

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

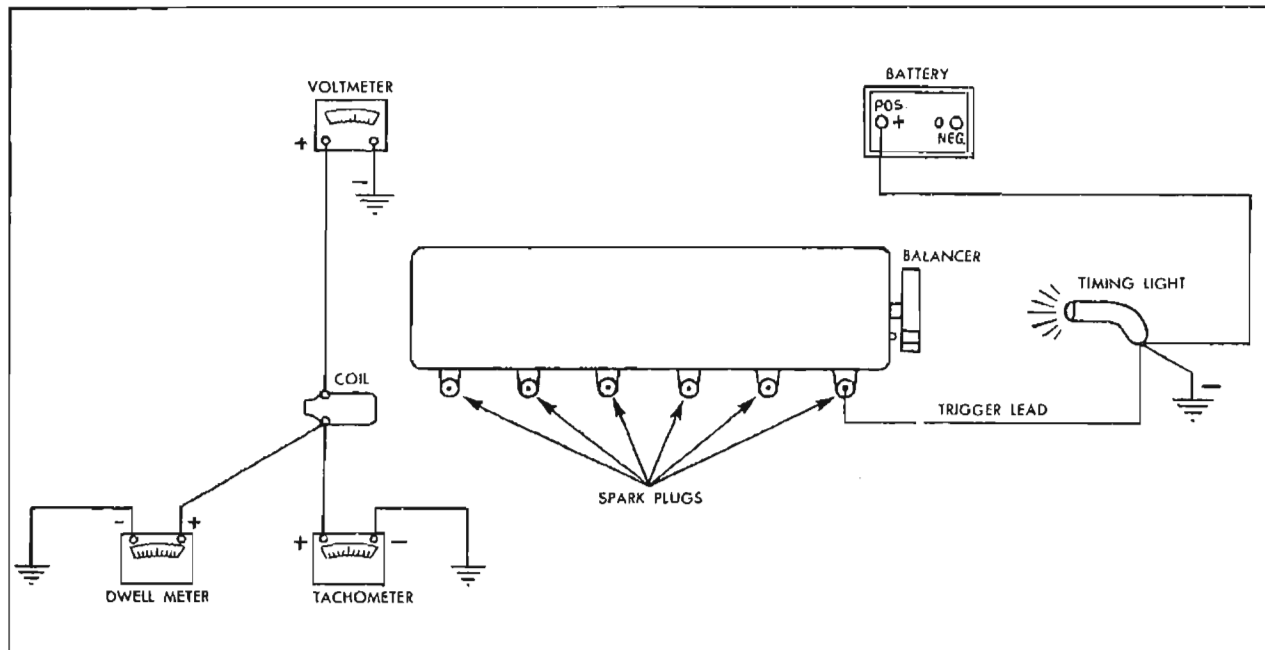


Fig. 6C-1 Basic Instrumentation for Tune-up

guide if equipment manufacturer's 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 wiring 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:

	GTO			
	L-6	V-326	4-bbl.	3 x 2
Hot idle speed- RPM				
Auto. Trans. in Dr.	480-500	480-500	480-500	580-600
Auto. Trans.* A/C off Trans. in Dr.	480-500	540-560	540-560	640-660
SMT	580-600	580-600	580-600	580-600
SMT A/C * A/C off	580-600	640-660	640-660	640-660

* 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 transmission 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 | 540-560 |
| 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, which causes 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.

ENGINE CLUTCH

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DESCRIPTION

A single plate, dry disc-type clutch is used on all Tempest cars with synchromesh transmissions. The clutch assembly consists of the clutch driven plate assembly, the clutch cover and pressure plate assembly, and the clutch release mechanism.

The driven plate for all three Tempest clutches (standard and heavy duty for 6 cylinder and one for V-8) differ from each other in plate size and damper spring calibration. The six cylinder standard clutch driven plate is 9.12 in diameter, the six cylinder heavy duty is 10.00 in diameter and the V-8 is 10.40 in diameter. Grooves on both sides of the clutch plate lining prevent the sticking of the plate to the flywheel and pressure plate due to vacuum between the members.

The driven plate incorporates a damper assembly in the hub to prevent the transmitting of torsional vibrations from engine to transmission.

The pressure plate for all three clutch assemblies is of the disc spring type, Fig. 6D-1. There is an overcenter effect inherent in the action of the disc spring itself. This eliminates the need for an overcenter spring.

Pressure plate spring pressure forces the driven plate against the flywheel, thereby coupling the engine to the transmission.

The clutch release mechanism consists of a ball thrust bearing, appropriate levers and linkage to manually control the action of the bearing. The ball thrust bearing is piloted on a tubular support. When

pressure is applied to the clutch pedal to release the clutch, the clutch fork pivots on its ball socket. The inner end then pushes the release bearing forward so that it presses against the inner ends of the clutch release levers, releasing the clutch (Fig. 6D-1). Pedal effort is transmitted by the pedal to the lever assembly and thence through the clutch fork.

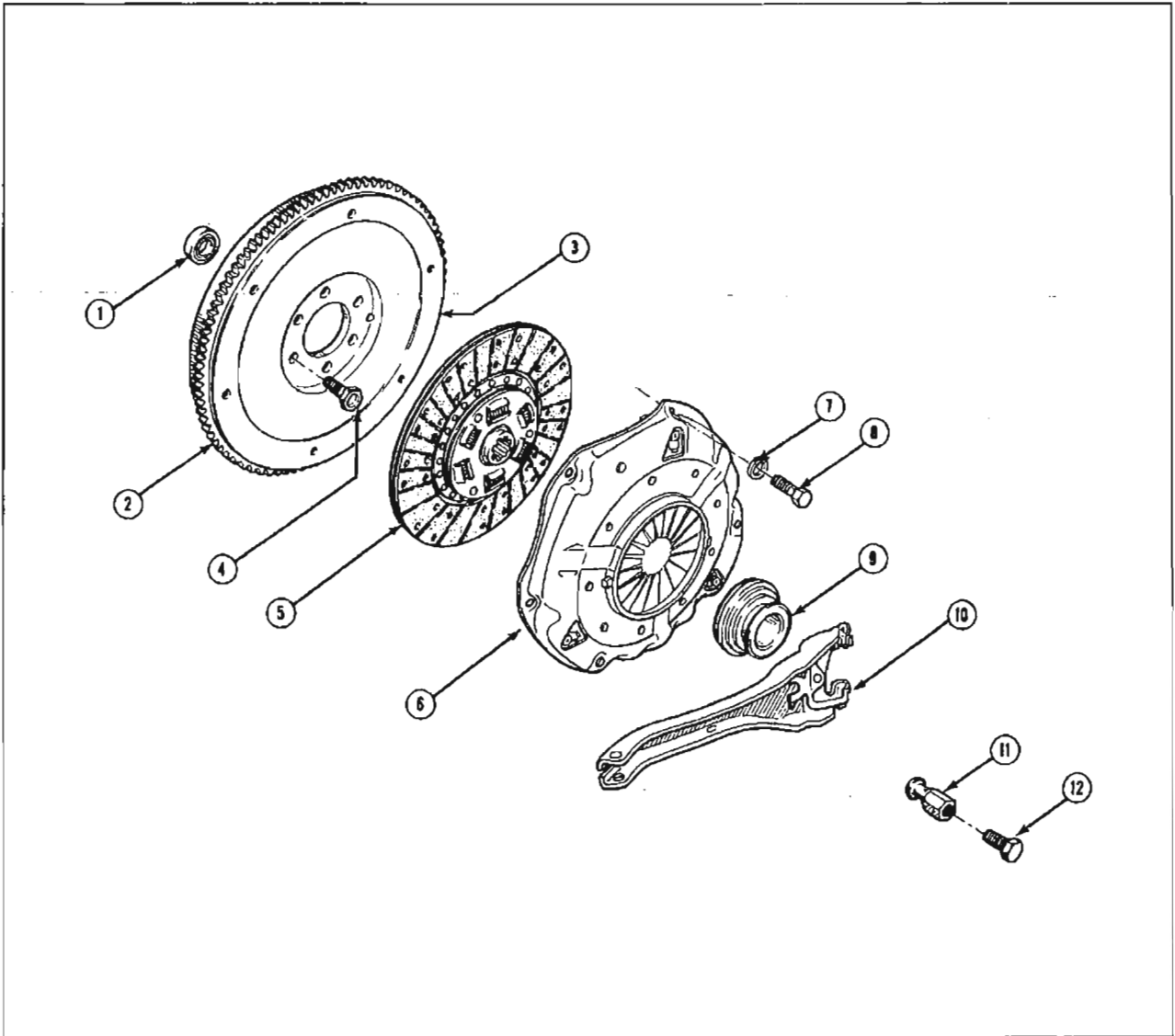
PERIODIC SERVICE

See "General Lubrication" Section.

CLUTCH PEDAL ADJUSTMENT

Wear on the clutch parts necessitates occasional lash adjustment. No other adjustment is made. Lash adjustment should be made as follows:

1. Unhook the linkage return spring.
2. With clutch pedal against stop: Loosen lock nut sufficiently to allow the adjusting rod to be turned out of swivel (8 cyl.) or push rod (6 cyl.) and rearward against the clutch fork until the release bearing contacts pressure plate fingers lightly.
3. Rotate push rod into swivel or push rod 3-1/2 turns and tighten lock nut 8-12 lb. ft. torque.
4. Install return spring. Approximately 1" of lash should be at pedal.



1. Crankshaft Clutch Pilot Bearing
2. Flywheel Ring Gear
3. Engine Flywheel
4. Flywheel to Crankshaft Bolt

5. Clutch Driven Plate
(with facings)
6. Clutch Cover and Pressure
Plate Assembly
7. Clutch Cover to Flywheel
Bolt Washer

8. Clutch Cover to Flywheel Bolt
9. Clutch Release Bearing
10. Clutch Release Fork
11. Clutch Release Fork Ball

Fig. 6D-1 Clutch and Flywheel Assembly - Exploded View

SERVICE & REPAIRS

CLUTCH CONTROL LINKAGE

REMOVE

1. Remove return spring.
2. Disconnect retainer from each end of intermediate rod.

3. Loosen nut and lockwasher from ball stud at frame and remove countershaft assembly.

REPLACE

1. Reverse removal steps. Tighten ball stud nuts 25-35 lb. ft. torque.
2. Adjust lash. See clutch adjustment under periodic service.

CLUTCH—REMOVE AND REPLACE

REMOVE

1. Disconnect battery to starter lead at battery.
2. Remove propeller shaft and transmission. See TRANSMISSION SECTION. Exercise care to avoid damaging transmission front retainer (release bearing support) when transmission is pulled back to free main drive (clutch) gear from flywheel housing.
3. Remove release bearing through rear opening in clutch housing. Do not place bearing in any degreasing solvent, etc.
4. Remove return spring.
5. Remove starter.

6. Remove front flywheel housing shield.
7. Remove flywheel housing bolts and pull housing off of dowels.
8. Remove flywheel housing.
9. Mark clutch pressure plate cover and flywheel to insure reassembly in the same position as balanced at factory.
10. Loosen bolts holding clutch cover to flywheel one turn at a time until tension is relieved.
11. Remove all but top bolt and move clutch assembly away from flywheel at bottom so as to permit removal of clutch driven plate.
12. Remove remaining bolt to remove clutch cover plate assembly.

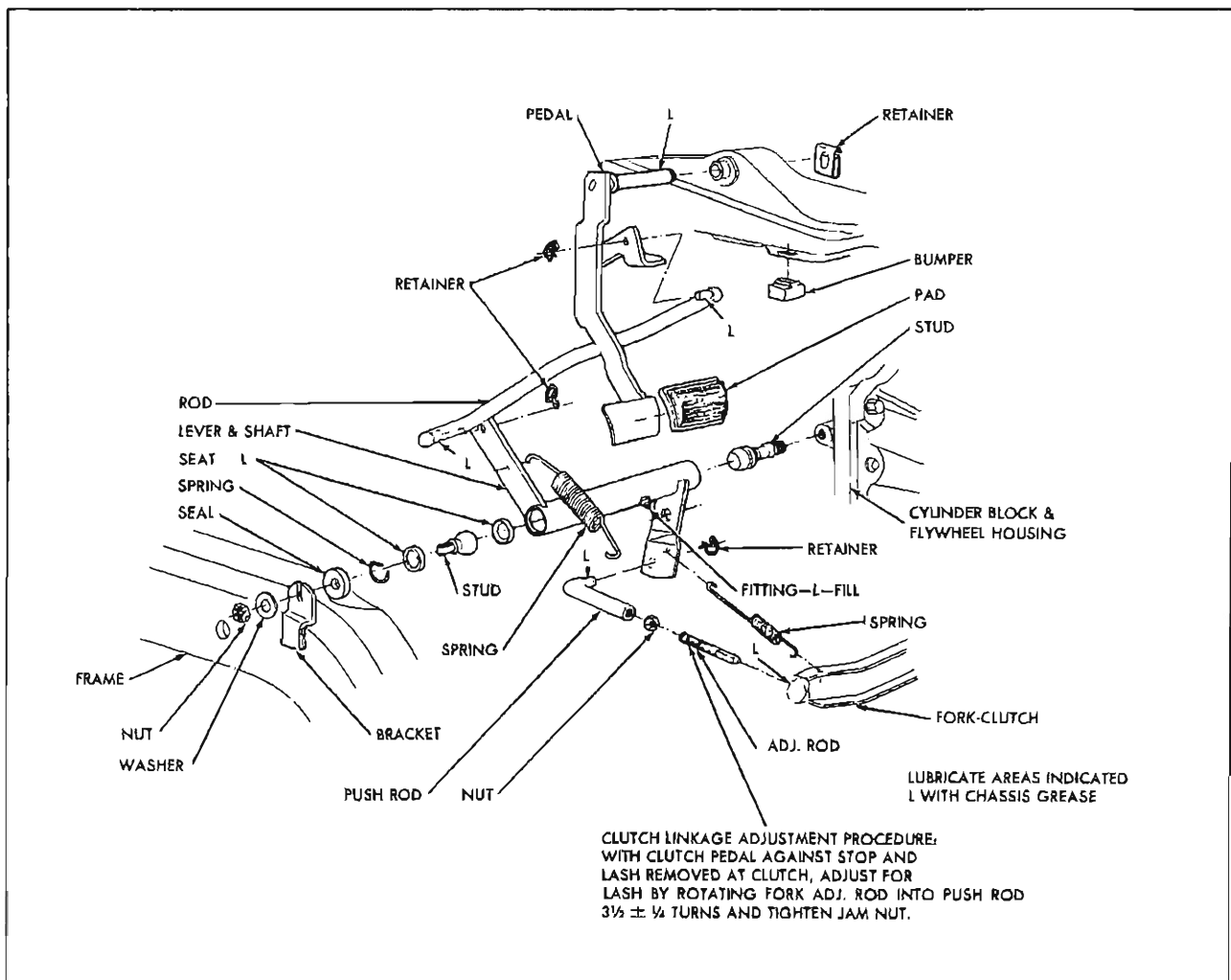


Fig. 6D-2 Clutch Control Linkage - 6 Cylinder

INSPECT

1. Inspect clutch driven plate for broken or distorted torsion springs, worn or loose facings, oil on facings, and damaged spline which could cause binding. If any of the above defects are present, replace driven plate with new assembly.

NOTE: Servicing of clutch driven plate must be by replacement of plate assembly only.

2. Inspect pressure plate and cover assembly to see that it is free of oil and grease. Check pressure plate for scores or cracked surface.

NOTE: Servicing of clutch driven plate or pressure plate and cover assembly must be made by replacement of assemblies only.

3. Examine transmission retainer carefully to be certain there are no burrs on outer surface which pilots clutch release bearing.

4. Try release bearing on transmission retainer to make sure no binding exists.

5. Check release bearing by placing thrust load on bearing by hand and turning bearing race. Replace if bearing feels rough or seems noisy when turning.

6. Clean flywheel face with carbon tetrachloride, sandpaper or steel wool. Inspect pilot bearing in crankshaft for roughness.

REPLACE

1. Position clutch driven plate so long end of hub is in flywheel and install clutch driven plate and

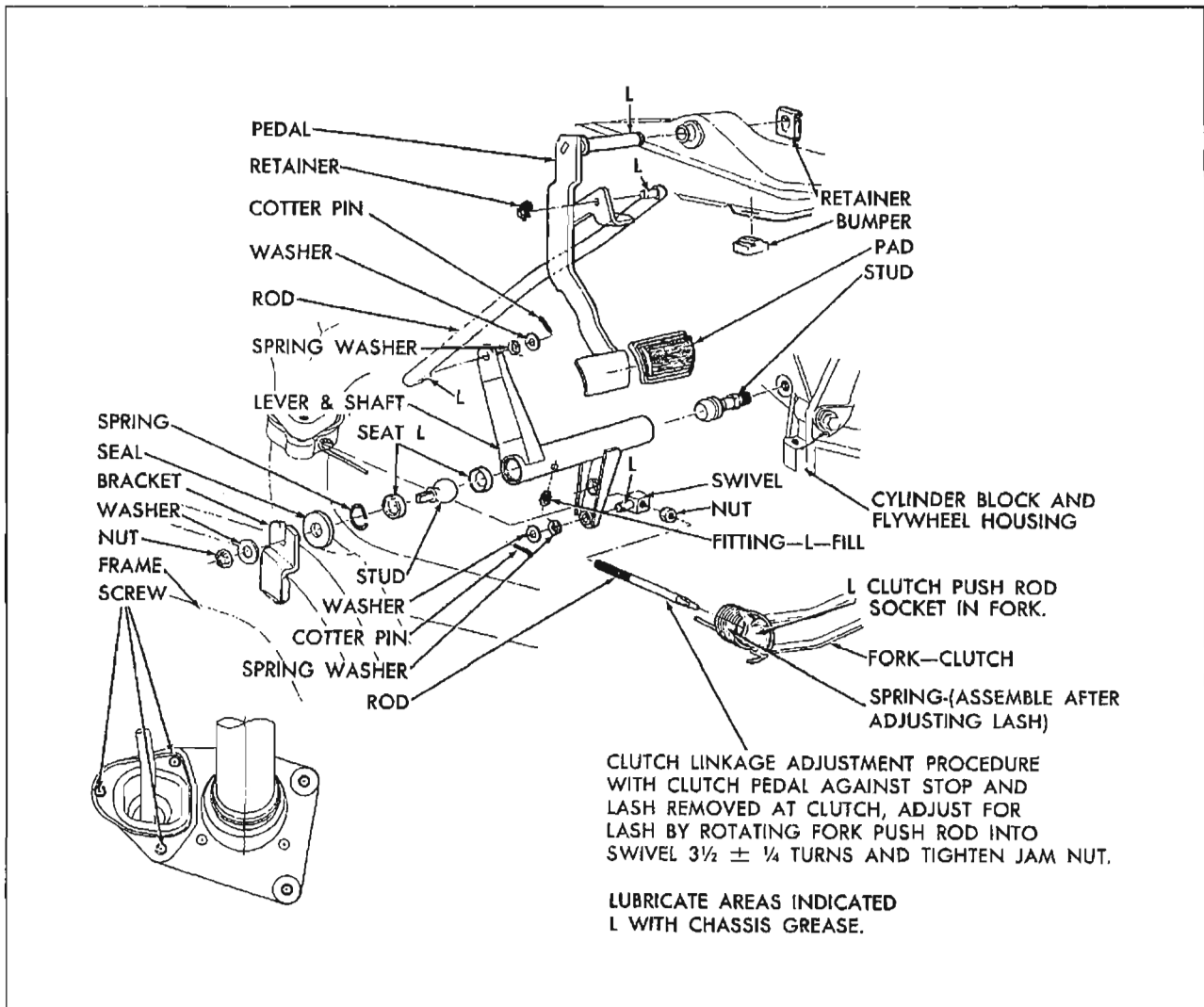


Fig. 6D-3 Clutch Control Linkage - 8 Cylinder

cover assembly on flywheel but do not tighten bolts (install lockwasher under each cover to flywheel bolt).

NOTE: Align marks placed on flywheel and on cover during disassembly.

2. Use a spare transmission main drive gear inserted in spline of clutch driven disc to move disc into correct alignment so pilot on end of drive gear will enter clutch pilot bearing. Tighten clutch cover and pressure plate to flywheel bolts one turn at a time until tight, then tighten to 25-35 lb. ft. torque. Remove spare main drive gear used to align clutch disc.

3. Lubricate surface of release fork fingers, which contact release bearing, sides of pressure plate lugs protruding through cover plate stamping, and the release fork ball fulcrum with high melting point wheel bearing lubricant and install release fork.

4. Apply a light coat of grease to inner diameter of clutch release bearing and fill recess in inner diameter of bearing.

5. Install clutch release bearing to fork in flywheel housing.

6. Apply a light coat of high melting point wheel bearing lubricant to full length of outer diameter of transmission release bearing support (retainer).

CAUTION: Do not overlubricate.

7. Install flywheel housing and tighten bolts to 30-45 lb. ft. torque.

8. Install transmission. See TRANSMISSION SECTION.

CAUTION: Use two transmission guide pins in upper holes in clutch housing.

9. Connect clutch linkage to release fork, Fig. 6D-2 (6 cyl.) or Fig. 6D-3 (8 cyl.).

10. Adjust pedal lash. See lash adjustment under Periodic Service.

FLYWHEEL OR CLUTCH PILOT BEARING— REMOVE AND REPLACE

1. Remove transmission.
2. Remove clutch assembly.

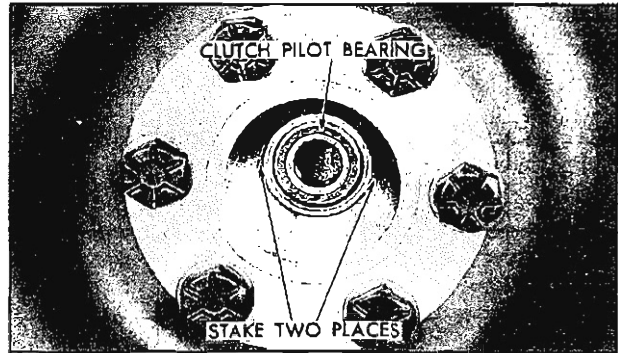


Fig. 6D-4 Clutch Pilot Bearing Staked

3. If clutch pilot bearing is to be replaced, use cold chisel to remove staking in end of crankshaft which keeps bearing in place when transmission is removed (Fig. 6D-4). Remove clutch pilot bearing from hole in crankshaft.

If bearing is a snug fit in crankshaft, use puller J-4383 and slide hammer J-2619-A or J-942 to remove bearing. When installing new bearing see that hole in crankshaft is thoroughly clean. Install new bearing with shielded side toward transmission. Start bearing into hole and tap into place by using clutch pilot bearing installer J-5736 against outer race. Stake slightly as shown in Fig. 6D-4 to keep bearing in place in case transmission is removed in the future.

4. If flywheel is to be removed and reinstalled, scribe marks on flywheel and crankshaft flange, remove flywheel to crankshaft bolts and remove flywheel. When reinstalling clean the mating flanges of flywheel and crankshaft carefully, making sure there are no burrs on either mounting face. Position flywheel on crankshaft flange with scribe marks in alignment and install flywheel to crankshaft bolts and tighten evenly to 85-100 lb. ft. torque.

NOTE: Flywheel bolts do not require lockwashers.

5. Install clutch and transmission.

PROCEDURE FOR REMOVING AND INSTALLING STARTER RING GEAR ON FLYWHEEL

REMOVING RING GEAR FROM FLYWHEEL

1. Place the flywheel, crankshaft side down, on a solid flat surface, or block, which is slightly smaller in diameter than the flywheel.

2. Drive the ring gear off the flywheel, using a suitable drift and hammer.

NOTE: Keep working around the circumference of the ring gear to avoid binding the ring gear on the flywheel.

3. Remove all burrs and rough spots from flywheel.

INSTALLING RING GEAR ON FLYWHEEL

1. Support flywheel in level position with side which goes toward cylinder block facing up.

2. Support ring gear on metal or concrete surface and, using a blow torch or acetylene torch, heat ring gear uniformly on the inside diameter, keeping the torch moving around the circumference of the ring gear to avoid localizing hot spots. Under no circumstances should the ring gear be heated over 400°F, as excessive heating may destroy the original heat treatment.

3. Pick ring gear up with tongs and place in position on flywheel with ring gear facing the same direction as the one just removed.

4. Tap ring gear down into place against shoulder on flywheel. If the ring gear can not be tapped into place readily, it may be necessary to remove it and apply additional heat, heeding the caution about over-heating in Step 2.

CLUTCH SPECIFICATIONS

Pedal Lash - 3-1/2 turns of adjusting rod from zero lash position.

Disc Facings

Type	Single Plate Dry
Diameter of Disc	Std.-9.12
	HD.-10.00
	V-8-10.40
Release Bearing	Sealed Ball Bearing
Number of Torsion Springs	6

TORQUE SPECIFICATIONS

	Lb. Ft.
Clutch Pressure Plate to Flywheel Bolts . . .	25 ±5
Flywheel Housing to Engine Block Bolts . . .	40 ±5
Clutch Fork Rod Adjusting Lock Nut	8-12
Transmission and Extension to Flywheel	
Housing Bolts	55 ±5
Countershaft Stud Assembly to Cylinder	
Block	30 ±5
Countershaft Stud to Side Rail Nut	30 ±5
	Lb. In.
Clutch Housing Cover to Flywheel Housing	
Screw	65 ±5
Control Rod Bellows Retainer to Floor	
Pan Screw	10-15