B 1 A	B 1 B	B 1 A	A 1 A
18																					
27	71134	NUT, 3/8-24 NF-3 cylinder hold-down	16																		
28	65321	GASKET, Exhaust flange		4	4	4	4	4	4	4	4	4	4	4		4	4				
	75118	GASKET, Exhaust flange													8						
29	61280	FLANGE, Exhaust, stainless		4	4	4	4	4		4	4	4	4	4		4					
30	STD-35	WASHER, 5/16 plain	8																		
31	STD-475	WASHER, 5/16 shakeproof lock	8																		
32	STD-1410	NUT, 5/16-18 plain	8																		

- See latest edition of Service Instruction No. 1060 for complete push rod application.
- Assemble on top side of #3 cylinder on IO-360-B1B Mooney installations.

**Figure 18. CYLINDER RELATED PARTS**

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LYCOMING DIRECT DRIVE AIRCRAFT ENGINES

Section 6
Cylinders, Pistons,
and Valve Train

6-118. (All Pistons.) Upon completion of assembly of the piston rings, check the side clearance of the rings in the grooves. Use feeler gage and straight edge as shown in figure 6-11.

NOTE

Under no circumstances should oversize piston rings be used in chrome plated barrels.

6-119. Assembly of Cylinder. See figure 6-5. Coat the valve guides and valves with a pre-lubricant as described in paragraph 3-39. Insert the intake and exhaust valve in their respective guides. The intake valve can be identified by the fact that it is slightly larger than the exhaust valve. Hold the ends of the valve stems and place the cylinder on the applicable cylinder holding block. Install on each valve a lower spring seat (5), outer and auxiliary valve spring (4 and 3), and outer valve spring seat (2).

NOTE

Assemble the dampener ends of springs (close wound coils marked with dye or lacquer) downward or next to lower spring seats.

6-120. Compress the valve springs with the valve spring compressor and assemble the valve retaining keys. If the valve is not seated properly the valve may be seated by using a wooden hammer handle against the tip of valve stem and hitting hammer with palm of hand. No other means should be used.

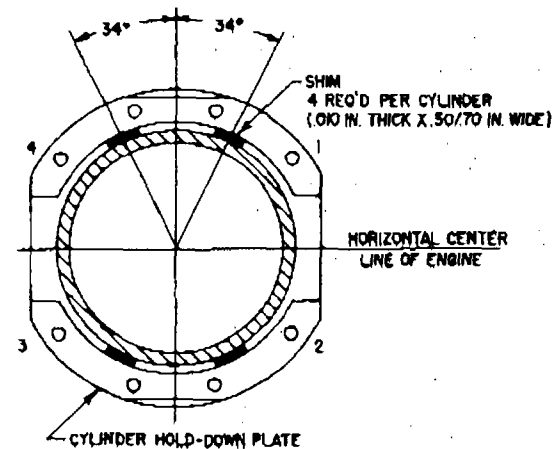
NOTE

Sodium-cooled exhaust valves are assembled with special keys and caps (32). Do not install caps until just before valve rockers are installed.

6-121. Installation of Pistons and Cylinders. See that all preservative oil accumulation on cylinder and piston assemblies is washed off with solvent and thoroughly dried with compressed air. Insert valve rocker shafts in their bores in the rocker box. Immediately prior to assembly of piston and cylinder to the engine, space the rings correctly and apply a generous coating of the oil mixture described in paragraph 3-39. Apply to the inside of the cylinder barrel and to piston and rings working the mixture well around the rings and into the grooves. Starting with No. 1 cylinder, proceed to install as follows:

6-122. Rotate crankshaft so that No. 1 piston, when installed, will be approximately at top dead center on the firing stroke; this is determined by both tappets of No. 1 cylinder being on the base circle of the cam lobes. Before any attempt is made to rotate the crankshaft support the connecting rods as shown in figure 6-2.

6-123. Assemble piston on connecting rod with piston number, which is stamped on bottom of piston head, toward the front of the engine. The piston pin should be palm or hand push fit. If the original piston pin is tighter than a palm push fit, it is probably caused by



INSTRUCTIONS - ON ENGINES USING CYLINDER HOLD-DOWN PLATES, DURING INITIAL TIGHTENING, USE TWO SHIMS BETWEEN EACH PLATE AND THE BARREL, LOCATED AS SHOWN. REMOVE SHIMS BEFORE FINAL TIGHTENING.

Figure 6-31. Location of Shims Between Cylinder Barrel and Hold-Down Plates

nicks or slight carbon in the piston pin bore of the piston. If a new piston pin or piston is to be installed, select the pin to give a palm push fit at room temperature of 15° to 20°C. (60° to 70°F.). After piston pin is in place and centrally located, insert a piston pin plug at each end of the piston pin.

6-124. Place a rubber cylinder base oil seal ring (27, figure 6-5) around the cylinder base, assemble the applicable piston ring compressor over the top piston rings and install the cylinder over the piston, pushing the piston ring compressor ahead with the cylinder barrel. This will encircle and compress the oil scrapper ring of O-235-C pistons at the piston skirt. As the cylinder barrel approaches the crankcase, catch the piston ring compressor as it drops off the piston skirt. When the base of cylinder is seated on crankcase pad, secure the cylinder with 3/8 inch and 1/2 inch cylinder base nuts, tightening the nuts finger tight only.

NOTE

Cylinder hold-down plates (10, figure 6-5) are not employed on all engines. Consult the applicable Parts Catalog for model application. When applicable, install the hold-down plates before assembling hold-down nuts. Also note that on O-235, O-290-D and -D2 series shroud tubes must be inserted prior to assembling cylinder to crankcase.

6-125. To assure proper assembly of the crankcase halves and to eliminate the possibility of subsequent loosening of cylinder base nuts, a definite and specific sequence of tightening all crankcase and cylinder base nuts must be followed. Be certain that crankcase halves have been brought together, and fastenings secured as directed in Section 7, before installing cylinders. The cylinder base hold-down nuts are installed as described in the following paragraphs.

Section 6
Cylinders, Pistons,
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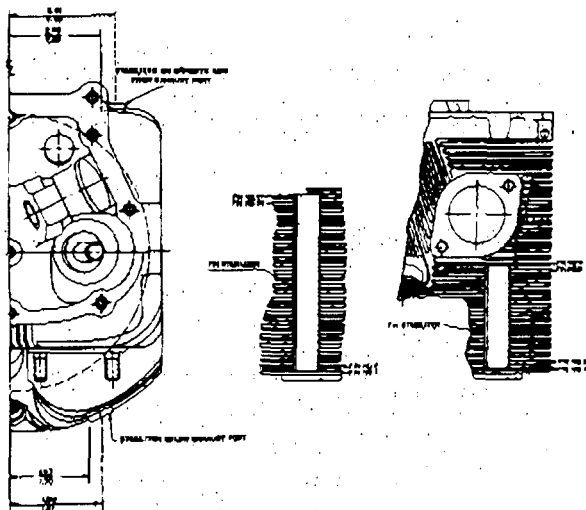


Figure 6-34. Cylinder Head Fin Stabilizers
Angle Head - Down Exhaust

6-141. Cylinder Painting. (All Models employing Cylinder Hold Down Plates.) This paragraph is intended to alert personnel to the extreme caution necessary when painting the cylinder base flange. Any excessive amount of paint between the cylinder hold down plate and the cylinder flange will lead to a loss of torque on the cylinder base nuts and eventual stud and/or cylinder failure. The following procedure should be followed when painting a cylinder:

a. Remove all old paint from the cylinder. A vapor degreaser is best suited for this purpose.

b. Mask off the following parts of the cylinder: Masking tape, corks, plugs, metal covers, etc. are acceptable for masking purposes.

1. Rocker box section including the rocker box flange. Both valve ports and flanges. Thermocouple hole. Spark plug holes. Push rod shroud tube holes. Valve rocker shaft cover flange. All other exposed threaded surfaces in which paint might accumulate.

c. Spray a very light coat of zinc chromate primer (.0005 maximum thickness) on the cylinder flange. See figure 6-35. If the correct amount of paint has been applied the color of the paint will be green with a yellowish tint and the metal will show through. If the paint is too thick the color will be zinc chromate yellow.

CAUTION

It is imperative that the paint thickness on the flange be held to .0005 maximum. To measure the thickness of the paint layer, one of two methods may be used. A Tinsley thickness gage which incorporates a magnetic needle and is scaled in tenth of thousandths is the most satisfactory method. If this type equipment is not available, use a micrometer to measure the thickness of the flange before and after painting. If the paint is too thick it must be removed and repainted.

d. Mask off the flange area as shown in figure 6-35. Proceed to paint the cylinder with a Phthalate resin type enamel (AMS3125C or equivalent MIL-E-7729) properly thinned with Toluene or equivalent (AMS3180 or equivalent Federal Spec. TT-T-548).

e. Use a cloth dipped in thinner to clean paint from all surfaces where paint may have accidentally accumulated.

f. The best finish will result if the cylinder is air dried for fifteen minutes and then baked in an oven until completely dry.

6-142. Intercylinder Baffles. (Where applicable.) All intercylinder baffles must be attached with an "S" type retaining hook and a slotted retainer. Hook the baffle retaining hook through the hole in the baffle. Place the baffle in position beneath and between the cylinders, running the hook up between the cylinder barrels. Place a baffle retainer in place between the cylinders and using a baffle installation tool, bring the retainer hook through the slot in the retainer. During the operation the retainer is forced down until the hook comes above the surface of the retainer far enough to be turned and hooked over the bridge between the slots in the retainer.

NOTE

The baffles on up exhaust cylinder assemblies are placed above and between the cylinders. The retainer is placed below and fastened in the same manner as described above.

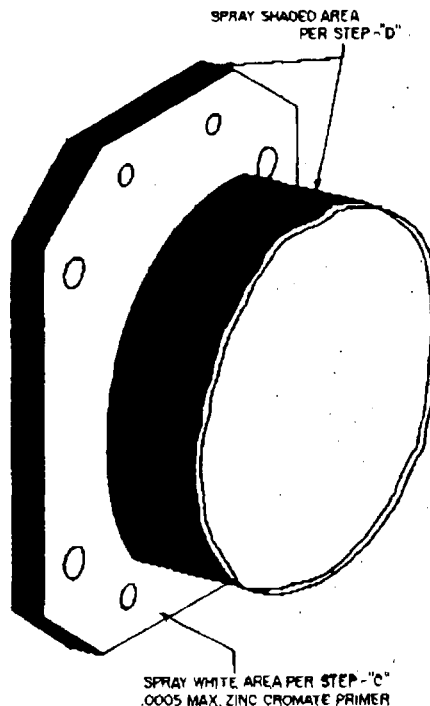


Figure 6-35. Cylinder Flange Area

Section 6
Cylinders, Pistons,
and Valve Train

OVERHAUL MANUAL -

LYCOMING DIRECT DRIVE AIRCRAFT ENGINES

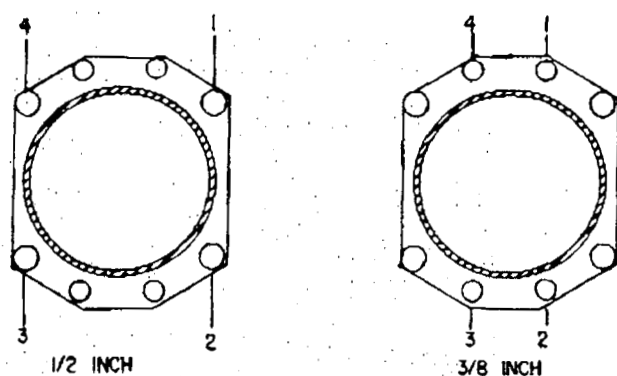


Figure 6-32. Sequence of Tightening
Cylinder Base Nuts

6-126. When all cylinders have been initially installed on the crankcase as described in paragraph 6-124, begin tightening all cylinder base nuts as described below, using the proper cylinder base nut wrenches and handle in conjunction with a suitable torque indicator. Torque wrenches should employ the flexible beam design hydraulic principle or a dial indicator with rack and pinion.

NOTE

Before installing cylinder hold-down nuts, lubricate crankcase through stud threads with any one of the following lubricants, or combination of lubricants.

1. 90% SAE 50W engine oil and 10% STP.
2. Parker Thread Lube
3. 60% SAE 30 engine oil and 40% Parker Thread Lube.

a. Assemble hold down plates (where applicable) and cylinder base hold down nuts. Install shims between hold down plates and cylinder barrel as directed in figure 6-31.

b. Tighten 1/2 inch or 7/16 inch hold down nuts to 300 inch pounds (25 foot pounds) torque.

c. Remove shims and using the same sequence, tighten the 1/2 inch nuts to 600 inch pounds (50 foot pounds) torque or the 7/16 inch hold down nuts to 420 inch pounds (35 foot pounds) torque.

d. Tighten the 3/8 inch hold down nuts to 300 inch pounds (25 foot pounds) torque. Sequence is optional.

NOTE

All O-235 series engines, except the 125 HP series, employ only 3/8 inch hold down nuts. Tighten these nuts to 300 inch pounds (25 foot pounds) torque in the sequence shown for 1/2 inch hold down nuts in figure 6-32.

e. As a final check, hold the torque wrench on each nut for about five seconds. If the nut does not turn, it may be presumed to be tightened to correct torque.

f. Recheck clearance between hold-down plates and cylinder barrel. If .010 clearance is not obtained,

loosen nuts and repeat steps b and c.

6-127. After all cylinder base nuts have been tightened, remove any nicks in the cylinder fins by filing or burring.

6-128. Install some type of vented plug in each spark plug hole after assembly of cylinder to prevent entrance of foreign matter and at the same time to permit the engine to be turned easily by hand.

6-129. (Except O-235, O-290-D). Install hydraulic tappet plunger and cylinder assemblies with spring end outward and sockets with concave end outward in the hydraulic tappet bodies.

CAUTION

Be sure that there is no oil inside tappet body and that the tappet plunger and cylinder assembly are thoroughly clean and dry. Wash any lubricating or preservative oil out of these parts, since tappet assemblies must be absolutely dry in order to check tappet clearance.

6-130. Assemble new shroud tube oil seals in both shroud tube oil seal retainers in crankcase and on outer end of the two push rod shroud tubes; then assemble a shroud tube seal sleeve over each of these seals, centering the sleeve on the seal.

6-131. Parallel Valve Cylinders. (Except O-235-C, O-290-D, -D2.) See figure 6-1. Install each shroud tube (1) through its hole in the rocker box and seat the end firmly in the crankcase. Place a spacer, two springs (2), a lockplate (3), and a plain 1/4-20 nut (4) over the stud provided in the rocker box. Tighten the nut to proper torque and secure by bending the lockplate over the nut and springs.

6-132. Angle Valve Cylinders. See figure 6-5. Assemble shroud tube spring (17) over the inner ends of the two shroud tubes (18) so that the detent notches in the spring are approximately 90° removed from detents on tubes. Place shroud tube washers (15), as many as necessary to bring minimum overlap between the spring and detent lugs to 1/8 inch, over end of each tube and insert tube ends through oil seals in crankcase. Hold both push rod shroud tubes with detent at inner end at unlocked position and insert the outer end of tubes in cylinder head rocker box. See that all rubber seals (14) are inserted squarely and then turn each shroud tube 90° thus locking the tubes by engaging the detents with the notches in the spring.

6-133. Select two push rods (13), dip in oil mixture described in paragraph 3-39 and insert full length through shroud tubes. Press tightly against outer ends and check for spring tension and free travel of unloaded or dry hydraulic tappet plungers.

6-134. Parallel Valve Cylinders. Pull rocker shaft out far enough to enable the rocker arm to be installed and push rocker shaft thru center hole, insert other rocker arm and secure with rocker shaft. Before installing exhaust rocker place special cap (39, figure 6-4) over the sodium cooled exhaust valve stem. Position rocker shaft until it protrudes equally from both outside bosses.

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6-135. Angle Valve Cylinder. Slide rocker shaft back and install rocker (22, figure 6-6) and thrust washer (23, figure 6-6). Before installing exhaust valve rocker place special cap (32, figure 6-6) over the exhaust valve stem. Slide rocker shaft back into position. Repeat with the other rocker arm and thrust washer. If clearance between the valve rocker and cylinder head cannot be brought within limits (See Table of Limits) by the use of standard valve rocker thrust washers, clean up the worn valve rocker support boss as described in paragraph 6-87 and use any two of the selective fit undersize washers to bring clearance within limits.

CAUTION

Exhaust and intake rocker assemblies are different due to angle of valves. Be sure rockers are correctly assembled.

6-136. (All engines except O-235, O-290-D.) Check dry or unloaded valve tappet clearance by pushing in on push rod end of valve rocker and checking clearance between end of valve rocker and valve stem tip, using

valve clearance gage. Valve rocker clearance on all subject engines is .028 - .080. If clearance is out of limits adjust by using a shorter or longer push rod. Inserting a longer rod will decrease the clearance. Consult Service Instruction No. 1060 for identification of push rods. At conclusion of valve rocker clearance check, assemble rocker shaft covers (31 figure 6-5 or 6-6) on angle valve cylinders temporarily to prevent displacement of valve rockers.

6-137. (O-235-C, O-290-D.) Set tappet clearance on these models in the following manner:

- Set tappets on numbers 2 and 4 cylinders at zero clearance. This will load the camshaft on one side.
- Rotate the crankshaft until No. 1 piston is at TDC of the compression stroke. Both valves will now be closed. Adjust each for a 0.007/0.009 clearance.
- Following the procedure set forth in step "B" for numbers 3, 2 and 4 in that order.
- Tappet clearance must be checked after engine run-in. At that time clearance desired is 0.010 inch. However, 0.006/0.012 is acceptable.

6-138. At completion of valve clearance check on each cylinder, recheck clearance on all cylinders and make necessary corrections. Coat all mechanism parts with-in rocker boxes as described in paragraph 3-37 and 3-39. Assemble rocker box cover gaskets and covers on each rocker box and tighten to specified torque. On the angle valve cylinder tighten rocker shaft covers to specified torque.

NOTE

On earlier models of the IO-540 series some leaking at the rocker shaft cover stud was experienced. This can be corrected by the application to the studs of Gasolla, a sealant manufactured by the Federal Process Co. Be certain to wipe off excessive sealant from the rocker shaft cover mounting surface.

6-139. Installation of Cylinder Head Fin Stabilizers. (Angle Valve Cylinders). Clean the stabilizers and affected fin areas thoroughly to remove all traces of grease, dirt or other foreign matter.

6-140. Apply Dow Corning Silastic 140 adhesive to the fin stabilizers and press surfaces together in the locations described in figures 6-33 and 6-34.

NOTE

Because of engineering changes two widths of fin stabilizers (one approximately .63 inch and one approximately .31 inch) may be encountered. See figures 6-33 and 6-34. Dotted lines call out measurements for narrow stabilizers, solid lines for wide stabilizers.

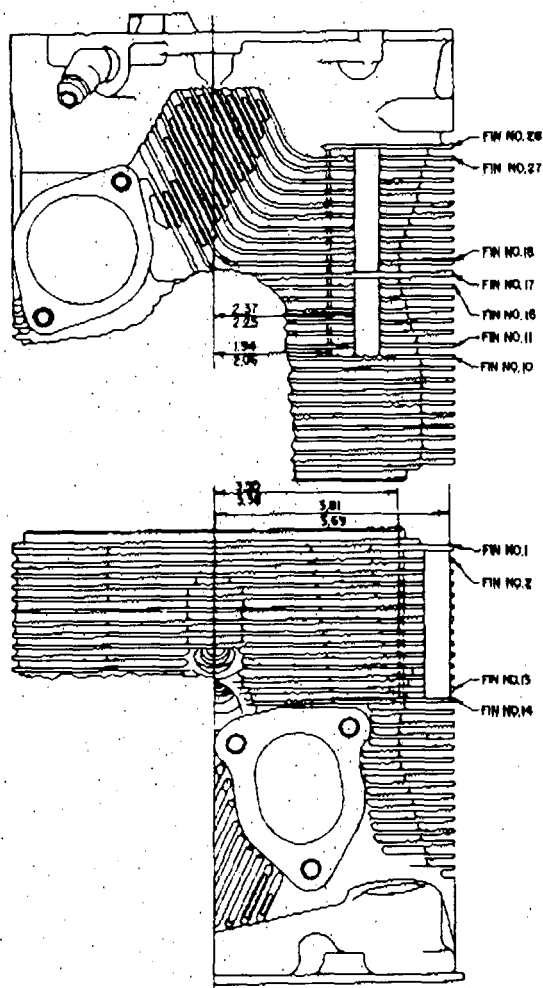


Figure 6-33. Cylinder Head Fin Stabilizers
Angle Head - Up Exhaust