

# ENGINE TUNE-UP

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### GENERAL DESCRIPTION

A minor tune and test consists of testing battery, cleaning, regapping or replacing, if required, spark plugs and distributor points; adjusting distributor dwell angle, ignition timing, carburetor idle mixture, hot idle speed and fast idle speed, checking manifold heat control valve and check automatic choke operation and setting.

The complete or major tune and test procedure consists of these basic items plus other ignition,

compression, electrical and carburetor checks, and a final road test to ensure continued trouble free operation.

### BASIC PROCEDURE

#### CONNECT TUNE-UP EQUIPMENT

Follow manufacturer recommendations for the use of testing equipment. Fig. 6C-1 shows a basic schematic for instrumentation which will apply to many types of test equipment and may be used as a rough

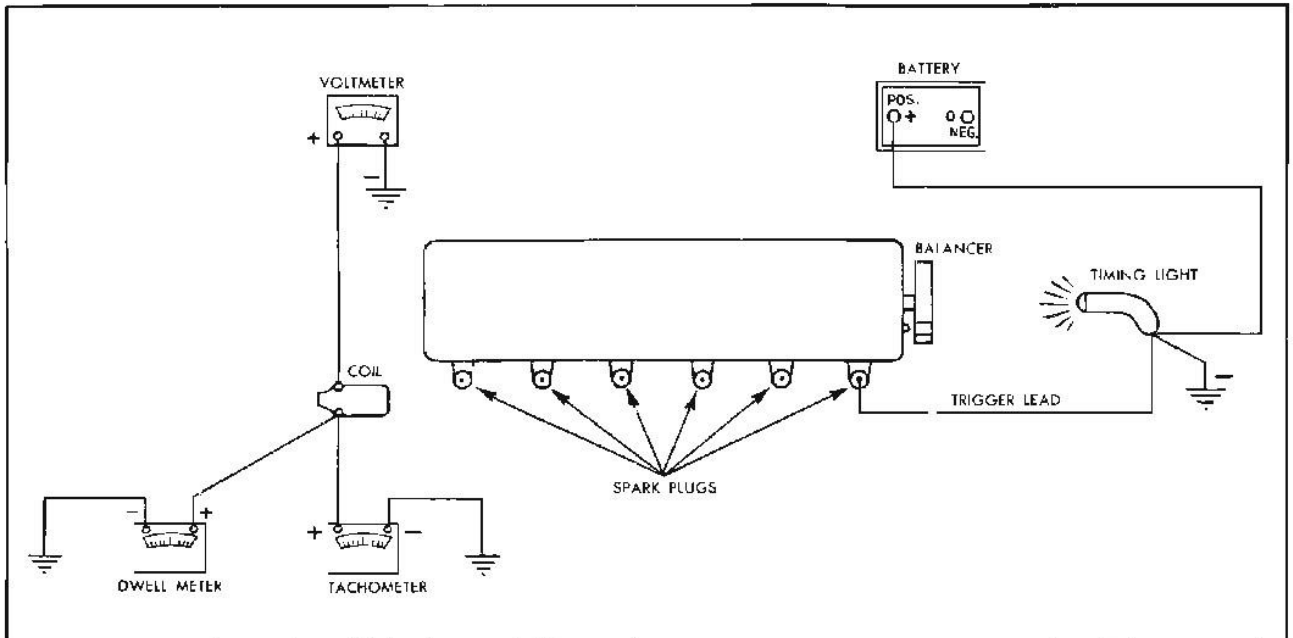


Fig. 6C-1 Basic Instrumentation for Tune-up

guide if equipment manufacturers instructions are not available.

Connections shown in Fig. 6C-1 are made as follows:

1. Voltmeter
  - a. Positive lead to resistor side of coil.
  - b. Negative lead to ground.
2. Timing Light
  - a. Positive lead to positive battery terminal.
  - b. Negative lead to ground.
  - c. Trigger lead to number 1 spark plug.
3. Tachometer
  - a. Positive lead to distributor side of coil.
  - b. Negative lead to ground.
4. Dwell Meter
  - a. Positive lead to distributor side of coil.
  - b. Negative lead to ground.

#### TEST BATTERY VOLTAGE BEFORE AND WHILE CRANKING ENGINE

*NOTE: Disconnect distributor to coil primary wire during this test to prevent engine from firing.*

Terminal voltage while cranking must not be less than 9.0 volts. Engine cranking speed (approximately 180 rpm) should also be observed during this check to see that it is satisfactory. If cranking speed is low, check starting circuit to locate cause of low speed. If battery voltage is low while cranking, further tests of battery and/or starting motor circuit should be made to locate trouble.

To insure proper electrical operation, the battery should be in good condition and be adequately charged. Check cell to cell voltage as outlined in section 11 and recharge or replace as necessary.

#### REMOVE AND RECONDITION SPARK PLUGS

See that correct spark plugs are used. Spark plug insulators should be thoroughly cleaned to prevent

possible flash-over. Thoroughly clean lower insulator and cavity by sand blasting. File both electrodes flat (rounded surfaces increase voltage required to fire plugs) and set gap to .035". When plugs are reinstalled, use new gaskets and tighten plugs to 25 lb. ft. torque.

#### CLEAN AND ADJUST DISTRIBUTOR POINTS

Remove distributor cap and inspect points for excessive burning or pitting. Replace points if necessary. Use a point file to clean contact area and remove scale from points. Filing is for cleaning purposes only. Do not attempt to remove all roughness. Apply a trace of bearing lubricant to the breaker cam. Adjust distributor dwell angle to 31-34 degrees on six cylinder models and 26-32 degrees on eight cylinder models.

#### SET IGNITION TIMING

With distributor vacuum line disconnected and car operating at normal idle speed or below, set ignition timing. Follow procedure outlined in Section 11 of this manual. Correct settings are 4° BTDC for 6 cyl. engines, 6° BTDC for V-8 engines.

#### ADJUST HOT IDLE SPEED AND MIXTURE

Following adjustment procedure outlined in section 6B, adjust carburetor idle speed and mixture to the following specifications:

	RPM	
	6 Cyl.	8 Cyl.
S.M. Transmission	580-600	580-600
S.M. Transmission with Air Conditioning*	580-600	640-660
Auto. Transmission with "Drive"	480-500	480-500
Auto. Transmission with Air Conditioning*	480-500	540-560

\*IDLE SPEED-UP DEVICE On automatic transmission and synchromesh transmission 6-cylinder engines with air conditioning only. Set hot idle speed and mixture as above and on automatic transmissions leave transmission in drive. Turn air conditioning on for maximum cooling and adjust diaphragm plunger screw to obtain the following engine speeds.

A. Automatic transmission	480-500
B. Synchromesh transmission	580-600

*CAUTION: The idle speed-up diaphragm plunger must be restrained from turning while adjusting plunger screw to prevent injury to diaphragm.*

### ADJUST FAST IDLE SPEED

Following procedures outlined in Section 6-B, adjust fast idle speed to the following:

V-8 (4 Bbl.)	2500 RPM
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### ANTI-STALL DIAPHRAGM SETTING

Before attempting to set the anti-stall diaphragm, the hot idle speed must be adjusted on 1 and 2 Bbl. carburetors, and the hot idle speed and fast idle speed both must be set on the 4 Bbl. carburetor to specifications.

With the engine running, place transmission in neutral, disconnect the vacuum hose from throttle return check and plug end of vacuum hose. Adjust the contact screw of the throttle return check to obtain 1030-1080 RPM. After adjustment, unplug vacuum hose and reconnect to throttle return check.

*CAUTION: The anti-stall diaphragm plunger must be restrained from turning while adjusting plunger screw to prevent injury to the diaphragm.*

### SEE THAT EXHAUST MANIFOLD HEAT VALVE OPERATES FREELY

Manifold heat valve must operate freely. If stuck open, it can cause sluggish operation of the engine, especially during warm-up. If stuck closed, engine performance when hot will be unsatisfactory.

### CHECK CARBURETOR CHOKE AND UNLOADER OPERATION AND ADJUSTMENT

The specified choke setting provides ideal choke operation in all climates. No seasonal changes are necessary.

Settings are listed in Section 6-B.

The choke should just close at 75°F. when set at index. In rare cases, it may be necessary to change

slightly (never more than two notches) from the standard setting to properly calibrate the choke. Excess carbon in choke housing may indicate a leaking choke heat tube.

Choke linkage and fast idle cam must operate freely. Do not lubricate linkage since this will collect dust and cause sticking.

Check unloader action. Inoperative unloader can cause complaints of difficult hot starting. Adjust as outlined in Section 6-B.

### ADDITIONAL PROCEDURES

For diagnosis purposes, it is sometimes necessary to proceed further than the basic tune-up procedure. The following steps plus a road test are included in a complete or major tune and test procedure.

### CLEAN TOP OF BATTERY, TIGHTEN TERMINALS AND HOLD DOWN CLAMP

*CAUTION: Never reverse battery leads, even for an instant, as reverse polarity current flow will damage diodes in the alternator.*

Clean top of battery and terminals with a solution of baking soda and water. Rinse off and dry with compressed air. The top of the battery must be clean to prevent current leakage between the terminals and from the positive terminal to the hold down clamp.

In addition to current leakage, prolonged accumulation of acid and dirt on top battery may cause blistering of the material covering the connector straps and corrosion of the straps. After tightening terminals, coat them with petrolatum to protect them from corrosion.

*CAUTION: Excessive tightening of the hold down clamp can crack the battery case.*

### TEST COMPRESSION PRESSURE OF EACH CYLINDER

*NOTE: If this test is to be performed, it should be done when plugs are removed for service during the basic tune-up procedure.*

Unless checking for worn rings or for the cause of low speed miss, compression check should not be necessary.

Test compression with engine warm, all spark plugs removed and throttle and choke open. No cylinder should be less than 80% of the highest cylinder (see examples). Excessive variation between cylinders, accompanied by low speed missing of the cylinder or cylinders which are low, usually indicates a valve not properly seating or a broken piston ring. Low pressures, even though uniform, may indicate worn rings. This may be accompanied by excessive oil consumption.

#### TEMPEST (6 Cyl.)

##### Example 1

Cyl.	1	2	3	4	5	6
Press.	129	127	130	121	116	102

80% of 130 (highest) is 104. Thus cylinder No. 6 is less than 80% of No. 3. This condition, accompanied by low speed missing, indicates a burned valve or broken piston ring.

##### Example 2

Cyl.	1	2	3	4	5	6
Press.	85	96	90	87	85	91

80% of 96 is 77. While all cylinders are well above 77, they are all excessively low. This indicates all poor valves or, if accompanied by oil consumption, worn rings or low crank speed.

If compression is subnormal, the tune-up will probably not be satisfactory.

#### TEMPEST (V-8)

##### Example 1

Cyl.	1	2	3	4	5	6	7	8
Press.	136	138	135	144	102	137	140	141

80% of 144 (highest) is 115. Thus cylinder No. 5 is less than 80% of No. 4. This condition, accompanied by low speed missing, indicates a burned valve or broken piston ring.

##### Example 2

Cyl.	1	2	3	4	5	6	7	8
Press.	85	91	90	87	96	93	87	89

80% of 96 is 77. While all cylinders are well above 77, they are all excessively low. This indicates all poor valves, or if accompanied by oil consumption, worn rings or low crank speed. If compression is subnormal, the tune-up will probably not be satisfactory.

#### CLEAN CARBURETOR AIR CLEANER AND CRANKCASE VENTILATOR AIR CLEANERS

The entire air cleaner should be removed from the car for cleaning. The metal cover and shell of the air cleaner should be cleaned on the inside surfaces.

Remove filter element from standard carburetor air cleaner. Wash dirt from filter element and from crankcase ventilator inlet by plunging up and down several times in suitable solvent. Drain dry and re-oil.

The heavy duty air cleaner element should be washed in kerosene, squeezed dry and dipped in SAE 10W-30 oil. Squeeze dry again to remove excess oil. DO NOT WRING DRY.

#### CLEAN AND INSPECT HIGH TENSION WIRES, DISTRIBUTOR CAP AND ROTOR

*NOTE: This operation is to be performed while checking distributor points during the basic tune-up procedure. Inspect distributor cap for cracks and flash over.*

External surfaces of all parts of the secondary system must be cleaned to reduce the possibility of voltage loss. All wires should be removed from the distributor cap and coil so that terminals can be inspected and cleaned. Burned or corroded terminals indicate that wires were not fully seated, causing arcing between the end of the wire and the terminal. When replacing wires in terminal, be sure they are fully seated before pushing rubber nipple down over tower. Check distributor rotor for damage.

#### TIGHTEN INTAKE MANIFOLD AND CARBURETOR ATTACHING NUTS

Intake manifold attaching screws and nuts on engines should be tightened to proper torque. Carburetor attaching nuts should be tightened securely. Leaks at these areas can cause rough idle, surging, deceleration popping, or deceleration whistle.

**INSPECTION**

Inspect for oil and/or coolant leaks. Check radiator hoses. Check and adjust engine fan and accessory drive belt tension. Clean steering wheel.

**ROAD TEST****TEST PERFORMANCE OF CAR**

Observe performance of engine at low speed, during acceleration, and at constant speed. Check for missing, stalling, surging, poor acceleration or flat spots on acceleration. If any irregularity is found, refer to the appropriate section of the manual for repair procedures.

**TEST OPERATION OF:**

**BRAKES** - Pedal should not go closer than 2" from floor mat and car should not pull to either side.

**PARKING BRAKE** - Should hold the car without excessive movement of parking brake pedal.

**AUTOMATIC TRANSMISSION** - Observe shift at minimum, medium, and full throttle and test part

throttle and forced downshift. Watch for slipping or unusual shift characteristics that may indicate need for adjustment.

**STEERING GEAR** - See that steering operates normally and that steering wheel does not have excessive play. Also observe for alignment of steering wheel, pull, wander, or other irregularity that might indicate need for front end alignment.

**WINDSHIELD WIPER** - Wiper operation should be tested with windshield wet in order to properly judge the action.

**CLUTCH** - See that clutch engages smoothly and that pedal has approximately 1" of free travel. "Hard" pedal or lack of pedal return may indicate need for linkage adjustment.

**LIGHTS AND HORNS** - Test operation and aim of headlights, operation of all lights and horn.

**INSTRUMENTS** - Observe operation of all instruments. Observe especially for possible abnormal readings which may indicate trouble.

**ACCESSORIES** - Test operation of radio, heater, defroster, cigar lighter, other accessories.

