TECUMSEH

TECUMSEH

* Model
  - VM70
  - VM80
  - VM100
  - HM70
  - HM80
  - HM100

** MEDIUM FRAME MODELS **

<table>
<thead>
<tr>
<th>Model</th>
<th>No. Cyls.</th>
<th>Bore</th>
<th>Stroke</th>
<th>Displacement</th>
<th>Horsepower</th>
</tr>
</thead>
<tbody>
<tr>
<td>VM70</td>
<td>1</td>
<td>2-15/16 in. (74.6 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>17.16 cu. in. (281 cc)</td>
<td>7 kW</td>
</tr>
<tr>
<td>VM80</td>
<td>1</td>
<td>8-1/16 in. (77.8 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>18.55 cu. in. (305 cc)</td>
<td>9 kW</td>
</tr>
<tr>
<td>VM100</td>
<td>1</td>
<td>3-9/16 in. (80.9 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>20.2 cu. in. (331 cc)</td>
<td>10 kW</td>
</tr>
<tr>
<td>HM70</td>
<td>1</td>
<td>2-15/16 in. (74.6 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>17.16 cu. in. (281 cc)</td>
<td>7 kW</td>
</tr>
<tr>
<td>HM80</td>
<td>1</td>
<td>3-1/16 in. (77.8 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>18.55 cu. in. (305 cc)</td>
<td>8 kW</td>
</tr>
<tr>
<td>HM100</td>
<td>1</td>
<td>3-9/16 in. (80.9 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>20.2 cu. in. (331 cc)</td>
<td>9 kW</td>
</tr>
</tbody>
</table>

** HEAVY FRAME MODELS **

<table>
<thead>
<tr>
<th>Model</th>
<th>No. Cyls.</th>
<th>Bore</th>
<th>Stroke</th>
<th>Displacement</th>
<th>Horsepower</th>
</tr>
</thead>
<tbody>
<tr>
<td>VH70</td>
<td>1</td>
<td>2-7/8 in. (69.8 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>15.0 cu. in. (246 cc)</td>
<td>7 kW</td>
</tr>
<tr>
<td>VH80</td>
<td>1</td>
<td>3-5/16 in. (84.1 mm)</td>
<td>2-7/8 in. (69.8 mm)</td>
<td>23.75 cu. in. (389 cc)</td>
<td>9 kW</td>
</tr>
<tr>
<td>VH100</td>
<td>1</td>
<td>3-5/16 in. (84.1 mm)</td>
<td>2-7/8 in. (69.8 mm)</td>
<td>23.75 cu. in. (389 cc)</td>
<td>10 kW</td>
</tr>
<tr>
<td>HH70</td>
<td>1</td>
<td>2-7/8 in. (69.8 mm)</td>
<td>2-17/32 in. (64.3 mm)</td>
<td>15.0 cu. in. (246 cc)</td>
<td>7 kW</td>
</tr>
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<td>HH80</td>
<td>1</td>
<td>3-5/16 in. (84.1 mm)</td>
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<td>8 kW</td>
</tr>
<tr>
<td>HH100</td>
<td>1</td>
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<td>2-7/8 in. (69.8 mm)</td>
<td>23.75 cu. in. (389 cc)</td>
<td>9 kW</td>
</tr>
<tr>
<td>HH120</td>
<td>1</td>
<td>3-7/8 in. (89.9 mm)</td>
<td>2-7/8 in. (69.8 mm)</td>
<td>27.36 cu. in. (453 cc)</td>
<td>12 kW</td>
</tr>
</tbody>
</table>

Engines must be identified by complete model number, including specification number in order to obtain correct repair parts. Numbers on early models are located on a name plate or tag. Numbers on later models are stamped in blower housing. It is important to transfer ID tags from original engine to replacement short block so unit can be identified later.

Medium frame engines have aluminum blocks with cast iron sleeves. Heavy frame engines have cast iron cylinder and block assemblies. Early VH70 and HH70 engines were identified as V70 and H70. Models VH and VM are vertical crankshaft engines and HM and HH models have horizontal crankshafts.

** Fig. T1—Exploded view of Tecumseh carburetor. **

** MAINTENANCE **

**SPARK PLUG.** Recommended spark plug is Champion J-8 or equivalent. Set electrode gap to 0.030 inch (0.762 mm). Spark plug should be removed, cleaned and adjusted periodically. Renew plug if electrodes are burned and pitted or if porcelain is cracked. If frequent plug fouling is experienced, check for following conditions:

a. Air cleaner setting too rich
b. Partially closed choke
c. Clogged air filter
d. Incorrect spark plug
e. Poor grade of gasoline
f. Too much oil or crankcase breather clogged

**CARBURETOR.** Tecumseh or Walbro float type carburetors may be used. Adjustment and service procedures for each type carburetor is outlined in the following paragraphs.
TECUMSEH CARBURETOR. Clockwise rotation of idle mixture needle (12—Fig. T1) and main fuel adjusting needle (34) lean the mixture. Initial adjustment of both needles is 1 turn open. Final adjustment is made with engine running at normal operating temperature. Adjust main fuel needle for smoothest operation at high speed. Then, adjust idle mixture needle for smoothest engine idle. Adjust idle speed stop screw (1) for engine idle speed of 1800 rpm.

When overhauling, check adjusting needles for excessive wear or other damage. Inlet fuel needle (22) seats against a Viton rubber seat (21) which is pressed into carburetor body. Remove rubber seat before cleaning carburetor in a commercial cleaning solvent. The seat should be installed grooved side first. See Fig. T2.

NOTE: Some later models have a Viton tipped inlet needle (Fig. T3) and a brass seat.

Install throttle plate (2—Fig. T1) with the two stamped lines facing out and at 12 and 3 o'clock position. The 12 o'clock line should be parallel to throttle shaft and to top of carburetor. Install choke plate (10) with flat side towards bottom of carburetor. Float setting should be 7/32-inch (5.5 mm), measured with body and float assembly in inverted position, between free end of float and rim on carburetor body. Fuel fitting (8) is pressed into body. When installing fuel inlet fitting, start fitting into bore; then, apply a light coat of Locite 271 to shank and press fitting into position.

WALBRO CARBURETOR. To adjust, refer to Fig. T4 and proceed as follows: Turn both fuel adjusting needles (9 and 33) in finger tight, then back idle mixture needle (9) out 1/4 turns and main fuel needle (33) out 2 turns. Make final adjustment with engine warm and running. Adjust main fuel needle until engine runs smoothly at normal operating speed. Back out idle speed stop screw (7), hold throttle to slowest idle speed possible without stalling and adjust idle mixture needle for smoothest idle performance. Readjust idle speed screw so engine idle speed is 1800 rpm.

Float setting for Walbro carburetors is 1/4-inch (3 mm) on horizontal crankshaft engines and 3/32-inch (2.4 mm) on vertical crankshaft engines when measured with carburetor in inverted position, between free side of float and body casting ring. See H—Fig. T5. Float travel should be 9/16-inch (14 mm) as measured at free end of float. Bend lip of float tang to adjust float level.

NOTE: If carburetor has been disassembled and main nozzle (16—Fig. T4) removed, do not reinstall nozzle: obtain and install a new service nozzle. Refer to Fig. T6.

GOVERNOR. A mechanical flyweight type governor is used on all models. Governor weight and gear assembly is...
Tecumseh

driven by camshaft gear and rides on a renewable shaft which is pressed into engine crankcase or crankcase cover. Press governor shaft in until shaft end is located as shown in Fig. T7, T8, T9 or T10.

To adjust governor lever position on vertical crankshaft models, refer to Fig. T11. Loosen clamp screw on governor lever. Rotate governor lever shaft counter-clockwise as far as possible. Move governor lever to the left until throttle is fully open, then tighten clamp screw.

On horizontal crankshaft models, loosen clamp screw on lever, rotate governor lever shaft clockwise as far as possible. See Fig. T12. Move governor lever clockwise until throttle is wide open, tighten clamp screw.

For external linkage adjustments, refer to Figs. T13 and T14. Loosen screw (A), turn plate (B) counter-clockwise as far as possible and move lever (C) to the left until throttle is fully open. Tighten screw (A). Governor spring must be hooked in hole (D) as shown. Adjusting screws on bracket shown in Figs. T13 and T14 are used to adjust fixed or variable speed settings.

Fig. T7 — View showing installation of governor shaft and governor gear and weight assembly on Models HH80, HH100 and HH120. Dimension (B) is 1 inch (25.4 mm).

Fig. T8 — Governor gear and shaft installation on Models VH80 and VH100. Dimension (C) is 1 inch (25.4 mm).

Fig. T9 — Correct installation of governor shaft and gear and weight assembly on Models HHH70, HHH70, HHH80 and HHH100. Dimension (D) is 1-1/4 inches (31.9 mm) on Models HHH70, HHH80 and HHH100 or 1-7/8 inches (32.1 mm) on Models HHH70.

Fig. T10 — Governor gear and shaft installation on Models VH70, VM70, VM80 and VM100. Dimension (E) is 1-19/32 inches (40.5 mm).

Fig. T11 — When adjusting governor linkage on Models VH70, VM70, VM80 or VM100, loosen clamp screw and rotate governor lever shaft and lever counter-clockwise as far as possible.

Fig. T12 — On Models HH70, HH70, HHH80 and HHH100, rotate governor lever shaft and lever clockwise when adjusting linkage.

Fig. T13 — External governor linkage on Models VH80 and VH100. Refer to text for adjustment procedure.

Fig. T14 — External governor linkage on Models HH80, HH100 and HH120. Refer to text for adjustment procedure.

Fig. T15 — On Models VM70, VH70, HM70, HM80, VM80, HHH80, VM100 and HM100 equipped with magneto ignition, adjust breaker point gap to 0.020 inch (0.508 mm) and align timing marks as shown.
is just below stator laminations as shown in Fig. T17. At this time, points should be ready to open and continuity light should be on. Rotate flywheel until mark just passes under edge of laminations. Points should open and light should be out. If not, adjust points slightly until light goes out. The points are actuated by push rod (53–Fig. T16) which rides against breaker cam (52). Breaker cam is driven by a tang on advance weight (55). When cranking, spring (54) holds advance weight in retarded position (TDC). At operating speeds, centrifugal force overcomes spring pressure and weight moves cam to advance ignition so spark occurs when piston is at 0.095 inch (2.413 mm) BTDC.

An air gap of 0.006–0.010 inch (0.152–0.254 mm) should be between flywheel and stator laminations. To adjust gap, turn flywheel magnet into position under coil core. Loosen holding screws and place shim stock or feeler gage between coil and magnet. Press coil against gage and tighten screws.

**BATTERY IGNITION.** Models HH80, HH100 and HH120 may be equipped with a battery ignition. Delco-Remy 1115222 coil and 1959548 condenser are externally mounted while points are located in crankcase cover. See Fig. T18. Points should be adjusted to 0.020 inch (0.508 mm) gap. To check timing, disconnect primary wire between coil and points and follow same procedure as described in MAGNETO IGNITION section.

**SOLID STATE IGNITION (WITHOUT ALTERNATOR).** The Tecumseh solid state ignition system shown in Fig. T19 may be used on some models not equipped with flywheel alternator. This system does not use ignition breaker points. The only moving part of the system is the rotating flywheel with charging magnets. As flywheel magnet passes...
Fig. T20 — Diagram of solid state ignition system used on some models.

Fig. T21 — View of solid state ignition unit used on some models equipped with flywheel alternator. System should produce a good blue spark ½-inch (3 mm) long at cranking speed.

Fig. T22 — Adjust air gap between long trigger pin and ignition unit to 0.006-0.010 inch (0.152-0.254 mm).

Fig. T23 — Remove flywheel and drive trigger pins in or out as necessary until long pin is extended 0.250 inch (6.35 mm) and short pin is extended 0.187 inch (4.75 mm) above mounting surface.

Fig. T24 — View showing ohmmeter connected for resistance test of ignition generator coil.

Fig. T25 — Ignition generator coil and stator service only as an assembly.

YARD & GARDEN TRACTOR

SOLID STATE IGNITION (WITH ALTERNATOR). The Tecumseh solid state ignition system used on some models equipped with flywheel alternator does not use ignition breaker points. The only moving part of the system is the rotating flywheel with charging magnets and trigger pins. Other components of system are ignition generator coil and stator assembly, spark plug and ignition unit.

The long trigger pin induces a small charge of current to close the SCR (silicon controlled rectifier) switch at engine cranking speed and produces a spark at TDC for starting. As engine rpm increases, the first (shorter) trigger pin picks up the small electric charge and turns SCR switch on, firing spark plug BTDC.

Test ignition system as follows: Hold high tension lead ½-inch (3 mm) from spark plug (Fig. T21), crank engine and check for a good blue spark. If no spark is present, check high tension lead and coil lead for loose connections or faulty insulation. Check air gap between long trigger pin and ignition unit as shown in Fig. T22. Air gap should be 0.006-0.010 inch (0.152-0.254 mm). To adjust air gap, loosen the two retaining screws and move ignition unit as necessary, then tighten retaining screws.

NOTE: The long trigger pin should extend 0.250 inch (6.35 mm) and the short trigger pin should extend 0.187 inch (4.75 mm), measured as shown in Fig. T23. If not, remove flywheel and drive pins in or out as required.

Remove coil lead from ignition terminal and connect an ohmmeter as shown in Fig. T24. If series resistance test of ignition generator coil is below 400 ohms, renew stator assembly (Fig. T25). If resistance is above 400 ohms, renew ignition unit.

LUBRICATION. On Models VH70, VM70, VM80 and VM100, a barrel and plunger type oil pump (Fig. T26 or T27) driven by an eccentric on camshaft pressure lubricates upper main bearing and connecting rod journal. When installing early type pump (Fig. T26), chamfered side of drive collar must be
against thrust bearing surface on camshaft gear. When installing late type pump, place side of drive collar with large flat surface shown in Fig. T27 away from camshaft gear.

An oil slinger (59 - Fig. T28), installed on crankshaft between gear and lower bearing is used to direct oil upward for complete engine lubrication on Models VH80 and VH100. A tang on slinger hub, when inserted in slot in crankshaft gear, correctly positions slinger on crankshaft as shown in Fig. T28.

Splash lubrication system on all other models is provided by use of an oil dipper on connecting rod. See Figs. T30 and T31.

Use only high quality, detergent motor oil having API classification SE, SF or SG. SAE 30 oil is recommended for operating in temperatures above 32°F (0°C) and SAE 10W for operating in temperatures below 32°F (0°C).

**REPAIRS**

**TIGHTENING TORQUE.** Recommended tightening torques are as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Torque (in.-lbs)</th>
<th>(N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder Head</td>
<td>180</td>
<td>(20.3)</td>
</tr>
<tr>
<td>Connecting Rod</td>
<td>120</td>
<td>(13.5)</td>
</tr>
<tr>
<td>Crankcase Cover</td>
<td>110</td>
<td>(12.4)</td>
</tr>
<tr>
<td>Ball Bearing Retainer</td>
<td>20</td>
<td>(2.3)</td>
</tr>
<tr>
<td>Flywheel Nut</td>
<td>440</td>
<td>(49.7)</td>
</tr>
<tr>
<td>Spark Plug</td>
<td>250</td>
<td>(28.2)</td>
</tr>
<tr>
<td>Magneto Stator Mounting</td>
<td>75</td>
<td>(8.5)</td>
</tr>
<tr>
<td>Carburetor Mounting</td>
<td>90</td>
<td>(10.3)</td>
</tr>
<tr>
<td>Cylinder Head</td>
<td>200</td>
<td>(22.6)</td>
</tr>
<tr>
<td>Connecting Rod</td>
<td>110</td>
<td>(12.4)</td>
</tr>
<tr>
<td>Crankcase Cover</td>
<td>110</td>
<td>(12.4)</td>
</tr>
<tr>
<td>Bearing Retainer</td>
<td>110</td>
<td>(12.4)</td>
</tr>
<tr>
<td>Flywheel Nut</td>
<td>650</td>
<td>(73.5)</td>
</tr>
<tr>
<td>Spark Plug</td>
<td>250</td>
<td>(28.3)</td>
</tr>
<tr>
<td>Magneto Stator Mounting</td>
<td>85</td>
<td>(9.6)</td>
</tr>
<tr>
<td>Carburetor Mounting</td>
<td>85</td>
<td>(9.6)</td>
</tr>
</tbody>
</table>

**Fig. T30** - Connecting rods used on Models VH80 and VH100 have two oil holes.

**Fig. T30A** - On Models VM70, VM70, VM80, HM80, HM100 and HM100, install piston on rod with arrow or casting number positioned as shown.

Illustrations courtesy Tecumseh Products Co.
CONNECTING ROD. Piston and connecting rod assembly is removed from cylinder head end of engine. The aluminum alloy rod rides directly on the crankshaft. Running clearance is not adjustable. Crankpin diameter is 1.1865-1.1870 inches (30.137-30.150 mm) on Models VM70, HM70, VM80, HM80, VM100, HM100, HH70 and TH70 and 1.3750-1.3755 inches (34.925-34.938 mm) on all other models.

Connecting rods are equipped with match marks and on some models pistons are marked for correct assembly. See Figs. T29, T30, T30A and T31. Install rod on all models so marks are toward top end of crankshaft. Use new self-locking nuts on rod bolt lock each time rod is installed.

CYLINDER HEAD. When removing cylinder head, be sure to note location of different length cap screws for aid in correct assembly. Always install new head gasket and tighten cap screws evenly in sequence shown in Figs. T32, T33, T34 or T35. Refer to TIGHTENING TORQUE section for correct torque values.

PISTON, PIN AND RINGS. Aluminum alloy piston is fitted with two compression rings and one oil control ring. Ring end gap on all models should be 0.010-0.020 inch (0.254-0.508 mm). Side clearance of new rings in ring grooves of a new piston should be 0.002-0.003 inch (0.051-0.089 mm) on Models HH89, HH-100, HHH-120; 0.0025-0.003 inch (0.0635-0.076 mm) on Models VH100, VH100; 0.002-0.003 inch (0.051-0.0635 mm) on Models VM70, VM70, VM80, HH70, VH70; 0.002-0.005 inch (0.051-0.127 mm) on Models VM100 and HM100. Piston rings and pistons are available in standard size and oversizes of 0.010 and 0.020 inch for Models VM70, VM70, VM80, HM80, VM100, HM100, HH70 and VH70 or in standard size and oversizes of 0.010, 0.020, 0.030 and 0.040 inch for all other models.

The top compression ring must be installed with inside chamfer to top of piston. If second compression ring has a notch on outside of ring, install ring with notch towards bottom of piston skirt. Oil ring can be installed either side up. Stagger ring gaps about 90 degrees around piston.

Piston skirt clearance in cylinder measured at thrust side of piston just below oil ring, should be 0.010-0.012 inch (0.254-0.305 mm) on Model HH120; 0.006-0.008 inch (0.152-0.203 mm) on HH100 and HH120; 0.003-0.004 inch (0.076-0.203 mm) on VH100 and VH100; 0.0045-0.006 inch (0.1143-0.152 mm) on all other models.

Piston pin diameter is 0.6248-0.6250 inch (15.870-15.875 mm) on Models VM70, VM70, VM80, HM80, VM100, HM100, HH70 and VH70 or 0.6873-0.6875 inch (17.457-17.462) on all other models. Piston pin clearance should be 0.001-0.0015 inch (0.0025-0.0203 mm) in rod and 0.0002-0.0005 inch (0.0051-0.0127 mm) in piston. If excessive clearance exists, both piston and pin must be renewed as pin is not available separately.

CYLINDER. If cylinder is scored or if taper or out-of-round exceeds 0.005 inch (0.127 mm), cylinder should be rebored to next suitable oversize. Standard cylinder bore is 2.9375-2.9380 inches (74.6125-74.6379 mm) on Models VM70 and HM70; 3.062-3.063 inches (77.773-77.800 mm) on early Models VM80 and HM80; 3.125-3.126 inches (79.375-
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79.400 mm) on late Models VM80 and HM80; 3.187-3.188 inches (80.950-
3.075 mm) on Models VM100 and HM100; 2.750-2.751 inches (69.850-
9.75 mm) on Models HH70 and VH70; 3.312-3.313 inches (84.125-84.150 mm)
on Models HH80, VH80, HH100 and VH100; 3.500-3.501 inches (88.900-
3.825 mm) on Model HH120.

CRANKSHAFT. Crankshaft main journals ride directly in aluminum alloy
bearings in crankcase and mounting flange (engine base) on vertical crank-
shafts engines or in two renewable steel backed bronze bushings. On some hori-
zontal crankshaft engines, crankshafts ride in a renewable sleeve bushing at
flywheel end and a ball bearing or bushing at pto end. Models HH80,
VH80, HH100, VH100 and HH120 are equipped with tapered roller bearings at
both ends of crankshaft.

Normal running clearance of crankshafts in aluminum bearings or
bronze bushes is 0.0015-0.0025 inch (0.0381-0.0635 mm). Renew crankshafts
if main journals are more than 0.001

inch (0.025 mm) out-of-round or if crank-
pin is more than 0.0005 inch (0.0127
mm) out-of-round.

Check crankshafts gear for wear,
broken tooth or loose fit on crankshaft.
If gear is damaged, remove from crank-
shafts with an arbor press. Renew gear
pin and press new gear on shaft making
certain timing mark is facing pto end of
shaft.

On models equipped with ball bearing
at pto end of shaft, refer to Figs. T36
and T37 before attempting to remove
crankcase cover. Loosen locknuts and
rotate protruding ends of lock pins
counter-clockwise to release bearing and
remove cover. Ball bearing will remain
on crankshaft. When reassembling, turn
lock pins clockwise until flats on pins
face each other, then tighten locknuts to
20 in-lbs. (2.3 N·m).

Crankshaft end play on Models VM70,
HM70, VM80, HM80, VM100, HM100,
HH70 and VH70 should be 0.0005-0.027
inch (0.127-0.686 mm), and is controlled
by washers (25 and 27 – Fig. T40) or (35
and 37 – Fig. T41).

To remove tapered roller bearings (30
and 51 – Fig. T42 or T43) from crank-
shafts on Models HH80, VH80, HH100,
VH100 and HH120, use a suitable puller.
Bearings will be damaged during
removal and new bearings must be in-
stalled. Heat bearings in oil to approxi-
Crankshaft dimensions are as follows:

**Main Journal Diameter**

- **VH70, HH70**
  - Flywheel and pto ends: 0.9985-0.9990 in. (25.362-25.375 mm)
- **VM70, HM70, VM80, HM80, VM100, HM100**
  - Flywheel end: 0.9985-0.9990 in. (25.362-25.375 mm)
  - Pto end: 1.1870-1.1875 in. (30.150-30.162 mm)
- **HH80, VH80, HH100, VH100, HH120**
  - Flywheel and pto ends: 1.1865-1.1870 in. (30.137-30.150 mm)

**Camsiaht.** The camshaft and camshaft gear are an integral part which rides on journals at each end of shaft. Renew camshaft if gear teeth are worn or if bearing surfaces are worn or scored. Cam lobe nose to heel diameter should be 1.3045-1.3985 inches (33.134-33.985 mm) on models HH80, VH80, HH100 and HH120 or 1.269-1.267 inches (32.800-32.182 mm) on all other models. Camshaft journal diameter is 0.6235-0.6240 inch (15.820-15.850 mm). Maximum allowable clearance between camshaft journal and bearing is 0.003 inch (0.076 mm).

Medium frame engines and Models VH70 and VH80 are equipped with Insta-matic Exee-Start compression release camshaft (Fig. T38). Check compression release parts for binding, or excessive wear or other damage. If any parts are damaged or worn, renew com-

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**Fig. T41—Exploded view of horizontal crankshaft engine typical of Models HH70, HM70, HM80 and HM100. Engines may be equipped with crankshaft bushing (41) or ball bearing (36) at pto end of shaft.**

Illustrations courtesy Tecumseh Products Co.
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Complete camshaft assembly. Compression release parts are not serviced separately.

On Models HH80, HH100 and HH120, timing advance unit should be inspected and any worn or damaged parts renewed. Refer to Fig. T43 for exploded view of timing advance (52 through 56).

On all models, when installing camshaft, align timing mark on cam gear with mark on crankshaft gear. Timing mark on crankshaft gear is a chamfered tooth.

VALVE SYSTEM. On Models HH80, VH80, HH100, VH100 and HH120, valve tappet gap with engine cold is 0.010 inch (0.254 mm) for intake and 0.020 inch (0.508 mm) for exhaust. Valve tappet gap on all other models with engine cold is 0.010 inch (0.254 mm) for both valves. To obtain correct gap, grind valve stem end off squarely. Valve seat angle width is 3/64-inch (1.2 mm) on all models. When valve head margin is less than 1/32-inch (0.8 mm), renew valve. See Fig. T39.

Valve guides are non-renewable on all models. If excessive clearance exists, valve guide should be reamed and a new valve with oversize stem installed. Ream guides to 0.344-0.345 inch (8.738-8.763 mm) on Models HH80, VH80, HH100, HH100 and HH120 and to 0.3432-0.3442 inch (8.717-8.743 mm) on all other models.

Valve spring free length should be 1.885 inches (47.88 mm) on Models HH80, VH80, HH100, VH100 and HH120. Valve spring free length should be 1.562 inches (39.67 mm) on all other models.

DYNA-STATIC BALANCER. The Dyna-Static engine balancer operates by means of a pair of counterweighted gears driven by crankshaft to counteract the unbalance caused by counterweights on crankshaft. The balancer used on medium frame engine is similar to those used on heavy frame models. On medium frame models, balancer gears are held in position on the shafts by a bracket bolted to crankcase or engine base (Fig. T44). Snap rings are used on heavy frame models to retain balancer gears on shafts.

The renewable balancer gear shafts are pressed into crankcase cover or engine base. On medium frame models,
Fig. T43—Exploded view of Model HH80, HH100 or HH120 horizontal crankshaft engine.

Press shaft into cover or engine base until a distance of 1.757-1.763 inches (44.628-44.780 mm) exists between shaft bore boss and edge of step cut on shafts and the outer edge of snap ring groove as shown in Fig. T46. Heavy frame model shafts should be pressed until a distance of 1.7185-1.7185 inches (43.528-43.560 mm) exists between cover boss and the outer edge of snap ring groove as shown in Fig. T47.

All balancer gears are equipped with renewable cage needle bearings. See Figs. T48 and T49. Using tool #670230, press new bearings into gears until cage is flush to 0.015 inch (0.381 mm) below edge of bore.

Fig. T44—View showing Dyna-Static balancer gears installed in Model VM80 or VM100 engine base. Balancer gears are identical in models HH80 or HM100 crankcase cover. Note location of washers between gears retaining bracket.

Fig. T45—View showing Dyna-Static balancer gears installed in Model HH80, HH100 or HH120 crankcase cover. Note gear retaining snap rings.

Fig. T46—On Models HM80, VM80, HM100 and VM100, balancer gear shafts must be pressed into cover or engine base so a distance of 1.783-1.783 inches (44.828-44.870 mm) exists between shaft bore boss and edge of step cut as shown.
When reassembling engine, balancer gears must be timed with crankshaft for correct operation. Refer to Figs. T50 and T51 and remove pipe plugs. Insert alignment tool #670240 through crankcase cover of Models HMB80 and HMB100 or engine base of Models VM80 and VM100 and into timing slots in balancer gears. On Models HMB80, HMB100 and HMB120, insert timing tool #670239 through cover and into balancer gears. Then, on all models, turn crankshaft to place piston at TDC and carefully install engine base or cover with balancer gears. When correctly assembled, piston should be on TDC and weights on balancer gears should be in directly opposite position. See Figs. T52 and T53.