

**CONTINENTAL<sup>®</sup>**  
**"R" SERIES**  
**GASOLINE ENGINES**

FORM X-30105

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**SPECIFICATIONS**

**"R" SERIES, FOUR CYLINDER OVERHEAD VALVE  
GASOLINE ENGINES**

ENGINE MODEL	BORE	STROKE	DISPLACEMENT CUBIC INCHES	COMP. RATIO	SPARK PLUG GAP	TAPPET SETTING (COLD)		DIST. POINT GAP
						INT.	EXH.	
R688-46	2.75	2.83	67.6	8.5:1	.025	.005	.008	.018
R800-46	2.28	3.14	51.6	8:1	.025	.005	.008	.018
R810-46	2.87	3.03	78.7	8.5:1	.025	.005	.008	.018
R839-46	2.19	3.14	47.8	8.5:1	.025	.005	.008	.018

DWELL ANGLE	FIRING ORDER	ENGINE OIL CAPACITY *	OIL PRESSURE		VALVE SEAT ANGLE		CHOKE
			IDLE RPM	OPER. SPD. RPM	INT.	EXH.	
61° ± 3°	1-3-4-2	2.75 qts.	10 lbs. @ 600	50 lbs. @ 4000	45°	45°	Manual
61° ± 3°	1-3-4-2	2.75 qts.	10 lbs. @ 500	50 lbs. @ 4000	45°	45°	Manual
61° ± 3°	1-3-4-2	2.75 qts.	10 lbs. @ 600	50 lbs. @ 4000	45°	45°	Manual
61° ± 3°	1-3-4-2	2.75 qts.	10 lbs. @ 650	50 lbs. @ 4000	45°	45°	Manual

\* Add an extra 1/2 pint for oil filter when changing filters.  
NOTE: Electrical System is negative ground.

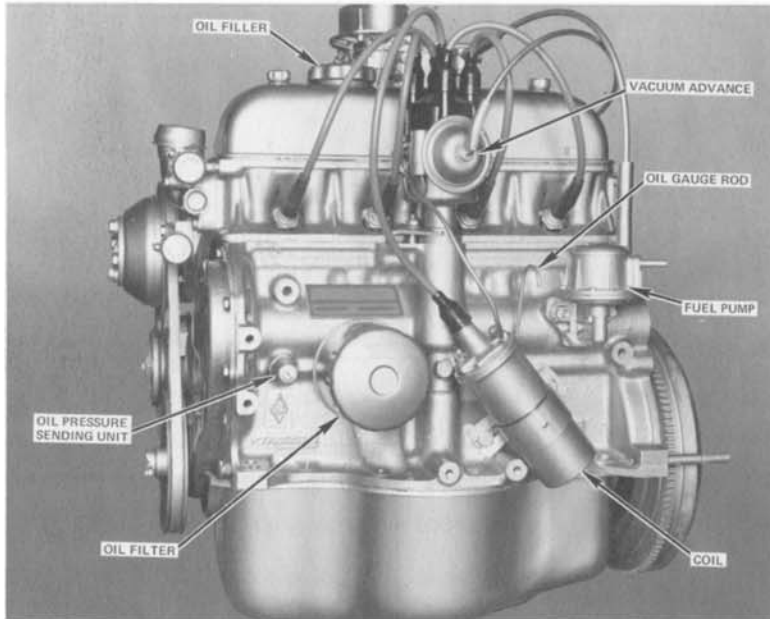


FIGURE 1. TYPICAL R688-R810 ENGINE - LEFT SIDE

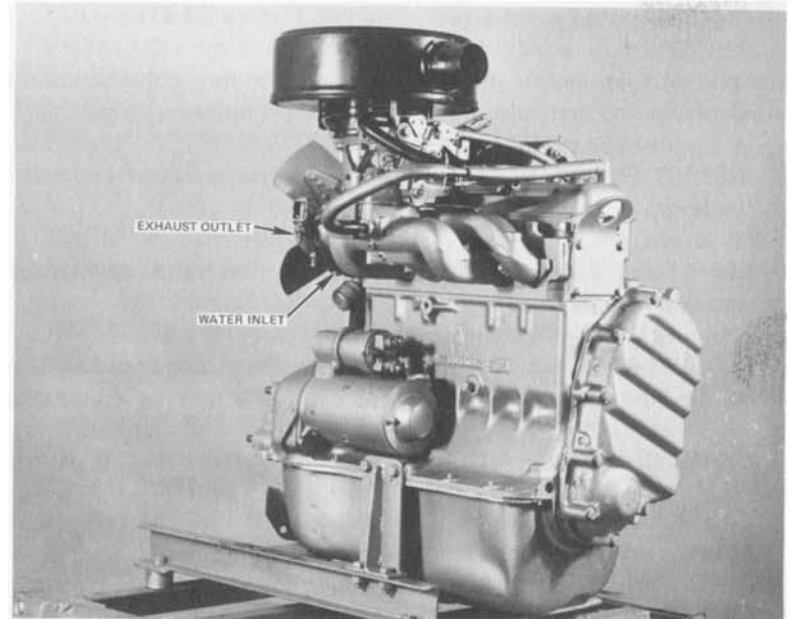


FIGURE 3. TYPICAL R800-R839 ENGINE - LEFT SIDE

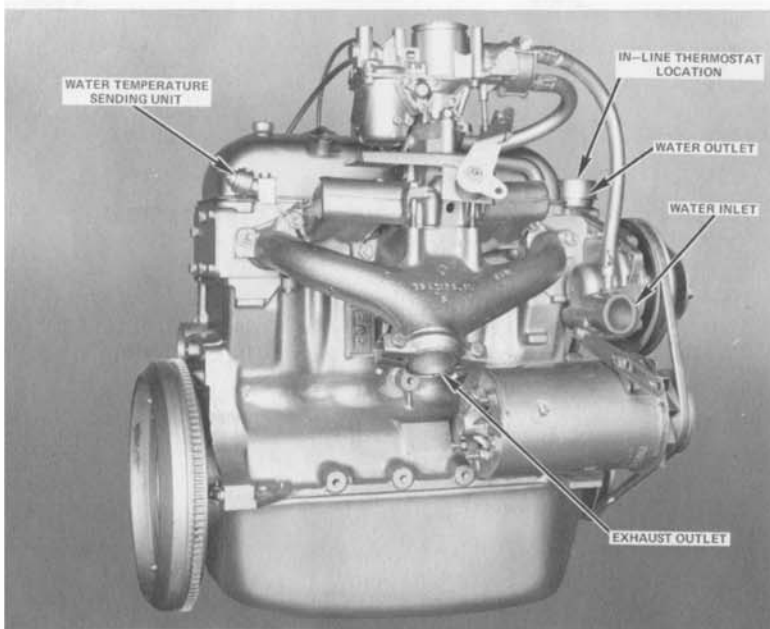


FIGURE 2. TYPICAL R688-R810 ENGINE - RIGHT SIDE

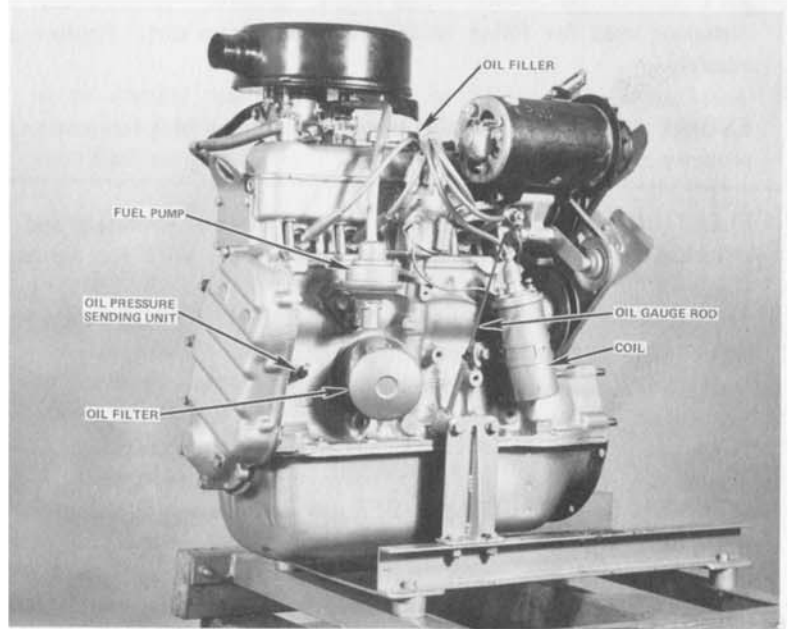


FIGURE 4. TYPICAL R800-R839 ENGINE - RIGHT SIDE

## PREPARATION OF NEW ENGINE FOR OPERATION

Before placing a new engine in operation, it must be thoroughly inspected for external damage and particular attention paid to the following items:

1. INSPECT ENGINE HOLD DOWN BOLTS - make certain that they are firmly set.
2. OPEN FUEL TANK SHUT-OFF VALVE - turn handle counterclockwise as far as it will go.
3. CLOSE WATER DRAIN COCKS - in lower radiator connection, and on the side of the block, (In some cases, this may be a pipe plug.)
4. EXAMINE OIL DRAIN PLUG - make certain that it is tight.
5. FILL CRANKCASE WITH SAE 10W-40 OIL - for the first week or 50-hours operation - then follow lubrication recommendations.
6. FILL RADIATOR TO PROPER LEVEL WITH CLEAN COOLANT - Note: during freezing weather, use a sufficient amount of anti-freeze to protect the system for the lowest anticipated temperature.
7. FILL GASOLINE TANK - Use regular gasoline. Be sure that the container used for filling is clean and free from dirt. Replace cap securely.
8. ENGINE ACCESSORIES - See that all points requiring lubrication are properly lubricated.
9. ELECTRICAL CONNECTIONS - Check battery terminals and all electrical connections. Check each spark plug wire for tightness.
10. THIS ENGINE IS EQUIPPED WITH METRIC THREADS - Be sure to save all attaching bolts and nuts.

## STARTING ENGINE

1. DISENGAGE POWER TAKE-OFF (If Equipped) - Starting engine under load throws overload on starter and battery.
2. OPEN THROTTLE CONTROL ABOUT 1/3 OPEN.
3. TURN ON IGNITION SWITCH.

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4. PULL OUT CHOKE (If manually operated) - but avoid flooding the engine. Operate the engine without choking as soon after starting as possible.
5. PUSH STARTER BUTTON IN - keep on until the engine starts, but not longer than 15 seconds at a time.
6. WARM-UP BEFORE APPLYING LOAD - Idle the engine 600-700 RPM for a few minutes to circulate and warm oil - then increase the speed approximately half throttle until the engine water reaches 100° F. This procedure will prolong the engine life. "Run-in" period for a new engine should be 20 hours before 3/4 load is exceeded.
7. CHECK OIL PRESSURE.
8. CHECK COOLANT TEMPERATURE.
9. DRAIN OIL - Change oil and oil filter after the first 50 hours of operation, using a quality multi-grade oil (10W-40 for normal summer and winter operation; below zero use 5W-20). Add 1/2 pint of oil for oil filter. Replace old oil drain plug gasket with a new one.

### CAUTION

*After starting new engine, run it at idle for 3 minutes, then stop engine and recheck oil level in crankcase; bring oil level to high mark on dipstick.*

### IMPORTANT

*Breaking in a new replacement, or rebuilt engine, for peak performance and economical operation, the following adjustments should be made during the first 10 hours operation.*

- 1) Remove rocker arm cover.
- 2) Torque-down cylinder head capscrews to specification (first 10 hours of operation only). When retorquing, back off number one (1) capscrew 1/4 turn and retorque. Follow this procedure until all capscrews have been retorqued individually.

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## PREVENTIVE MAINTENANCE

- 3) *Adjust valve tappets to specified clearances (refer to page 16).*
- \*4) *Adjust carburetor idle speed to 500-650 RPM minimum.*
- 5) *Re-install rocker arm cover. Check cover gasket for damage and replace if necessary. Replace the thumb nut gaskets with new ones. Finger-tighten thumb nuts. Over tightening may cause gaskets to leak.*

*\*NOTE: This readjustment should also be performed on all new units.*

### RETORQUE CYLINDER HEAD SCREWS

Retorque cylinder head screws in the order shown in figure 5 (first 10 hours only). Refer to torque chart shown below.

When retorquing, back off No. 1 capscrew 1/4 turn and retorque. Follow this procedure until all capscrews have been retorqued individually.

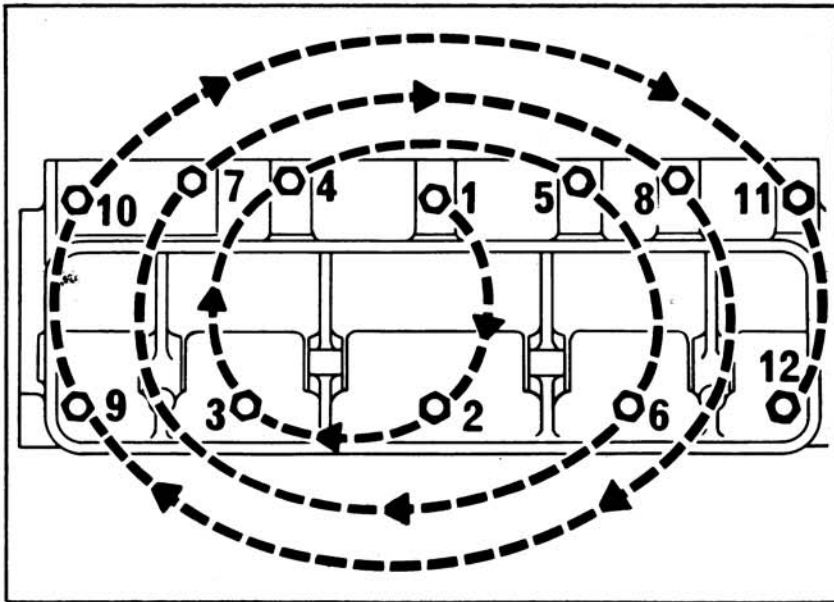


FIGURE 5. TORQUE SEQUENCE

In order to obtain maximum efficiency from your gasoline engine, a definite maintenance program should be set-up and followed. Haphazard maintenance will only lead to faulty engine performance and shorten engine life.

All moving parts in the engine are subject to wear; however, wear can be retarded by careful operation and a planned maintenance program.

In general, gasoline engine operation demands careful attention to cleanliness of air, fuel and oil and maintaining operating temperatures of 180°-200° F.

The following pages, covering DAILY, 50-250 and 500 hour maintenance, have been worked out with our field service division as "Minimum Requirements" to keep your engine in dependable operating condition.

### DAILY PREVENTIVE MAINTENANCE SCHEDULE

#### 1. OVERHAUL VISUAL INSPECTION OF ENGINE.

Look for evidence of fluid leaks on floor, cylinder head and block, indicating loose fuel, oil or water connections. Tighten if found.

#### 2. CHECK OIL LEVEL OF ENGINE.

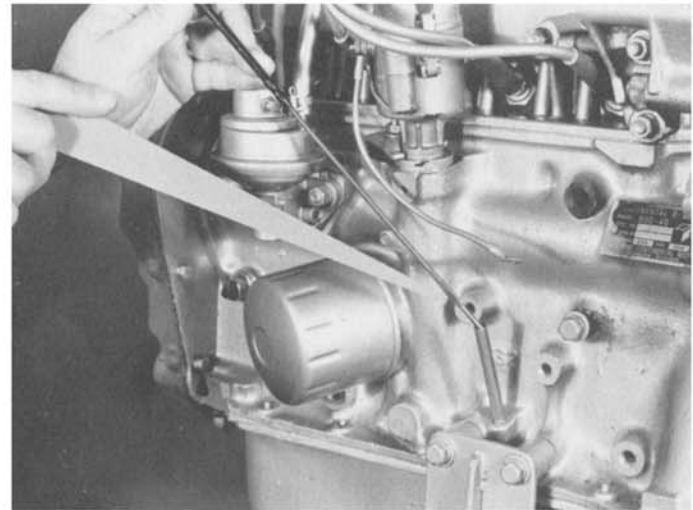


FIGURE 6. CHECKING OIL LEVEL

The dipstick indicates the high and low oil level in the crankcase. Make allowance for additional oil drainage back into oil pan if engine has not been stopped 15 minutes. The most efficient oil level is between the two dipstick levels.

**NOTE**

*Do not add oil until oil level approaches the low mark, then add only enough to bring it to high level, NEVER ABOVE.*

*Do not operate the engine with oil below low level mark.*

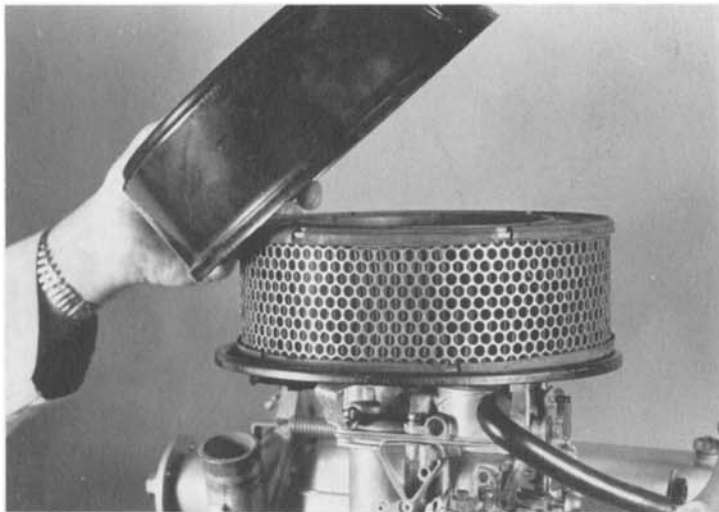
**3. CHECK RADIATOR.**

Fill radiator with a mixture of water and permanent type anti-freeze to normal level (allow for expansion). Visually inspect fan and belt for condition and adjustment.

**4. FILL FUEL TANK.**

This should be done at end of day's operation to prevent condensation forming in tank. Clean filler cap and area around spout before filling to prevent entrance of dust into fuel system.

**5. CHECK AIR CLEANER.**



**FIGURE 7. DRY-TYPE AIR CLEANER**

**A. OIL BATH AIR CLEANER.** Inspect daily or more often in extremely dusty conditions. Change oil and clean cup when oil becomes thick or 1/2 inch of dirt collects in bottom of cup. Always refill cup to exact oil level as indicated on the cup. Use SAE 20 oil in summer and SAE 10 oil or lighter in winter. Inspect all hoses, clamps and connections between air cleaner and engine. Tighten loose clamps and replace damaged hoses promptly.

**B. DRY-TYPE AIR CLEANER.** Under normal conditions, dry-type filters should be serviced every 50 hours of operation. Extreme conditions will require daily cleaning. Cartridge can be cleaned best by flowing compressed air from inside out. Do not apply air closer than 2 inches and don't use more than 30 pounds pressure. Do not damage gasket surface or bend outer screen. Cleaning can only be done a few times as the element will finally clog and restrict air flow. The cartridge must then be replaced.

**CAUTION**

*When replacing with TCM dry element, make sure the large diameter rubber seal is placed at the bottom or carburetor side of the air cleaner.*

*Air cleaner manufacturer's recommendations should be followed in cleaning dry elements.*

**6. CHECK OIL PRESSURE.** See Chart on pages 2 and 3.

**7. NOTE ANY UNUSUAL NOISE.**

Operators familiar with daily engine operation soon becomes alert to any noise not normally present. This is very valuable in correcting defects in the early stages and preventing expensive repairs or delays.

**EVERY 50 HOURS**

**1. REPEAT DAILY OPERATIONS OUTLINED.**

Follow previous instructions.

**2. CHANGE CRANKCASE OIL.**

Engine life is dependent upon clean oil being circulated to all moving parts; therefore, the frequency of oil changes and oil filter replacement is very important and should be made at regular, scheduled periods.

## IMPORTANT

*The schedule for changing oil is directly dependent upon the operational environment. An extremely dirty operation (foundry or cement factory) should be 50 hours or less. When draining the oil, always replace the old oil drain plug gasket with a new one.*

Replace the oil filter element, at every oil change.

Thoroughly clean the filter, cover and sealing surfaces before replacing new element and gasket.

### 3. SERVICE AIR CLEANER.

Every 50 hours or oftener, if conditions require. If oil-bath air cleaner is used, remove bottom half of air cleaner, clean thoroughly and fill with engine oil to oil level mark on cup, avoid overfilling. Replace cup and check all connections to manifold. Be sure that no unfiltered air can enter the engine intake manifold.

If a dry type air cleaner is used, clean element with compressed air. (See Caution on page 11.)

### 4. CHECK FAN BELT TENSION.

The fan belt should require tightening after 50 hours of running. When correctly tensioned deflection should be 3/16 inch under an 8.88 load on the long span of the belt. It is adjusted by moving the generator after loosening the bolt and adjusting lug (Figure 8).

Unnecessary wear on the bearings will result if the belt is over-tightened.

After fitting a new belt, re-tension it after running the engine for 10 minutes and again after approximately 50 hours.

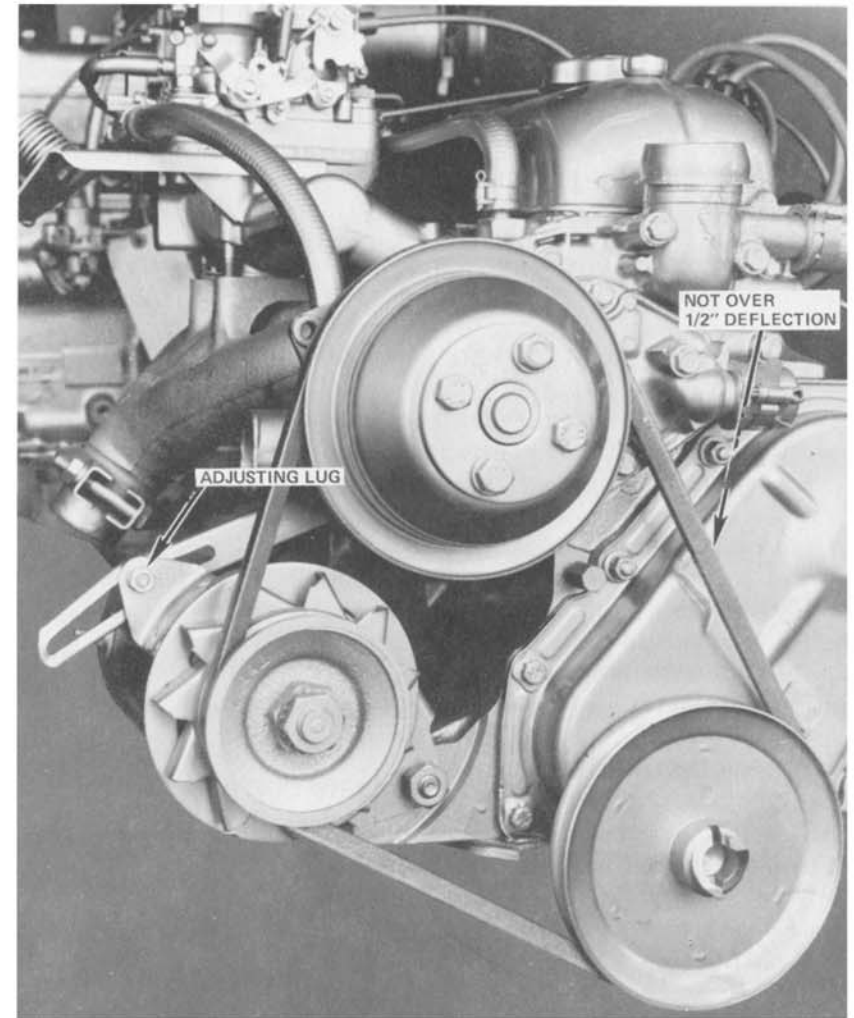


FIGURE 8. CHECKING FAN BELT TENSION

### 5. CHECK BATTERY.

In accordance with equipment manufacturers recommendation.

### 6. LUBRICATE GENERATOR AND STARTER.

If they are equipped with oil cups, apply 3 to 5 drops of engine oil to each cup on the generator and, if required, on the starter. (Many starters and generators have sealed bearings.)



## EVERY 250 HOURS

### 1. REPEAT DAILY AND 50-HOUR SCHEDULES.

Follow previous instructions.

### 2. CLEAN EXTERIOR OF ENGINE.

Use steam, if available, otherwise any good commercial engine cleaner to wash down the engine.

### 3. CHECK GOVERNOR CONTROL. (If Used).

Clean and lubricate all governor linkage to insure free operation of governor. Free-up any joints that may be binding or rods or levers that may be twisted. Check for full throttle opening.

### 4. CLEAN SPARK PLUGS.

Clean depressions around plugs before removing them, then clean and re-set plug gap (See Chart on Page 2).

Install spark plugs (14 mm) and tighten to 25-30 ft./lbs. torque.

### 5. CHECK DISTRIBUTOR.

Clean distributor cap inside and outside with solvent without removing wires and blow off with compressed air. Inspect cap and rotor for cracks.

Examine contact surfaces of points. Replace if burned or pitted, and adjust points to 0.018" gap.

Lubricate distributor cam sparingly.

Check distributor clamp bolts, if found loose, retiming the engine will be necessary.

Correct distributor adjustment can only be carried out on a test bench (by measuring the Dwell percentage, see specifications). Adjustment by measuring the point gap, when fully separated by the action of the cam, is a poor alternative. After adjusting the contact points, the distributor initial setting must be readjusted.

The distributor is set to the correct ignition initial setting by means of a pointer on the timing gear cover and a notch in the crankshaft pulley. At top

dead center, the notch is opposite the pointer tooth which has a hole in it. (On Models R800-R839, the timing mark appears on the flywheel.)

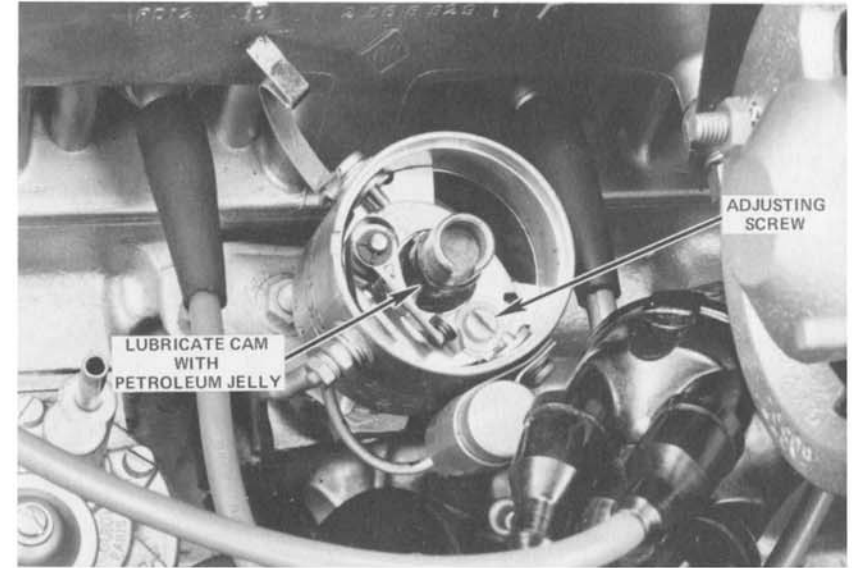


FIGURE 9. DISTRIBUTOR CHECK

### 6. INSPECT IGNITION WIRES AND CONNECTIONS.

Examine ignition wires for breaks in insulation, chafing and loose connections. Replace if defective.

### 7. IF DRY REPLACEMENT ELEMENT AIR CLEANER IS USED, REPLACE ELEMENT.

## EVERY 500 HOURS

### 1. REPEAT DAILY, 50-HOUR AND 250-HOUR SCHEDULES.

### 2. COOLING SYSTEM.

Clean radiator core by blowing out with compressed air. Inspect radiator mounting. Inspect water pump and connections for leaks. Check fan and accessory drive belts.



### 3. ADJUST VALVE TAPPET CLEARANCE.

Check and adjust intake and exhaust valve tappets to correct clearances when engine is cold (Page 2).

When the adjustment has been correctly made, the feeler gauge will pass between the tappet and valve freely.

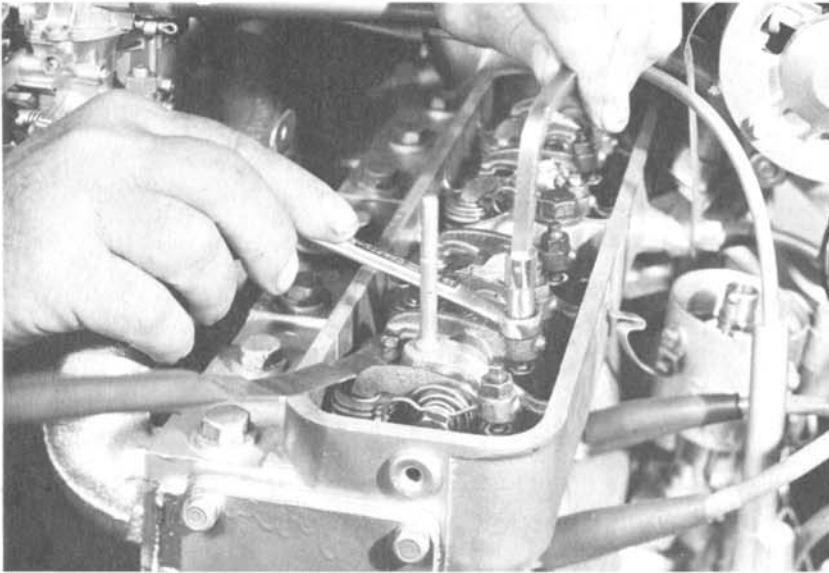


FIGURE 10. ADJUSTING TAPPETS

### 4. BELT TENSIONER PULLEY (For Models R800 and R839).

Remove the snap ring (1) and the grease cap (2) from tensioner pulley. Refill the cap with a quality grease and reassemble.

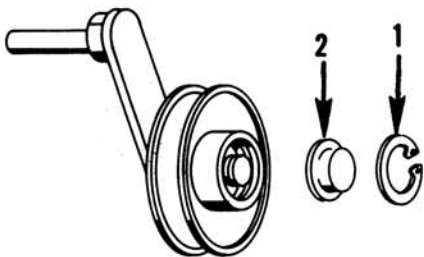


FIGURE 11. BELT TENSIONER PULLEY (for Models R800 and R839)

### ADDITIONAL MAINTENANCE DATA

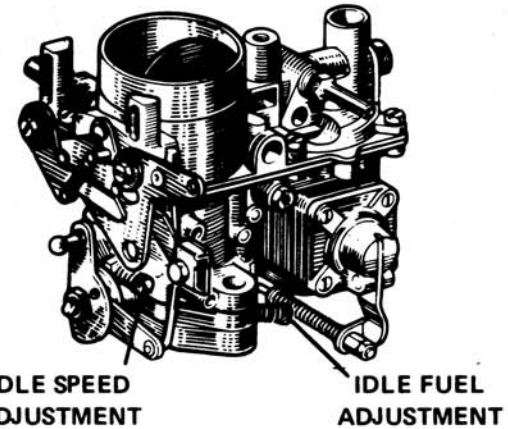


FIGURE 12. R839 CARBURETOR

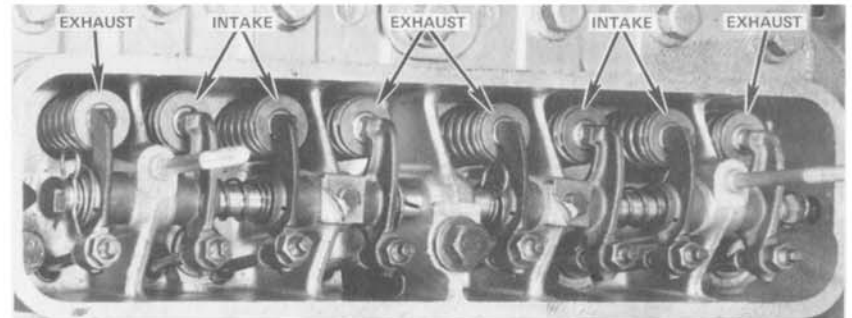


FIGURE 13. EXHAUST AND INTAKE VALVE LOCATION

*cold*  
*Int. .005*  
*Exh. .008*

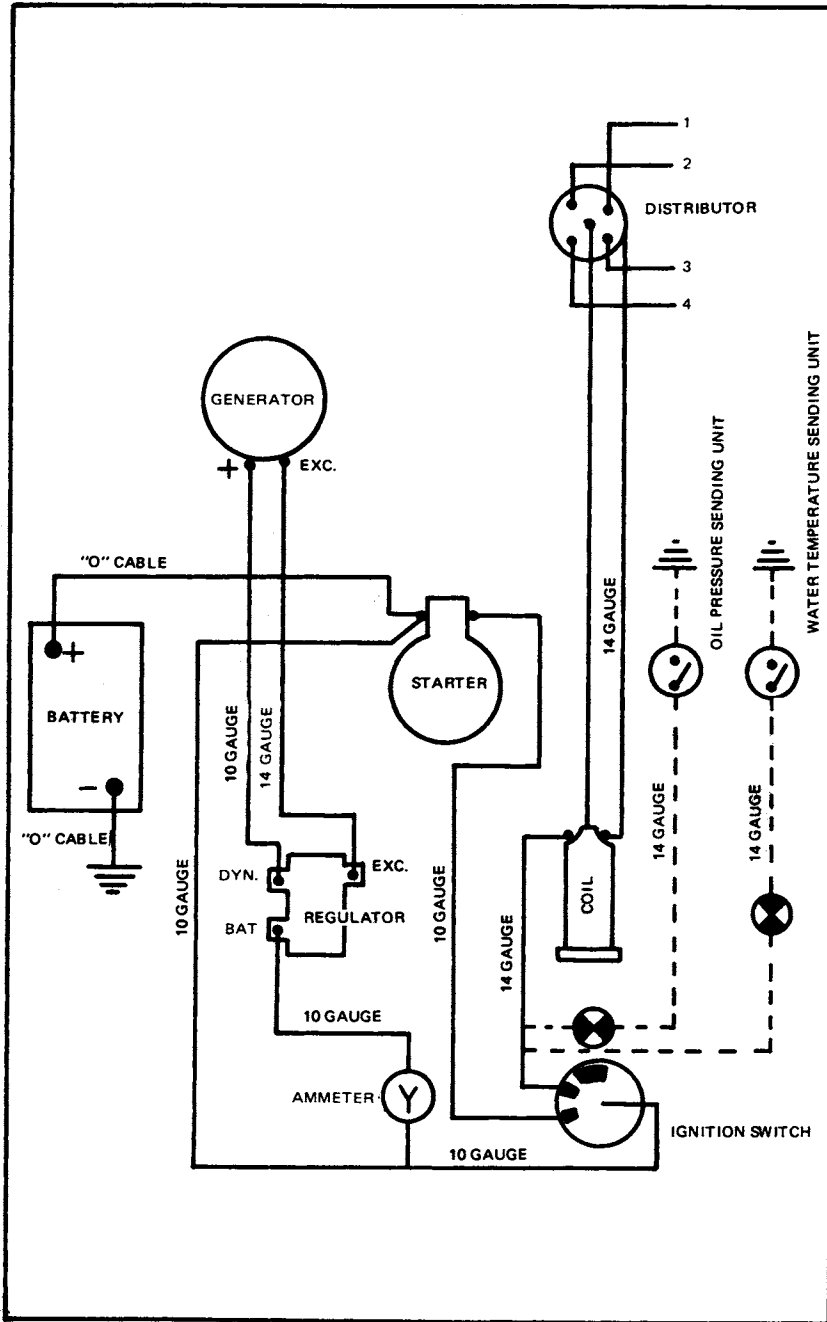


FIGURE 14. WIRING DIAGRAM FOR GENERATOR

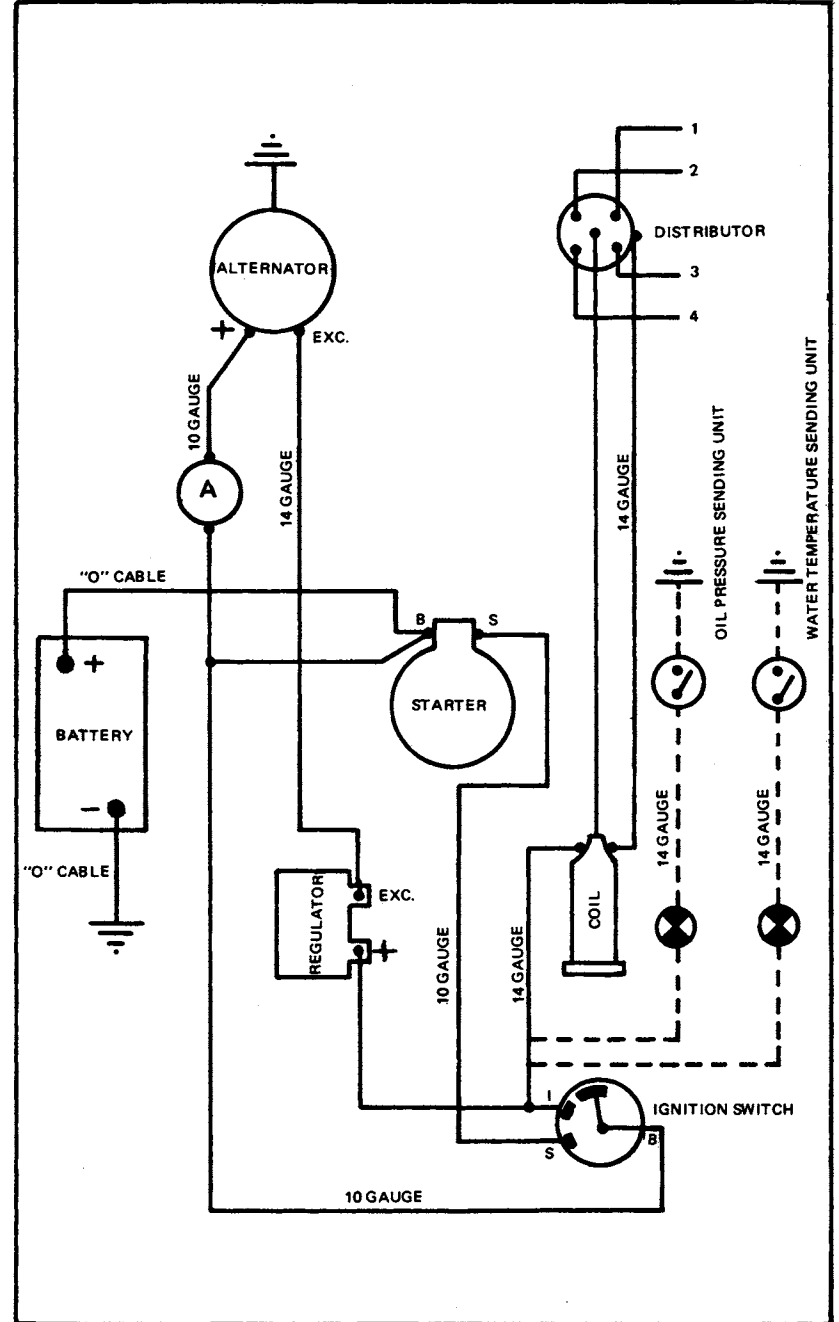


FIGURE 15. TYPICAL ALTERNATOR WIRING DIAGRAM

## DISTRIBUTOR IGNITION TIMING

*With timing light*

Normally the "R" engines, with distributor-ignition, are timed to have the distributor points start to open when No. 1 cylinder is on compression stroke and the mark on the flywheel (or pulley) lines up with the pointer on the housing (or gear cover).

Follow this sequence:

1. Disconnect vacuum advance and tape end of vacuum line.
2. Paint a line on the flywheel (or in some cases, on the front pulley) so the timing mark will be more legible under the timing light.
3. Clip blue secondary lead of light to the No. 1 or No. 4 spark plug. Leave spark plug wire on plug.
4. Connect primary positive lead (red) to positive terminal of battery.
5. Connect primary negative lead (black) to negative battery terminal.
6. Start engine and run at idle speed, 500 RPM or lower, so the automatic advance of the distributor is completely retarded. (Also make sure that the vacuum advance is disconnected.) **THIS IS VERY IMPORTANT TO OBTAIN CORRECT TIMING.**
7. Direct timing light on the crankshaft pulley (or on the flywheel), and note timing marks as light flashes.
8. Timing is set at  $5^{\circ}$  BTDC on the R688 and R180 engines and  $7^{\circ}$  BTDC on the R800 and R839 series engines.
9. To advance timing, turn distributor body *counterclockwise*. To retard timing, turn distributor body *clockwise*.
10. When timing is correct, (timing mark opposite pointer), tighten distributor clamp screw securely, then recheck timing again with light.
11. This operation is best performed in shaded area, so timing light is visible.
12. Using a tachometer, re-set engine RPM to equipment manufacturer's recommendation.

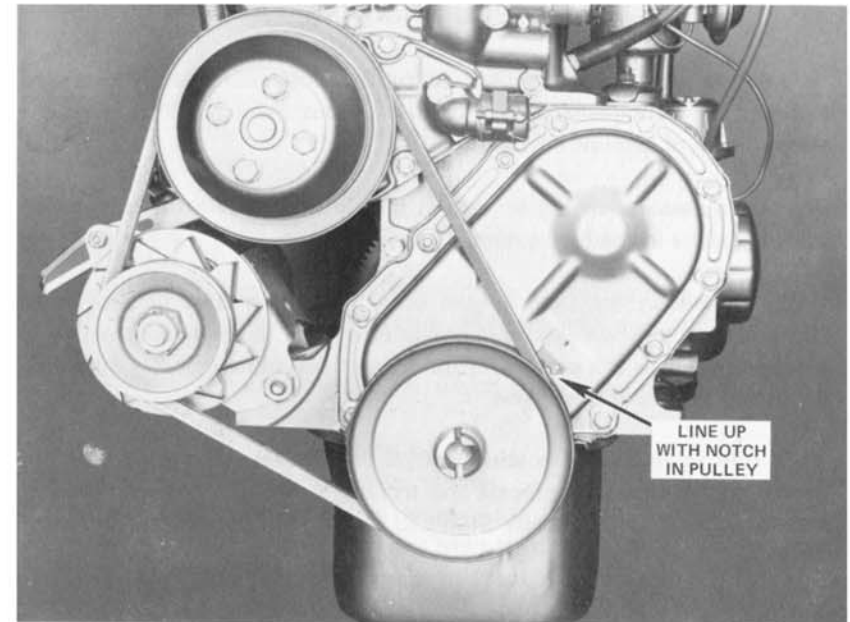


FIGURE 16. TIMING MARKS

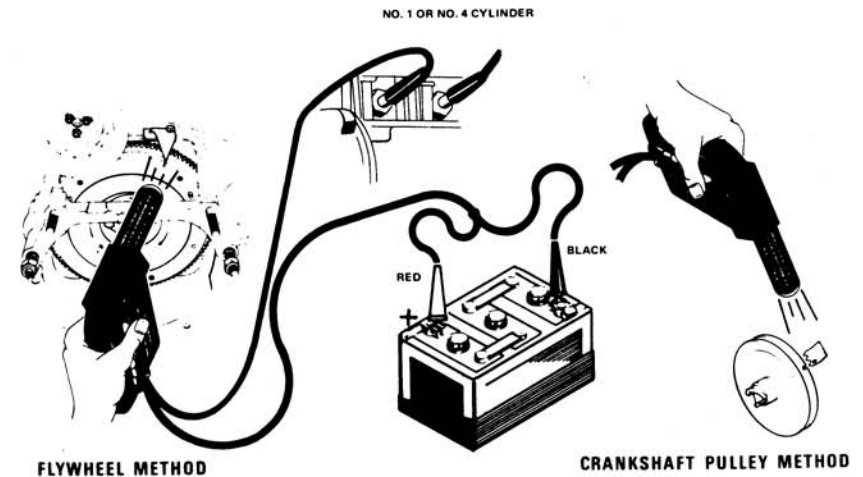


FIGURE 17. CHECKING TIMING WITH A TIMING LIGHT

## TROUBLE SHOOTING

A preventive maintenance system including inspection, lubrication and adjustment as recommended in our Maintenance Section will prevent the greater portion of gasoline engine troubles.

Failure of a gasoline engine to start is mainly due to two things; ignition trouble or failure in the fuel system.

Operators handling the same engine every day, soon develop a sense of impending trouble when abnormal operation occurs. Immediate attention to these danger signals can prevent major failures, insure dependable operation and increase the life of the engine.

A good rule to follow in locating trouble is to never make more than one adjustment at a time, then locate the trouble by a process of elimination. Remember the cause is usually SIMPLE, rather than mysterious and complicated.

Following are listed some of the normal complaints encountered in routine operation of all gasoline engines and the probable causes.

### A. STARTING MOTOR—WILL NOT CRANK ENGINE:

1. Weak or dead battery. (Generator or alternator may not be charging.)
2. Poor ground connection.
3. Faulty starting switch or relay.
4. Defective starting motor.
5. Internal engine seizure. Turn engine manually to determine cause.

### B. ENGINE CRANKS—BUT DOES NOT START:

Disconnect one spark plug wire, turn ignition on with starter cranking engine and free end of wire 1/8 inch from cylinder head. Note spark.

1. No Spark - if ammeter shows no discharge, it indicates an open primary circuit due to:
  - a. Points not closing.
  - b. Open primary wires.
  - c. Defective ignition switch.
  - d. Faulty coil.

### 2. Weak Spark - may be caused by:

- a. Loose ignition wiring connections.
- b. Burned or pitted distributor points.
- c. Wet spark plug wires.
- d. Defective condenser.
- e. Cracked distributor cap.
- f. Weak ignition coil.

### 3. Good Spark at each Plug - indicates that ignition system is OK and trouble is in fuel system, which may be due to:

#### a. No gas in carburetor, which may be due to:

- (1) No gas in tank.
- (2) Clogged filter or lines.
- (3) Faulty fuel pump.
- (4) Leaky fuel line from tank.
- (5) Plugged vent in fuel tank neck.

#### b. Gas in carburetor, which may be flooded due to:

- (1) Too much choking. Plugs are wet.
- (2) Wrong float level.
- (3) Choke not operating correctly.
- (4) Water in gas.

### C. ENGINE RUNS WITH CONTINUOUS MISFIRING DUE TO:

1. Uneven compression.
2. Wet or deteriorated high tension wires.
3. Cracked distributor cap.
4. Faulty spark plug. If spark plug porcelain is white when removed, use COLDER plug, if light brown OK, if black or oily use HOTTER plug.

### D. ENGINE RUNS UNEVENLY:

1. At Idling Speed, which may be due to:
  - a. Too wide spark plug gaps.
  - b. Poor carburetor idle adjustment.
  - c. Wrong float level.
  - d. Carburetor or intake manifold air leaks.
  - e. Leaky cylinder head gasket.

2. At High Speed, which may be due to:
  - a. Wide breaker points.
  - b. Weak distributor breaker arm spring.
  - c. Weak valve springs.
  - d. Spark plug of wrong type or incorrect gap.

**E. ENGINE RUNS IMPROPERLY:**

1. Back-Firing into Manifold - indicates too rich a fuel mixture; into carburetor indicates too lean a mixture, may be due to:
  - a. Late ignition timing.
  - b. Clogged air cleaner.
  - c. Fuel line restrictions.
  - d. Clogged carburetor jets.
  - e. Sticking valves.
  - f. Weak or broken valve springs.
2. Excessive Ping (Detonation) - results in damaged pistons, bearings, cylinder head, gaskets and is caused by pre-ignition or using inferior grade of gas.
3. Engine Idles Too Fast - indicates improper throttle adjustment or weak throttle return springs.
4. Engine Dies When Idling - which indicates incorrect speed or mixture adjustment; clogged idling circuit in carburetor or wrong choke adjustment, or air leaks in intake manifold.
5. Engine "Stumbles" on Acceleration - which may be due to defective accelerator pump or air in fuel lines.
6. Defective Spark Plugs.

**F. LACK OF POWER - which may be due to:**

1. Poor compression.
2. Wrong timing.
3. Throttle control not opening fully.
4. Air leak in fuel system.
5. Restriction in air cleaner, should have vacuum less than 10-inches of water.
6. Exhaust line obstructed, should have back pressure of not more than 20-inches of water.

7. Poor fuel.
8. Piston rings sticking or worn.

**G. POOR COMPRESSION:**

Check with compression gauge, if irregular, seal the piston with a teaspoonful of engine oil through the spark plug hole, and take a second reading; if pressure does not increase, this will indicate that poor seating of valves is the trouble. Pressure between the four cylinders should not vary more than 10%. Poor compression may be due to:

1. Valves holding open. No tappet clearance.
2. Leaky cylinder head gasket.
3. Broken or weak valve springs.
4. Burned or sticking valves.
5. Badly worn, broken or stuck piston rings.
6. Wrong valve timing.

**H. OVERHEATING:**

1. Lack of water in radiator.
2. Fan belts slipping.
3. Thermostat sticking or inoperative.
4. Radiator clogged or leaky.
5. Late ignition timing.
6. Back pressure in exhaust line.
7. Defective water pump.
8. Overloading of engine.

**I. LOW OIL PRESSURE:**

1. Low oil level.
2. Oil pressure gauge or line faulty.
3. Oil too light, diluted.
4. Suction screen plugged.
5. Dirt in relief valve or broken spring.
6. Worn bearings.
7. Worn or damaged oil pump gears.
8. Worn cam bushings.

**J. HIGH OIL PRESSURE:**

Oil pressure should not exceed recommended pressure except when engine is starting up cold. Abnormally high oil pressure is not desirable because it increases oil consumption. Possible causes of high oil pressures are:

1. Engine oil too heavy.
2. Stuck relief valve.
3. Obstruction in distributing line.
4. Faulty oil pressure gauge.

**K. HIGH OIL CONSUMPTION:**

1. Oil leaks.
2. Too high oil level.
3. Incorrect grade of oil used.
4. Clogged crankcase breather.
5. Oil pressure too high, stuck relief valve.
6. Piston rings not run-in, due to too smooth cylinder bore finish or glazed condition.
7. Worn, broken or stuck piston rings and clogged oil control rings.
8. Worn, pistons and sleeves.
9. Worn bearings.
10. Worn valve guides.

**L. ENGINE KNOCKS AND OTHER NOISES:**

1. Operating Knocks - which may be due to:
  - a. Pre-ignition, most common cause is due to wrong type plugs which are too hot.
  - b. Carbon, noticeable when engine is accelerated while hot. Clean head and pistons.
  - c. Timing. Early timing causes knocks similar to carbon, but may tend to kick back when starting.
  - d. Fuel. Detonation knock caused by poor gas.
  - e. Overloads, particularly at lower operating speeds.
2. Mechanical Knocks - result from wear, abuse or improper adjustments, which may be due to:
  - a. Crankshaft and Main Bearings:
    - (1) Worn or Burned-out Main Bearings - a heavy, dull knock when accelerating under load. Locate by shorting out plugs on both sides of the bad bearing.
    - (2) Crankshaft End Play - excessive end play is indicated by an intermittent knock which will come and go when the load is released and engaged.

b. Connecting Rod Bearings:

- (1) Worn or Burned-out Bearings - the worst condition, a light pound or metallic knock, is noted at idling and to about 2/3 maximum speed. Bad bearings can be determined by shorting out plugs.

c. Pistons and Piston Pins:

- (1) Loose Piston Pins - noise doubles when the correct plug is shorted out, most noticeable at idling speed.
- (2) Piston Loose in Cylinder - "Piston-Slap" is noted by metallic knocking at low speed under load; but disappears at high speed, also most noticeable when starting cold. Test by shorting out plugs.

d. Broken Piston Ring or Pin - sharp clicking noise that won't short out.

e. Valves:

- (1) Burned Valves and Seats - engine misses, especially at low speeds, or acceleration under load.
- (2) Weak or Broken Valve Springs - missing at low or high speeds when under load.
- (3) Sticking Valves - loss of power and popping sound when bad.
- (4) Tappet Noise - excessive clearances cause noise when cold which diminishes at normal operating temperature.

f. Camshaft - noise due to loose bearings or end play, usually occurs at half engine speed.

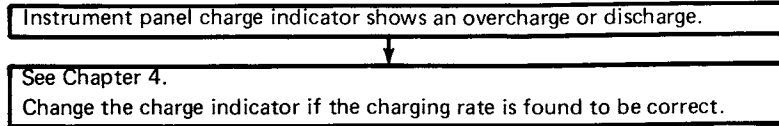
3. Vibration Originating at Engine - the most common sources of vibration originating in or on the engine, as distinguished from causes created outside the engine are as follows:

- a. Misfiring.
- b. Misalignment of engine.
- c. Bent or off-center coupling.
- d. Engine loose on bed and type of mountings.
- e. Out of balance condition of flywheel and clutch assembly.

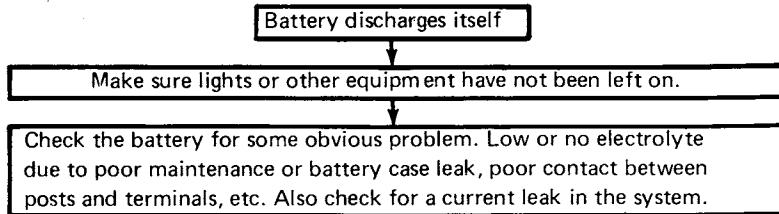
## M. ELECTRICAL—CHARGING CIRCUIT:

Details are given below of a method to be used when checking the various components in the charging circuit fitted with an alternator.

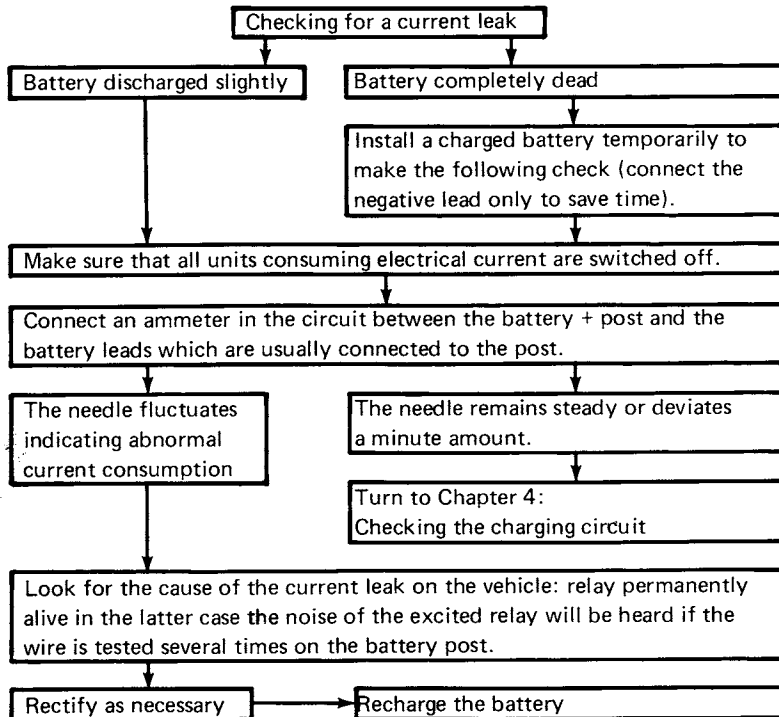
### CHAPTER 1



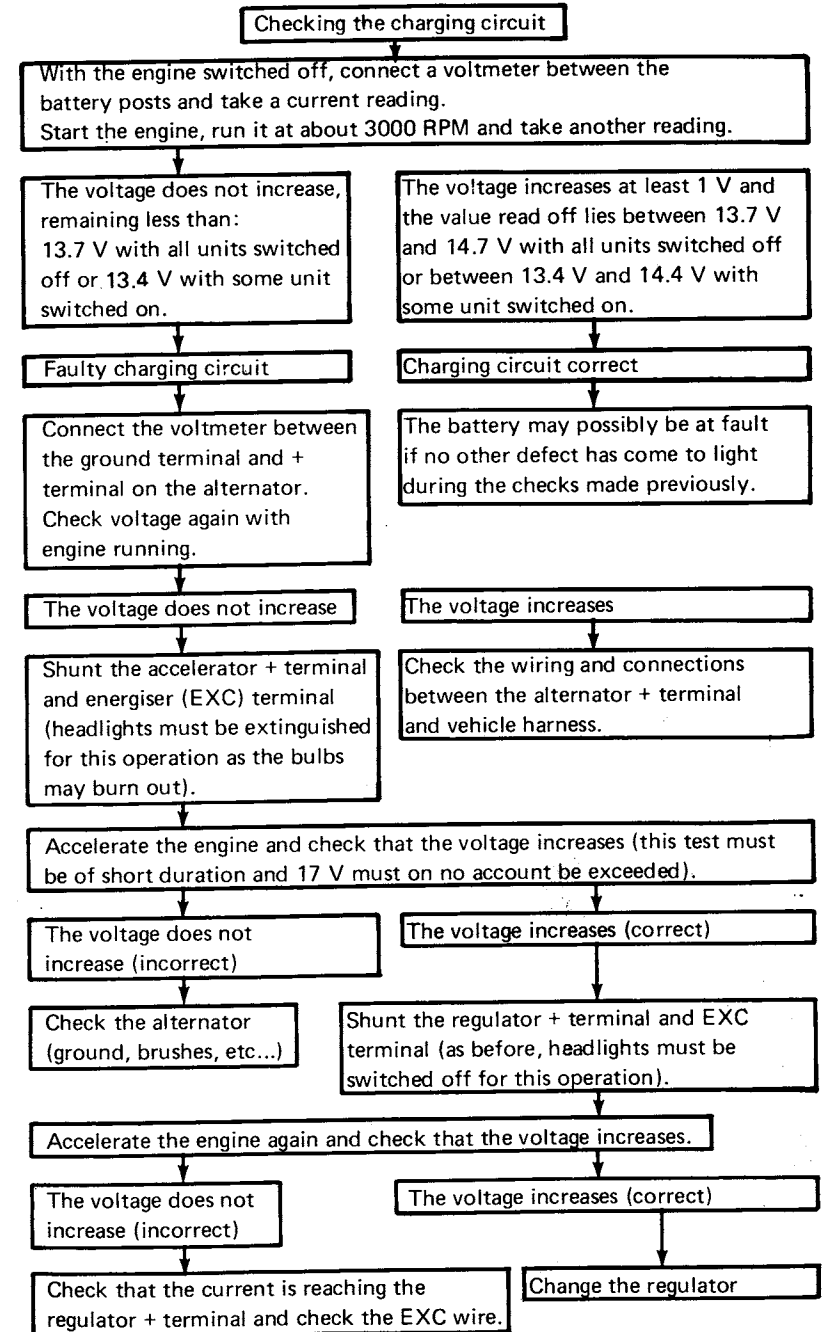
### CHAPTER 2



### CHAPTER 3



## CHAPTER 4





## CHAPTER 5

Checking alternator output  
(amperage)

Connect on ammeter in series to the circuit (as in Chapter 3), before starting the engine.  
Increase the engine speed up to about 2500 RPM.  
Switch on all possible units using current.  
Read off the amperage output.

Alternator output should increase each time a unit is switched on.  
The alternator output will not exceed the maximum values of 35A, 40A or 50A respectively, depending on the type of alternator fitted to your equipment.

## CHAPTER 6

*Possible incidents on the battery, battery charge indicator, alternator or regulator:*

### A. BATTERIES:

1. Lack of maintenance or vehicle parked an extended time
  - (a) Insufficient or no electrolyte
2. Manufacturing incident
  - (a) Leakage (small bridge)
  - (b) Faulty soldering
  - (c) Leak from joint
3. Exterior causes affecting the battery
  - (a) Some units remain switched on
  - (b) Relay cross connected (constantly alive)

### B. BATTERY CHARGE INDICATOR:

1. False reading due to poor adjustment or being out of adjustment

### C. INCIDENTS ON ALTERNATORS AND REGULATORS:

Incident	Possible Causes		
	Drive Belt	Alternator	Regulator
No Charge	Broken	- worn brushes or poor contact - charging circuit or ground return cut - energising circuit cut	Internal fault
Low or unsteady charge	Slack	- worn brushes or poor contact - charging circuit broken intermittently - rectifying diode short-circuiting	Poor contact on + terminal or EXC terminal
Excessive output and high voltage			Internal fault or poor ground between alternator and regulator
Alternator noisy	Whistling due to incorrect voltage or wear	- rectifying diode short-circuiting - stator winding short-circuiting - worn bearing - loose pulley - alternator pulley and drive pulley out of line	

## TORQUE SPECIFICATIONS

The "R" engines have many studs, bolts and cap screws of special material and sizes and it is very important that special care is exercised to replace all studs and bolts in their respective locations during assembly of engine.

The torque specifications, foot pounds, listed below, MUST be followed in order to have the assembled engine conform to the original specifications:

	R688-46	R800-46 R839-46	R810-46
Cylinder Heads	45	45	45
Connecting Rods	25-30	25-30	30-35
Main Bearing Caps	45	45	45
Flywheel	35-40	30-35	35-40
Manifolds	10-13	10-13	10-13
Camshaft Nut	10-12		10-12

## PREPARATION OF ENGINE FOR SEASONAL STORAGE

### CAUTION

*Before starting the processing, engine must be cooled down to the surrounding temperature, since oil will adhere much better to cold metal surfaces.*

1. DRAIN OIL FROM OIL PAN - and replace drain plug.
2. REFILL OIL PAN - with anti-rust oil that meets Specification MIL-L21260-30 to one-half its normal capacity.
3. START UP ENGINE - and run at above 600 RPM for two minutes to complete oil distribution on all surfaces. DO NOT RUN LONGER THAN TWO MINUTES.
4. STOP ENGINE. Remove all spark plugs.
5. POUR ONE OUNCE OF ANTI-RUST ENGINE OIL - into each spark plug hole.
6. IGNITION CUT OFF – CRANK ENGINE WITH STARTER - for at least a dozen revolutions to distribute this oil over the cylinder walls and valve mechanism.
7. DRAIN OIL FROM PAN AND REASSEMBLE PLUG.
8. DRAIN COOLING SYSTEM AND CLOSE DRAIN COCKS.
9. DRAIN ALL GASOLINE - from tank, lines and carburetor bowl.
10. REPLACE ALL SPARK PLUGS.
11. SEAL AIR CLEANER INLET, EXHAUST OUTLET, CRANKCASE BREATHER TUBE - with weather proof masking tape.
12. CHECK OIL FILLER CAP, GAS TANK CAP AND RADIATOR CAP to make certain they are securely in place.

## SHORT TERM STORAGE

(Instructions below should be adhered to every 90 days on outside storage and every six months on inside storage.)

If the shut down period is to be over 30 days duration, the following instructions should be adhered to:

1. Stop engine, remove spark plugs.
2. Pour one ounce of clean engine oil in each spark plug hole.
3. With ignition off, crank engine with starter at least a dozen revolutions to distribute this oil over the cylinder walls and valve mechanism.
4. Replace all spark plugs.
5. Remove drain plug from carburetor bowl and drain gasoline.
6. Replace drain plugs.

### CAUTION

*Gasoline evaporates if left in carburetor for long periods. This evaporation of gasoline will leave a gum and varnish coating over jets and moving parts; when engine is started up again, you may have flooding or poor operation from carburetor.*