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MANDATORY
SERVICE BULLETIN

DATE: May 26, 1967

Service Bulletin No. 293B
 (Supersedes Service Bulletin No. 293A)

SUBJECT: PART I: Inspection of Exhaust Valve Guides
 PART II: Installation of New Camshafts

Approved by FAA

MODELS AFFECTED: All Avco Lycoming O-320 Series Aircraft Engines except the following which were either manufactured or factory remanufactured with P/N 74167, 70492 or 70492-YA camshaft assemblies (detail part numbers of these camshafts are 74166, 70491 and 70491-YB, respectively).

O-320-A -C, -E Series, Serial Numbers 285-27, 310-27, 382-27, 330-27, 583-27, 642-27, 1063-27, 1253-27, 1418-27, 2719-27, 3526-27, 3588-27, 4247-27, 4255-27, 4340-27, 4354-27, 4911-27, 5899-27, 7106-27, 7224-27, 9088-27, 9729-27, 9933-27, 9948-27, 9950-27, 10093-27, 10118-27, 10119-27, 10218-27, 10555-27, 11403-27, 12102-27, 12686-27 thru 12819-27, 12821-27, 12822-27, 12824-27, 12825-27, 12829-27, 12831-27 thru 12835-27, 12839-27 thru 12859-27, 12861-27 thru 12870-27, 12881-27 thru 12884-27, 13056-27 and up.

O-320-B and -D Series, Serial Numbers 671-39, 725-39, 805-39, 816-39, 868-39, 879-39, 891-39, 924-39, 1113-39, 1154-39, 1240-39, 1365-39, 1391-39, 1581-39, 1771-39, 1818-39, 1852-39, 2014-39, 2131-39, 2331-39, 2531-39, 2647-39, 2657-39, 2672-39, 2680-39, 3206-39, 4209-39, 4622-39 thru 4853-39, 5070-39, 5086-39 and up.

All remanufactured O-320 Series Engines shipped after June 1, 1962 (excepting 3329-27, 9879-27 and 1314-39).

TIME OF COMPLIANCE: PART I: (As shown in chart)
 PART II: At next overhaul or earlier at owner's discretion.

Category	Definition	Engines with less than 200 hours service	Engines with more than 200 hours service	Engines with less than 400 hours service	Engines with more than 400 hours service
I	Engines installed in aircraft engaged in crop dusting or chemical application.	Prior to 300 hrs. and every 300 hrs. thereafter.	Within next 100 hrs. and every 300 hrs. thereafter.		
II	New engines and overhauled engines installed in aircraft engaged in normal utility or standard category flying operations that have a record of new valve guide replacement in at least No.'s 3 and 4 cylinders. (Applies to engines with camshaft, Part No. 68769 only.)			Prior to 500 hrs. and every 500 hours thereafter.	Within next 100 hrs. and every 500 hours thereafter.
III	Engines installed in aircraft engaged in normal utility or standard category flying operations in which valve guides have not been replaced at last overhaul.	Prior to 300 hrs. and every 500 hrs. thereafter.	Within next 100 hrs. and every 500 hours thereafter.		

Engine life in the O-320 series has been limited in some instances by exhaust valve failure that is caused by excessive wear of the exhaust valve guide. This can result from high temperatures induced by excessively lean fuel air mixtures during take-off and cruise operation. It can also result from failure to replace worn valve guides at overhaul.

Extensive studies have been conducted to determine the measures that must be taken to minimize the possibility of valve failure. The results have proven that valve life is increased by use of an improved camshaft.

And, it has been demonstrated that excessively worn valve guides are a distinct prelude to eventual valve failure. Consequently, it is recommended that both camshaft replacement and valve guide inspection as described in this bulletin, be made items of major priority with all owners and operators of applicable aircraft.

The inspection procedure that follows is made possible by the development of a valve guide wear gage that provides a quick means of checking the condition of the valve guide without removing the valve from the cylinder.

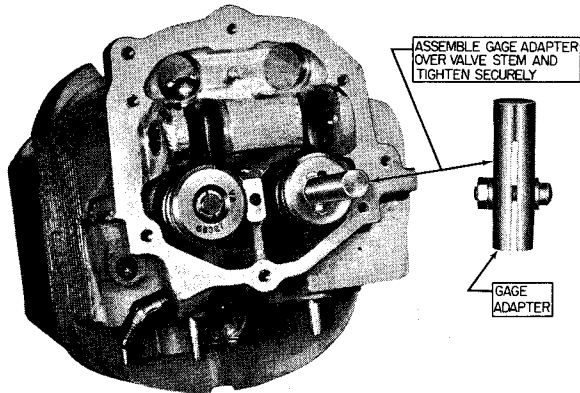


Figure 1. Gage Adapter Assembled on Exhaust Valve Stem

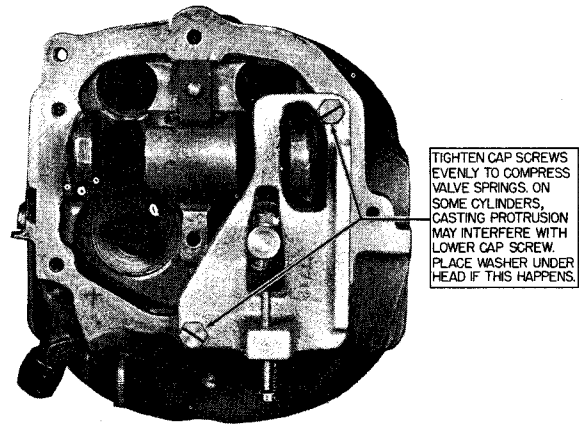


Figure 2. Compressor Plate Fixture Installed on Rocker Box

PART I

INSPECTION OF EXHAUST VALVE GUIDES

PROCEDURE FOR ENGINES WITH SODIUM COOLED EXHAUST VALVES

1. Remove rocker box cover and gasket from cylinder.
2. Push rocker shaft to left; remove exhaust rocker, rotator cap and push rod to provide clearance for assembly of valve guide wear gage. (Only sodium cooled exhaust valves have rotator caps installed over the valve tips.)
3. Wipe oil from area of exhaust valve spring retainer.
4. Assemble the split gage adapter (figure 1) over the end of the exhaust valve stem and tighten it securely. If the adapter can be moved by hand, it is not correctly assembled nor securely tightened.
5. On the pressure plate portion of the gage, turn the set-screw counter-clockwise so the end of the screw will not interfere with the split gage adapter.
6. Install the pressure plate (figure 2). Use two 1/4 x 20 x 1.25 inch long hex head cap screws; turn the screws alternately to compress the valve spring evenly. On some cylinders, a casting protrusion on the cylinder head may interfere with the end of the lower capscrew; if this happens, place several flat washers under the head of the capscrew before tightening. See figure 2.

NOTE

Be sure the pressure plate is tightened securely against rocker box gasket face. Also, be sure the valve opens as spring is depressed, this will keep rotator keys from being displaced.

7. Use finger to push against split gage adapter to move the valve toward its open position as far as possible.
8. Insert the blade of a screwdriver in the area between the exhaust valve spring and the pressure plate as shown in figure 3. Using the pressure plate as a pivot, press the blade of the screwdriver against the exhaust valve spring, forcing it toward the exhaust port side of the cylinder, as far as it will go, figure 4. Friction

will prevent the valve from returning to its normal position.

CAUTION

After the valve has been positioned, any movement of the adapter will cause a false measurement. Therefore, from this point, do not touch the adapter.

9. Select a .010 inch feeler gage and insert it between the gage adapter and the set-screw as shown in figure 5.
10. Turn the set-screw toward the gage adapter to obtain a slight drag on the feeler gage. Be careful not to turn the screw far enough to move the valve stem; also be careful not to change the position of the screw after it has been correctly set.

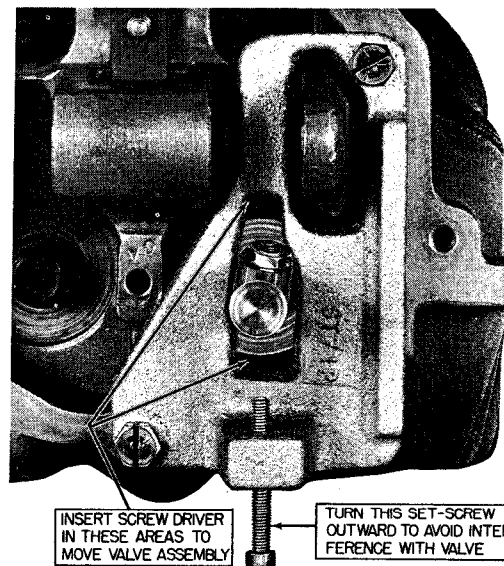


Figure 3. View Showing Area of Exhaust Valve with Components of Gage Fixture Assembled

11. Using the screwdriver, force the valve and spring assembly as far as it will go, away from the exhaust port side of the cylinder.

12. Using the feeler gages, measure the gap between the set-screw and the gage adapter. Do not force the feeler gage in the gap; this will cause the split gage adapter to move. If the gap is found to be less than .040 inch the valve stem and guide are satisfactory. However, if the gap is .040 inch or more the guide is excessively worn and the cylinder must be removed for exhaust valve and guide replacement.

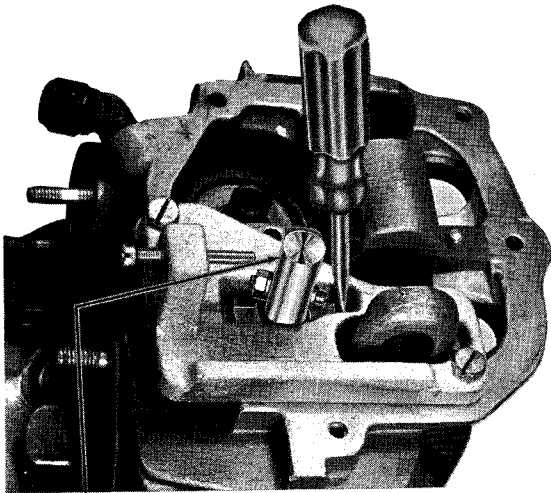


Figure 4. View Showing Screwdriver in Position for Moving Exhaust Valve Assembly

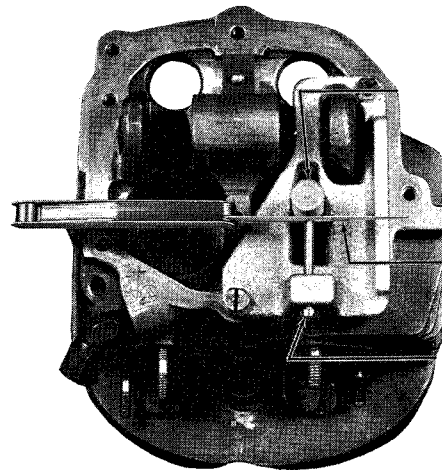


Figure 5. Feeler Gage in Position Between Set-Screw and Gage Adapter

CAUTION

It is important that both exhaust valve guide and exhaust valve be replaced if excessive wear is indicated by the above procedure. Replacement of the valve or guide alone will not prevent subsequent valve damage.

13. Make this check on all cylinders. Enter the inspection results, as well as a notation of any valve and guide replacement in the aircraft engine log book.

PROCEDURE FOR ENGINES WITH SOLID STEM EXHAUST VALVES

NOTE

Early production O-320 engines were built with solid stem exhaust valves; some of these engines have not been converted for use of the sodium cooled exhaust valves, as described in Service Bulletin No. 203C and are still in use with the solid stem valves. (Solid stem exhaust valves are identified by the fact that rotator caps are not used over the valve tips.) The procedure for checking valve guide wear in these engines is substantially the same as for engines with sodium cooled valves, however, a special tool must be fabricated to move the valve; the valve keys must be removed, and special care must be exercised to avoid dropping the valve into the cylinder. In detail, this procedure is as follows:

1. Remove rocker box cover and gasket from cylinder.

2. Push rocker shaft to left; remove exhaust rocker and push rod to provide clearance for assembly of valve guide wear gage.

3. Wipe oil from area of exhaust valve spring retainer.

4. On the pressure plate portion of the gage, turn the set-screw counter-clockwise so the end of the screw will not interfere with the split gage adapter.

5. Install the pressure plate. Use two 1/4 x 20 x 1.25 inch long hex head cap screws; turn the screws alternately to compress the valve spring evenly. Be sure the pressure plate is tightened securely against the rocker box gasket face. On some cylinders, a casting protrusion in the cylinder head may interfere with the end of the lower capscrew; if this should happen, place several flat washers under the head of the capscrew before tightening. See figure 2.

6. Fabricate a small, hooked tool as shown in figure 6 and insert it into the gap between the valve keys and

engage the hook of the tool with the underside of the valve tip as shown in figure 7.

7. Exert a steady pull on the hooked tool while tapping lightly on the pressure plate with a plastic headed hammer until the valve and keys break loose from the spring retainer. If the valve and keys do not readily release, penetrating oil, or petroleum solvent may be used to loosen them. When loose, move the valve far enough to permit removal of the keys.

NOTE

Prior to removing the keys bring the piston to near its top end of travel, thus eliminating the possibility of the valve falling into the cylinder; but not so far that the valve can touch the piston during the following check.

8. Assemble the split gage adapter (figure 1) over the end of the exhaust valve stem and tighten it securely. If the adapter can be moved by hand, it is not correctly assembled nor securely tightened.

9. Use finger to push against split gage adapter to move the valve toward its open position as far as possible.

10. Insert the blade of a screwdriver in the area between the exhaust valve spring and the pressure plate as shown in figure 3. Using the pressure plate as a pivot, press the blade of the screwdriver against the exhaust valve spring, forcing it toward the exhaust port side of the cylinder, as far as it will go, figure 4. Friction will prevent the valve from returning to its normal position.

CAUTION

After the valve has been positioned, any movement of the adapter will cause a false measurement. Therefore, from this point, do not touch the adapter.

11. Select a .010 inch feeler gage and insert it between the gage adapter and the set-screw as shown in figure 5.

12. Turn the set-screw toward the gage adapter to obtain a slight drag on the feeler gage. Be careful not to turn the screw far enough to move the valve stem; also be careful not to change the position of the screw after it has been correctly set.

13. Using the screwdriver, force the valve and spring assembly as far as it will go, away from the exhaust port side of the cylinder.

14. Using the feeler gages, measure the gap between the set-screw and the gage adapter. Do not force the feeler gage in the gap; this will cause the split gage adapter to move. If the gap is found to be less than .040 inch the valve stem and guide are satisfactory. However, if the gap is .040 inch or more the guide is excessively worn and the cylinder must be removed for exhaust valve and guide replacement.

NOTE

If valves are to be replaced, do not use solid stem exhaust valves. See Avco Lycoming Service Bulletin No. 203C for instructions on replacement with sodium cooled exhaust valves. Also, it is important that both exhaust valve guide and exhaust valve be replaced if excessive wear is indicated by the above procedure. Replacement of the valve or guide alone will not prevent subsequent valve damage.

15. Remove gage adapter from end of valve stem and insert the keys around the valve, making sure they are properly seated in the recess beneath the valve tip.

16. Remove the pressure plate from the cylinder.

17. Engines equipped with solid stem exhaust valves that have been operated on highly leaded fuels may have valves damaged by erosion, or "necking" of the valve stem. Therefore, in addition to the preceding check, it will also be necessary to check for this condition. Remove the exhaust manifold and examine the exhaust valve through the exhaust port. Any evidence of erosion on the area of the valve between the guide and the seat is reason for replacement of the valves and guides.

18. Make these checks on all cylinders. Enter the inspection results, as well as a notation of any valve and guide replacement in the aircraft engine log book.

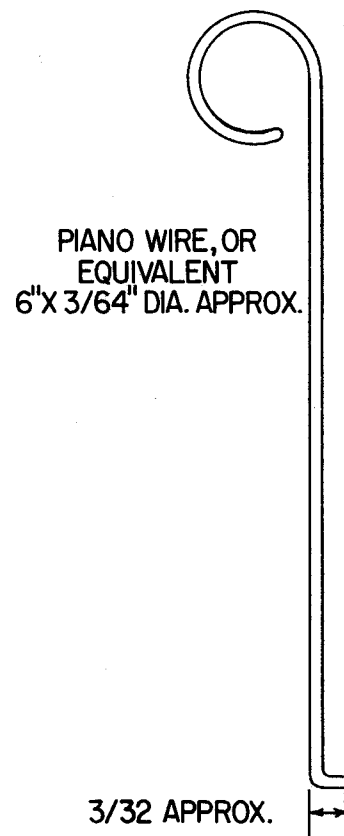


Figure 6. Hooked Tool for Pulling Valve

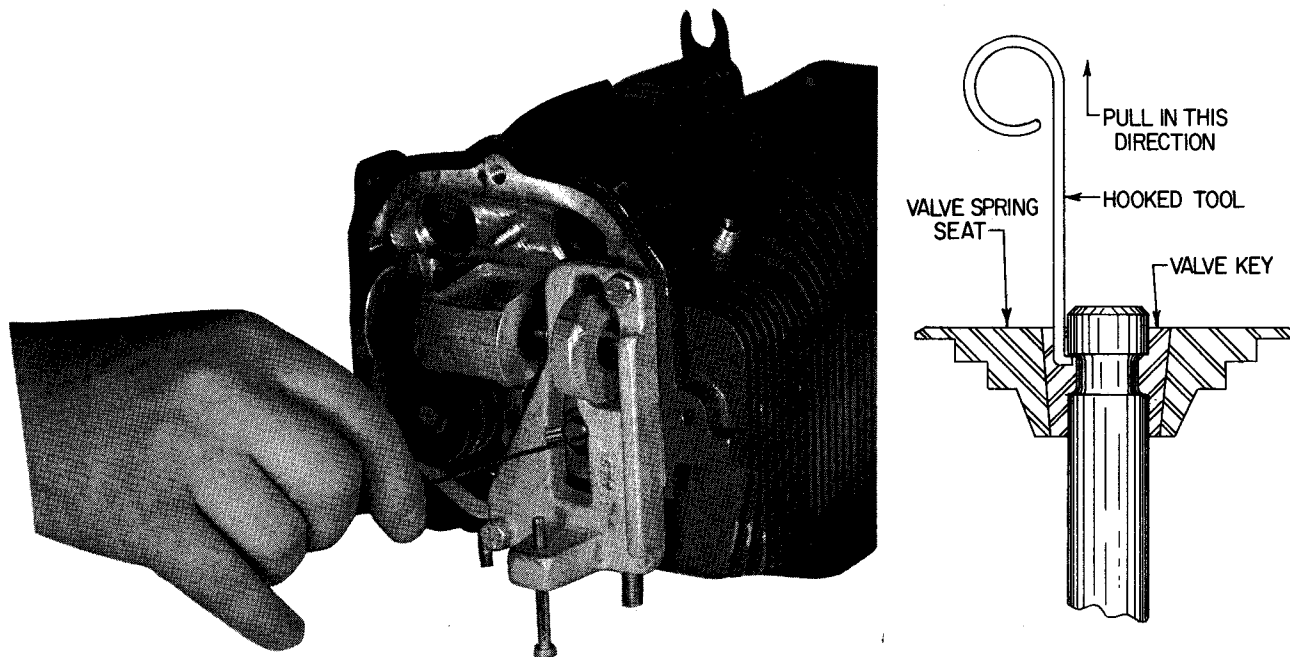


Figure 7. Method of Using Hooked Wire Tool to Pull Valve (Solid Stem) in Position for Removal of Keys

PARTS REQUIRED:	Qty.	Part No.	Nomenclature
	As Required	69534	Valve, exhaust (sodium cooled for O-320 series)
	As Required	71595	Valve, exhaust (sodium cooled for O-320-B series)
	As Required	69533	Guide, exhaust (for O-320 series)
	As Required	61246	Gasket, rocker box cover

SPECIAL TOOLS REQUIRED:	Qty.	Tool No.	Nomenclature	List Price
	1	ST-71	Gage, valve guide wear	\$22.25
	As Required		Valve,guide replacement tools (see overhaul manual)	

PART II

INSTALLATION OF NEW CAMSHAFTS

As noted under "Models Affected", certain engines were manufactured with P/N 74167, 70492 or 70492-YA camshafts. These engines are exempt from the periodic inspection described in Part I.

All other O-320 series engines not listed under "Models Affected" were manufactured with the P/N 68769 camshaft. These will require periodic inspection in accordance with Part I. Therefore, it is recommended that all O-320 engines having the 68769 camshaft be rebuilt using the new P/N 74167 camshaft assembly at next overhaul. See Service Instruction No. 1053B for further information on camshaft replacement.

NOTE

Remanufactured and overhauled engines in which new exhaust valves, guides and 70492 (70492-YA) or 74167 camshafts are installed may be considered exempt from the inspection procedure required by Part I of this service bulletin. On these engines, it is recommended that this inspection be applied prior to adding any extension beyond the normal overhaul period.

NOTE: Revision "B" to Service Bulletin No. 293 adds O-320-E series.