

Section 6 COMPRESSION

COMPRESSION

Briggs & Stratton does not publish any compression pressures, as it is extremely difficult to obtain an accurate reading without special equipment.

It has been determined through extensive testing, a simple and accurate indication of compression can be made as follows:

Spin the flywheel counterclockwise (flywheel side) against the compression stroke, a sharp rebound indicates satisfactory compression. Slight or no rebound indicates poor compression.

Loss of compression will usually be the result of the following:

1. The cylinder head gasket blown or leaking.
2. Valves sticking or not seating properly.
3. Piston rings not sealing, which would also cause the engine to consume an excessive amount of oil.

Carbon deposits in the combustion chamber should be removed every 100 to 300 hours of use (more often when run at a steady load), or whenever the cylinder head is removed.

Remove Cylinder Head and Shield

Always note the position of the different cylinder head screws so that they may be properly re-assembled. If a screw is used in the wrong position, it may be too short and not engage enough threads. It may be too long and bottom on a fin, either breaking the fin, or leaving the cylinder head loose.

CYLINDER HEAD TORQUE PROCEDURE

Assemble the cylinder head with a new head gasket, cylinder head shield, screws and washers in their proper places. (A graphite grease or part no. 93963 should be used on aluminum cylinder screws.)

Do not use a sealer of any kind on gasket. Tighten the screws down evenly by hand. Use a torque wrench and tighten head bolts in the sequence shown, Fig. 1, and to the specified torque in Table 1.

Do not turn one screw down completely before the others, as it may cause a warped cylinder head.

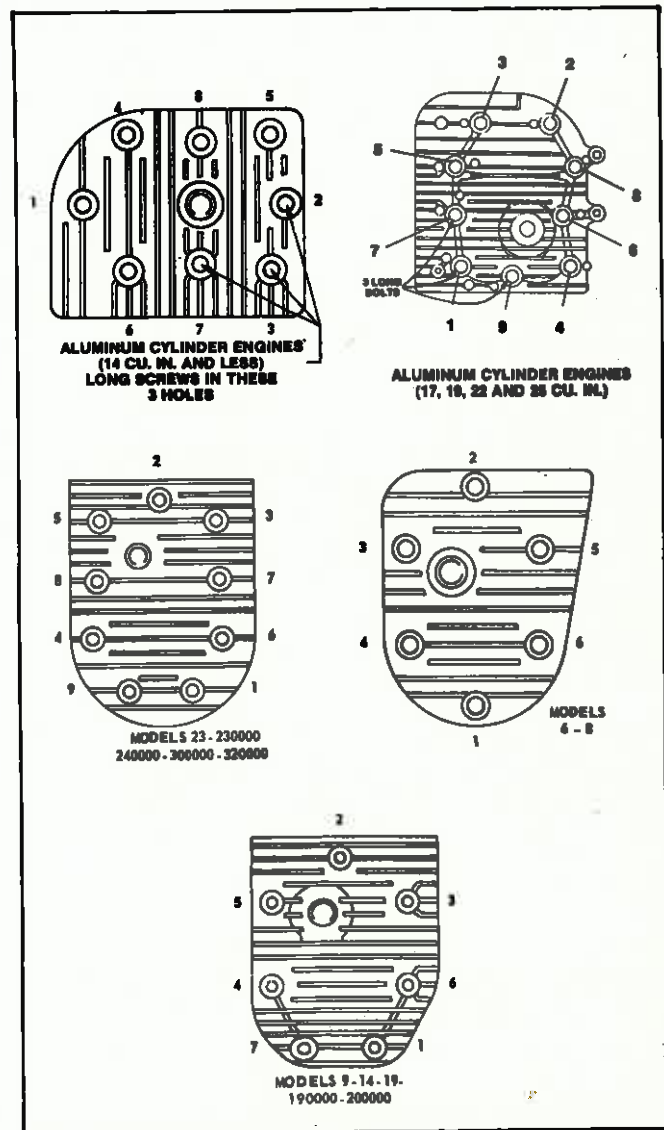


Fig. 1 — Cylinder Heads

COMPRESSION Valves

TABLE NO. 1
CYLINDER HEAD TORQUE

| BASIC MODEL SERIES | Inch Pounds | Meter Kilopond | Newton Meter |
|---|-------------|----------------|--------------|
| ALUMINUM CYLINDER | | | |
| 6B, 60000, 8B, 80000, 82000, 92000, 94000, 110000, 100000, 130000 | 140 | 1.61 | 15.82 |
| 140000, 170000, 190000, 220000, 250000 | 165 | 1.90 | 18.65 |
| CAST IRON CYLINDER | | | |
| 5, 6, N, 8, 9 | 140 | 1.61 | 15.82 |
| 14 | 165 | 1.90 | 18.65 |
| 19, 190000, 200000, 23, 230000, 240000, 300000, 320000 | 190 | 2.19 | 21.47 |

To Remove Valves

Fig. 2 shows the three methods used to hold the valve spring retainers. To remove types shown in Illus. 1 and 2, use 19063 compressor; adjust jaws until they just touch the top and bottom of the valve chamber. This will keep the upper jaw from slipping into the coils of the spring. Push the compressor in until the upper jaw slips over the upper end of the spring. Tighten the jaws to compress the spring. Fig. 3. Remove collars or pin and lift out valve. Pull out compressor and spring. Fig. 4.

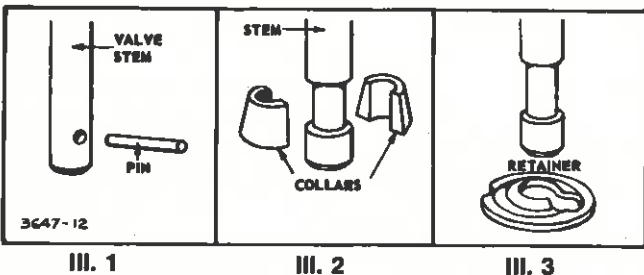


Fig. 2 — Valve Spring Retainers

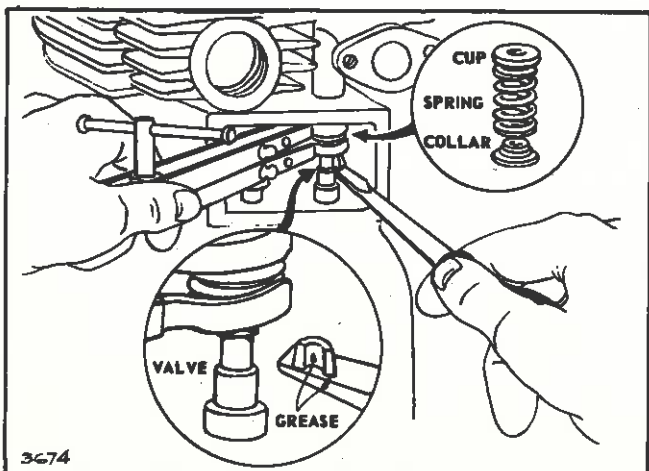


Fig. 3 — Removing Spring

To remove valves using retainers, Fig. 2, Illus. 3, slip the upper jaw of 19063 compressor over the top of the valve chamber and lower jaw between spring and retainer. Compress spring. Remove retainer. Pull out valve. Remove compressor and spring. Fig. 5.

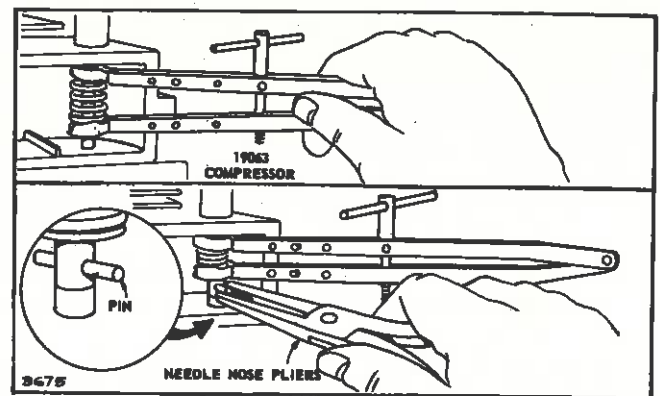


Fig. 4 — Removing Spring

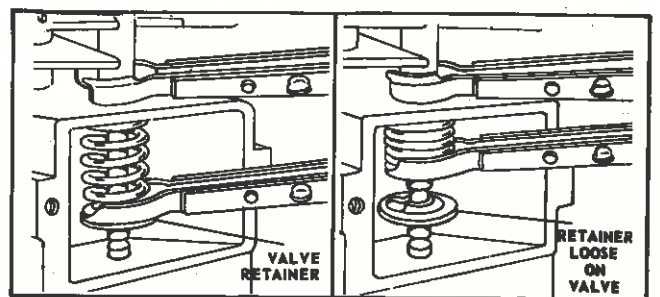


Fig. 5 — Removing Retainer and Spring

Old 19063 valve spring compressors can be modified by grinding as shown in Fig. 6.

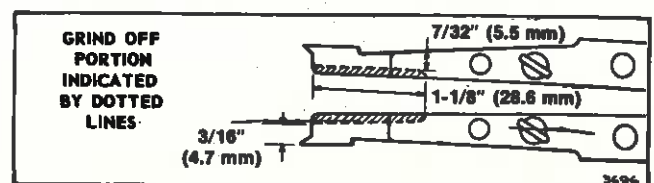


Fig. 6 — Modified #19063 Compressor

**TABLE NO. 2
VALVE TAPPET CLEARANCE**

| MODEL SERIES | INTAKE | | | | EXHAUST | | | |
|---|--------|-------------|--------|-------------|---------|-------------|--------|-------------|
| | MAX. | | MIN. | | MAX. | | MIN. | |
| | Inches | Milli-meter | Inches | Milli-meter | Inches | Milli-meter | Inches | Milli-meter |
| ALUMINUM CYLINDER | | | | | | | | |
| 6B, 60000, 8B, 80000, 82000, 92000, 94000, 100000, 110000, 130000, 140000, 170000, 190000, 220000, 250000 | .007 | 0.18 | .005 | 0.13 | .011 | 0.28 | .009 | 0.23 |
| CAST IRON CYLINDER | | | | | | | | |
| 5, 6, 8, N, 9, 14, 19, 190000, 200000 | .009 | 0.23 | .007 | 0.18 | .016 | 0.41 | .014 | 0.36 |
| 23, 230000, 240000, 300000, 320000 | .009 | 0.23 | .007 | 0.18 | .019 | 0.48 | .017 | 0.43 |

To Reface Valves and Seats

Faces on valves and valve seats should be resurfaced with a valve grinder or cutter, to an angle of 45°. NOTE: SOME ENGINE MODELS HAVE A 30° INTAKE VALVE AND SEAT. Valve and seat should then be lapped with a fine lapping compound to remove grinding marks and assure a good seat. Valve seat width should be 3/64" to 1/16" (1.19-1.58 mm). Fig. 7. If the seat is wider, a narrowing stone or cutter should be used. If either the seat or valve is badly burned, it should be replaced. Replace valve if margin is 1/64" (0.4 mm) or less after refacing. Fig. 7.

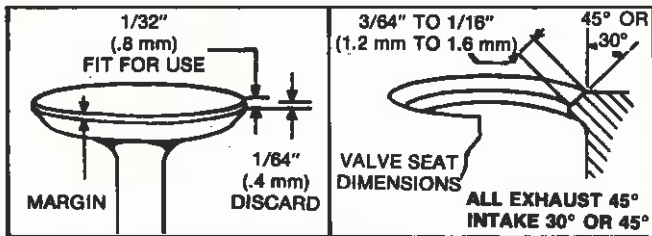


Fig. 7 — Valve and Seat Dimensions

To Check and Adjust Tappet Clearance

Insert the valves in their respective positions in the cylinder. Turn the crankshaft to top dead center, end of compression stroke. Both valves are now closed. Then check clearance on the intake and exhaust valves with feeler gauge. See Table 2. Grind off the end of the valve stem if necessary, to obtain proper clearance.

CAUTION: Piston **MUST** be at top dead center at the end of compression stroke to assure both valves being closed.

NOTE: Check clearance cold.

To Install Valves

Some engines use the same spring for intake and exhaust side, while others use a heavier spring on the exhaust side. Compare springs before installing.

If retainers are held by a pin or collars, Fig. 2, Illus. 1 and 2, place valve spring and retainer (and cup on Model Series 9, 14, 19, 20, 23, 24 and 32) into valve spring compressor 19063. Compress the spring until it is solid. Insert the compressed spring and retainer (and cup when used) into the valve chamber. Then drop the valve into place, pushing the stem through the retainer. Hold the spring up in the chamber, and the valve down. insert the retainer pin with a needle nose pliers or place the collars in the groove in the valve stem. Lower the spring until the retainer fits around the pins or collars, then pull out the spring compressor. Fig. 3. Be sure pin or collars are in place.

If self-lock retainer, Fig. 2, Illus. 3, is used, compress retainer and spring with compressor 19063. Large diameter of retainer should be toward front of valve chamber. Fig. 8. Insert compressed spring and retainer into valve chamber. Drop the valve stem through larger area of retainer slot and move the compressor so as to center the small area of the valve retainer slot onto the valve stem shoulder. Release the spring tension and remove the compressor.

COMPRESSION Valves & Guides

NOTE: Apply "LED-PLATE" or Part No. 93963 lubricant to valve stems and guides before installing. Be sure that no "LED-PLATE" or Part No. 93963 is on the ends of the valve stems or tappets.

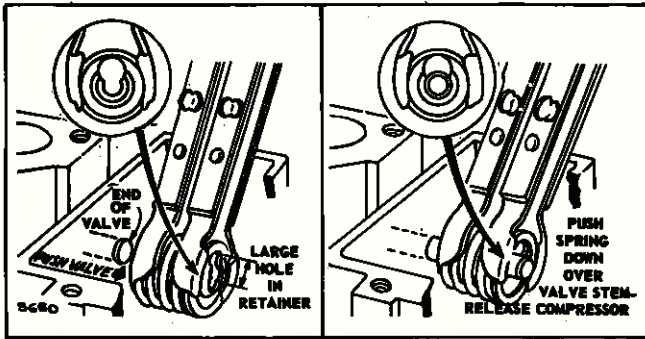


Fig. 8 — Installing Valves

Valve Guides

Models 5, 6, 8, 6B, 60000, 8B, 80000, 82000, 92000, 94000, 100000, 110000, 130000

If the flat end of valve guide plug gauge 19122 can be inserted into the valve guide for a distance of 5/16" (7.94 mm), the valve guide is worn and should be rebushed in the following manner. Fig. 9.

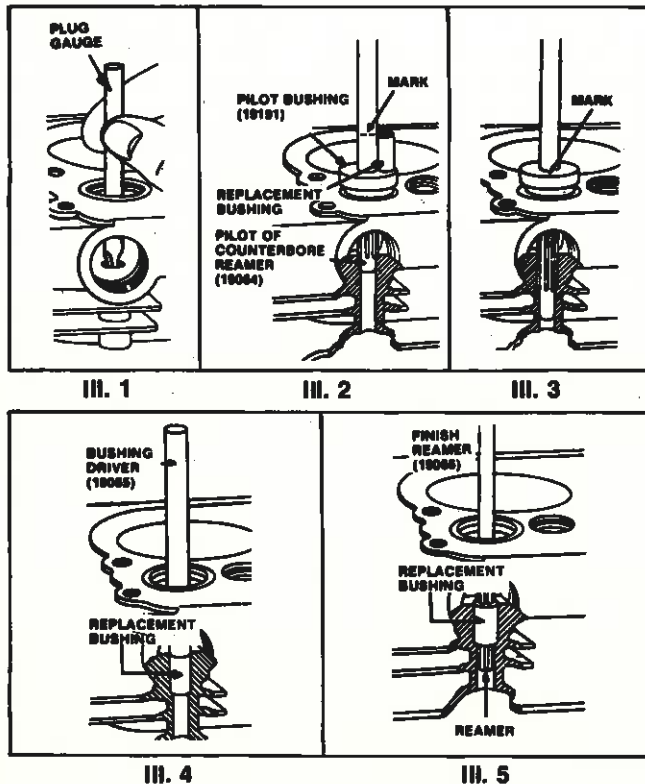


Fig. 9 — Bushing Valve Guides

Place pilot of counterbore reamer no. 19064 in valve guide, Fig. 9, Illus. 1. Install pilot bushing 19191 over counterbore reamer and lower pilot bushing to rest in valve seat. Hold replacement valve guide bushing 63709 on top of pilot bushing next to reamer. Make a mark on reamer 1/16" (1.59 mm) above top of replacement bushing, Fig. 9, Illus. 2.

Ream out valve guide until mark on counterbore reamer is level with top of pilot, Fig. 9, Illus. 3. (Lubricate reamer with kerosene or equivalent lubricant.)

Place replacement bushing in reamed-out hole, Fig. 19. Press replacement bushing down until it is flush with the top of the hole with valve guide bushing driver 19065, Fig. 9, Illus. 4.

Finish ream the replacement bushing with a valve guide bushing finish reamer 19066, Fig. 9, Illus. 5. (Lubricate reamer with kerosene or equivalent lubricant.)

NOTE: It is usually not necessary to bush factory installed brass valve guides. However, if bushing is required, DO NOT REMOVE ORIGINAL BUSHING — follow standard procedure outlined.

Models 9, 14, 19, 23, 140000, 170000, 190000, 200000, 220000, 230000, 240000, 250000, 300000, 320000

Checking Valve Guide Wear

If the flat end of valve guide plug gauge no. 19151 can be inserted into the valve guide for a distance of 5/16" (7.9 mm) the guide is worn and should be rebushed in the following manner. Fig. 9, Illus. 1.

Removing Valve Guide Bushings Using Kit 19232 (Aluminum Engines)

To remove factory or field installed guide bushings on aluminum engines, rotate nut no. 19239 up to head of 19238 puller screw. Center washer on valve seat. (Larger washer may be required on some model intake seats.) Lubricate cutting surface of screw and inside of guide bushings with Stanisol or kerosene. Insert screw 19238 thru washer 19240, centering washer on seat. See Fig. 10. Use 3/4" socket to turn screw clockwise to a depth of 1/4" (6.5 mm) or until bushing starts to turn — and —STOP. While holding screw stationary, turn nut down onto washer until bushing is free.

COMPRESSION Valve Seat Inserts

To Remove Valve Seat Insert

Use valve seat puller 19138 as shown in Fig. 15, and select the proper puller nut. See Table 3. Be sure the puller body does not rest on the valve seat insert. Fig. 16. Turn the 5/16" bolt with a wrench until insert is pulled out of the cylinder. Fig. 16.

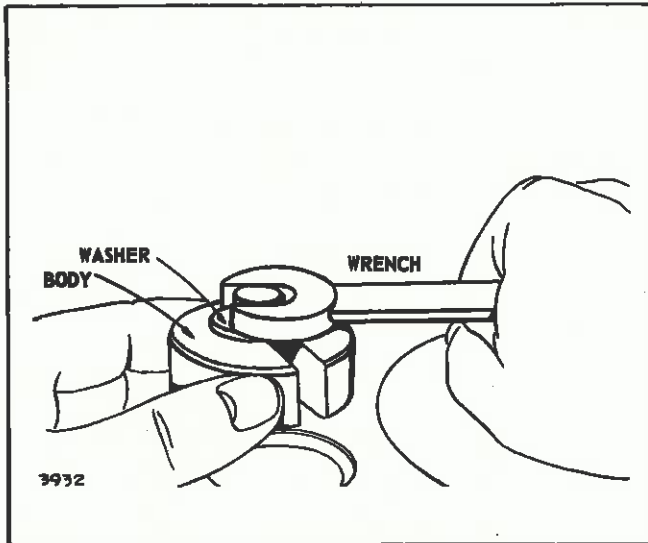


Fig. 15 — Removing Valve Seat

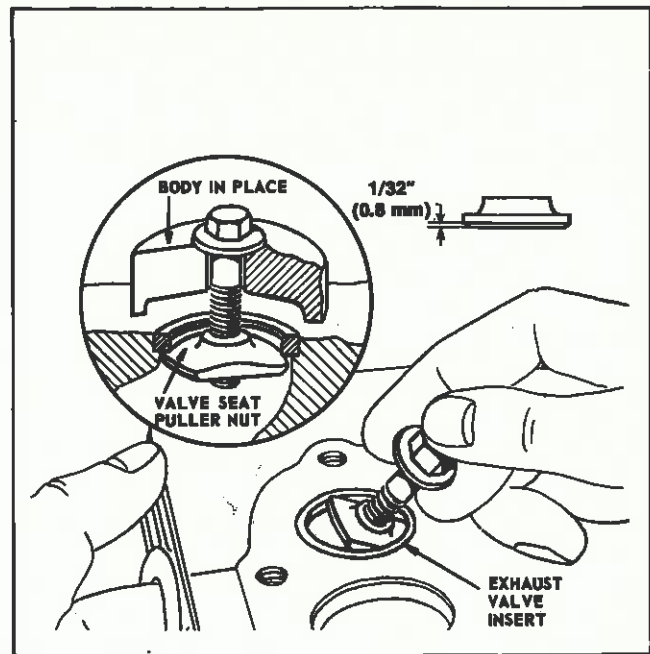


Fig. 16 — Inserting Valve Seat Puller

NOTE: On aluminum alloy cylinder models, it may be necessary to grind the puller nut until the edge is 1/32" (0.8 mm) thick in order to get the puller nut under the valve insert. Fig. 16.

TABLE NO. 4
VALVE SEAT INSERT AND COUNTERBORE TOOLS

| BASIC MODEL SERIES | COUNTERBORE CUTTER | SHANK | CUTTER & DRIVER PILOT | INSERT DRIVER |
|---------------------------|--------------------|-------|-----------------------|---------------|
| ALUMINUM CYLINDER | | | | |
| 6B, 8B | | | 19126 | 19136 |
| 60000, 80000 | | | 19126 | 19136 |
| 82000, 92000, 94000 | | | 19126 | 19136 |
| 100000, 130000 | | | 19126 | 19136 |
| 140000, 170000, 190000 | | | 19127 | 19136 |
| CAST IRON CYLINDER | | | | |
| 5, 6, N | 19133 | 19129 | 19126 | 19136 |
| 8 | 19132 | 19129 | 19126 | 19136 |
| 9 | 19132 | 19129 | 19127 | 19136 |
| 14, 19, 190000 | 19131 | 19129 | 19127 | 19136 |
| 200000, 23 | 19131 | 19129 | 19127 | 19136 |
| 230000, 240000 | 19131 | 19129 | 19127 | 19136 |
| 300000, 320000 | | | 19127 | 19136 |

COMPRESSION

Valve Seat Inserts

To Drive in New Valve Seat Insert

Select the proper valve seat insert and the correct pilot and driver according to Table 3 & 4. You will note that one side of the seat insert is chamfered at the outer edge. This side should go down into the cylinder.

Insert the pilot into the valve guide. Then drive the valve insert into place with the driver, as shown in Fig. 17. The seat should then be ground lightly and the valves and seats lapped lightly with grinding compound. Clean thoroughly. NOTE: Aluminum alloy cylinder models. Use the old insert as a spacer between the driver and the new insert. Drive new insert until it bottoms. Top of insert will be slightly below cylinder head gasket surface. Then peen around the insert as shown in Fig. 18.

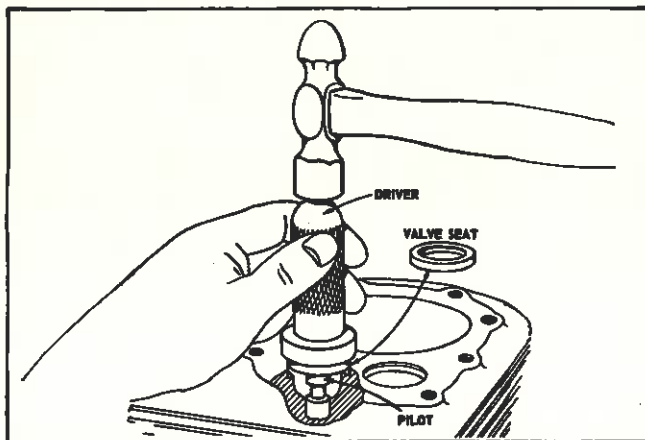


Fig. 17 — Driving in Valve Seat

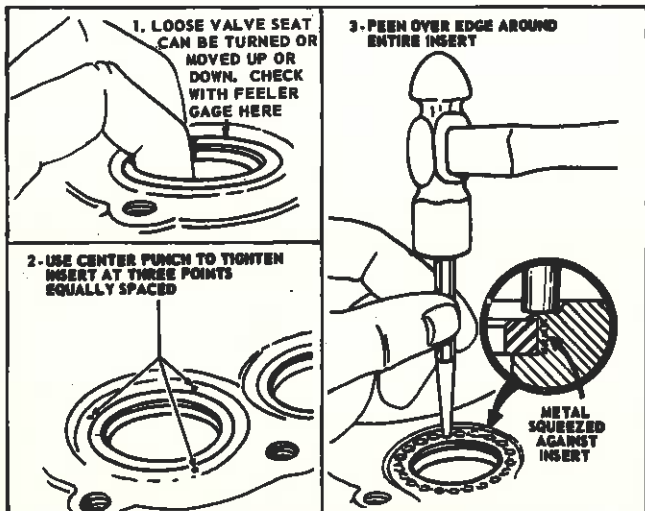


Fig. 18 — Peening Valve Seat

NOTE: Replace Cylinder if a .005" (0.13 mm) Feeler Gauge enters between Valve Seat and Cylinder.

To Counterbore Cylinder for Intake Valve Seat Cast Iron Cylinder Models

These models must be counterbored to allow installation of the intake valve seat insert. Select proper seat insert, cutter shank, counterbore cutter, pilot and driver according to Table 4.

Insert pilot in intake valve guide. See Fig. 19. Assemble correct counterbore cutter to cutter shank as shown in Fig. 20.

Counterbore the cylinder by hand until stop on cutter touches the top of the cylinder. Fig. 21. Do not force the cutter to one side or it will cut oversize. Blow out all chips. Use knock out pin 19135, to remove cutter from cutter shank.

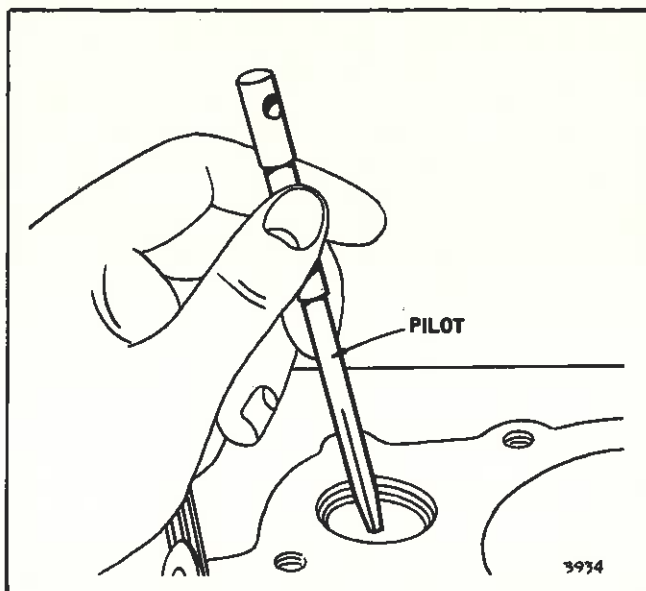


Fig. 19 — Inserting Pilot

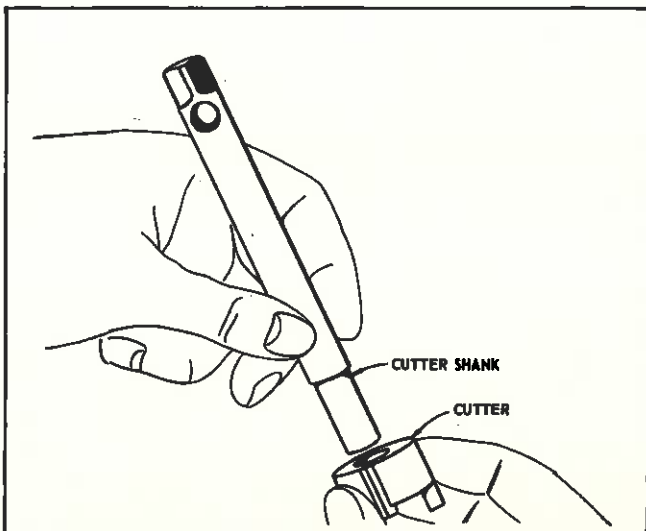


Fig. 20 — Inserting Cutter Shank

COMPRESSION Stellite® Valves & Rotators

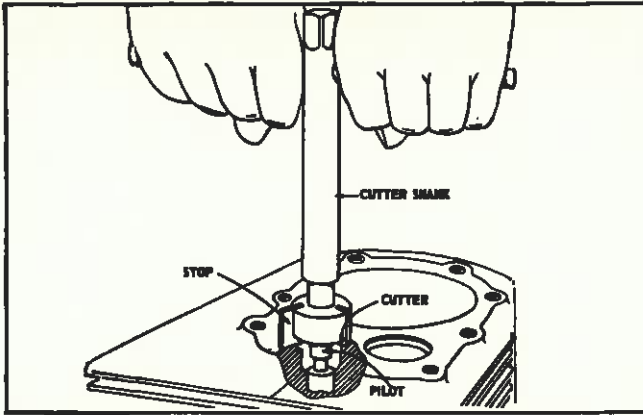
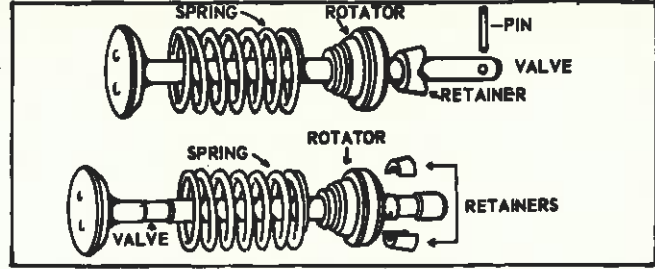


Fig. 21 — Counterboring for Valve Seat

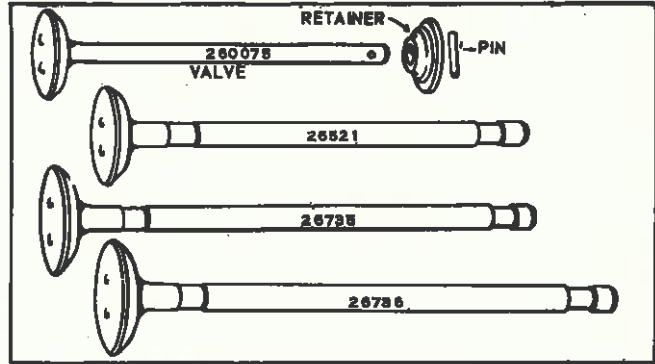
Valves, Valve Conversions

The life of a valve is considered to be the period of time the valve will operate before repair or replacement is necessary. The life of a standard exhaust valve is often shortened because of burning, which occurs when pieces of combustion deposit lodge between the valve seat and valve face, preventing the valve from closing completely. This is most likely to occur on engines which are operated at constant speed and constant load, for long periods of time. Exhaust valve life can be extended by using:

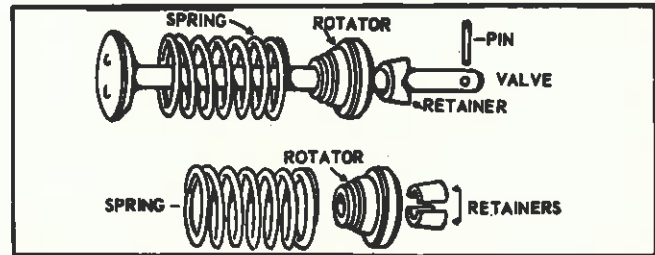
1. A Rotocap (Valve Rotator), which turns the exhaust valve a slight bit on each lift, wiping away any deposits which tend to lodge between the valve face and seat, or,
2. A Stellite® Exhaust Valve which has a greater resistance to heat.



Standard Valve and Rotocap



Stellite® Valve Only



Stellite® Valve and Rotocap

Use Table 5 below, Table 6 on page 10 or Table 7 on page 11 for Part Numbers.

TABLE NO. 5

| BASIC MODEL SERIES | STELLITE® VALVE AND ROTOCAP CONVERSION | | | | |
|--|--|-------------------------|---------|----------|------------------|
| | STELLITE® VALVE | ROTOCAP ONLY CONVERSION | | | |
| | | SPRING | ROTOCAP | RETAINER | PIN |
| ALUMINUM CYLINDER | | | | | |
| 60000*, 80000*, 82000*, 92000*, 94000* | 260443 | 26826 | 292259 | 230127 | 230126 |
| 100000, 130000 | 260860 | 26826 | 292259 | 230127 | 230126 |
| 140000, 170000, 190000, 200000, 250000 | 390420 | 26828 | 292260 | 93630 | |
| CAST IRON CYLINDER | | | | | |
| 14, 19, 190000, 200000 | 26735 | 26828 | 292260 | 68283 | |
| 23, 230000 | 261207 | 26828 | 292260 | 68283 | |
| 240000, 300000, 320000 | 261207 | 26828 | 292260 | 68283 | (Stellite® Std.) |

*To use Rotocap only #26973 standard valve must be used.

NOTE: Rotocap not used with LP Gas on 6, 8 and 10 cu. in. engine.

COMPRESSION

Stellite® Valves & Rotators

TABLE NO. 6

| TO CONVERT FROM STANDARD EXHAUST VALVE TO STELLITE® EXHAUST VALVE WITH VALVE ROTATOR | | | | | | | | |
|---|---|-------------------------------|----------------------|-------------------------|------------------------|-------------------------------|----------------------|----------|
| MODEL Series | REMOVE | | | ADD | | | | |
| | Standard Exhaust Valve | Retainer | Spring | Stellite® Exhaust Valve | Rotator | Retainer | Spring | Pin |
| 60000■ 80000■ 90000■ | 296676 | 93312 | 26478 | 260443 | 292259 | 230127 (Sleeve Type) | 26826 | 230126 |
| 100000■ 130000■ | 211119 | 93312 | 26478 | 260860 | 292259 | 230127 (Sleeve Type) | 26826 | 230126 |
| 170000●■ 190000●■ 400000★ | 390419 | Reuse Split Retainers (93630) | Reuse Spring (26828) | 390420 | Reuse Rotator (292260) | Reuse Split Retainers (93630) | Reuse Spring (26828) | Not Used |
| 220400★ 221400★ 250000★ 420000★ | Stellite® Exhaust Valve and Seat With Rotator Standard | | | | | | | |
| 200000 | 23835 | 68293 (Collar Type) | 65906 | 26735 | 292260 | Reuse Split Retainers (68283) | 26828 | Not Used |
| 233000 | 23923 | 68293 (Collar Type) | 65906 | 261207 | 292260 | Reuse Split Retainers (68283) | 26828 | Not Used |
| 243000★ 300000★ 320000★ | Stellite® Exhaust Valve and Seat With Rotator Standard | | | | | | | |

■Some standard with Stellite® exhaust valve and seat with valve rotator. Stellite® valves are usually marked "TXS" on head.

●Valve rotator standard with standard exhaust valve.

★Standard with Stellite® exhaust valve and seat with valve rotator.

NOTE: APPLY BRIGGS & STRATTON PART NO. 93963 "VALVE GUIDE LUBRICANT" TO VALVE STEMS AND GUIDES BEFORE INSTALLING VALVES ESPECIALLY WHEN OPERATING WITH LP FUEL OR NATURAL GAS.

TABLE NO. 7

| TO CONVERT FROM STELLITE® EXHAUST VALVE WITH ROTATOR TO STELLITE® EXHAUST VALVE WITHOUT ROTATOR | | | | | | |
|--|--|----------------------------|------------|---------------------------|--|------------|
| REMOVE | | | | ADD | | |
| Rotator | Retainer | Spring | Pin | Retainer | Spring | Pin |
| 292259 | 230127 (Sleeve Type) | 26826 | 230126 | 23184 (Collar Type) | 26478 | 23187 |
| 292259 | 230127 (Sleeve Type) | 26826 | 230126 | 23184 (Collar Type) | 26478 | 23187 |
| 292260 | Reuse Split Retainers (93630) | Reuse Spring (26828) | Not Used | 68293 (Collar Type) | Reuse Spring (26828) | Not Used |
| 292260 | Reuse Split Retainers (93630) | Reuse Spring (26828) | Not Used | 68293 (Collar Type) | Reuse Original Spring (26828) | Not Used |
| 292260 | Reuse Split Retainers (68283) | 26828 | Not Used | 68293 (Collar Type) | 65906 | Not Used |
| 292260 | Reuse Split Retainers (68283) | 26828 | Not Used | 68293 (Collar Type) | 65906 | Not Used |
| 292260 | Reuse Split Retainers (68283) | 26828 | Not Used | 68293 (Collar Type) | 65906 | Not Used |

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