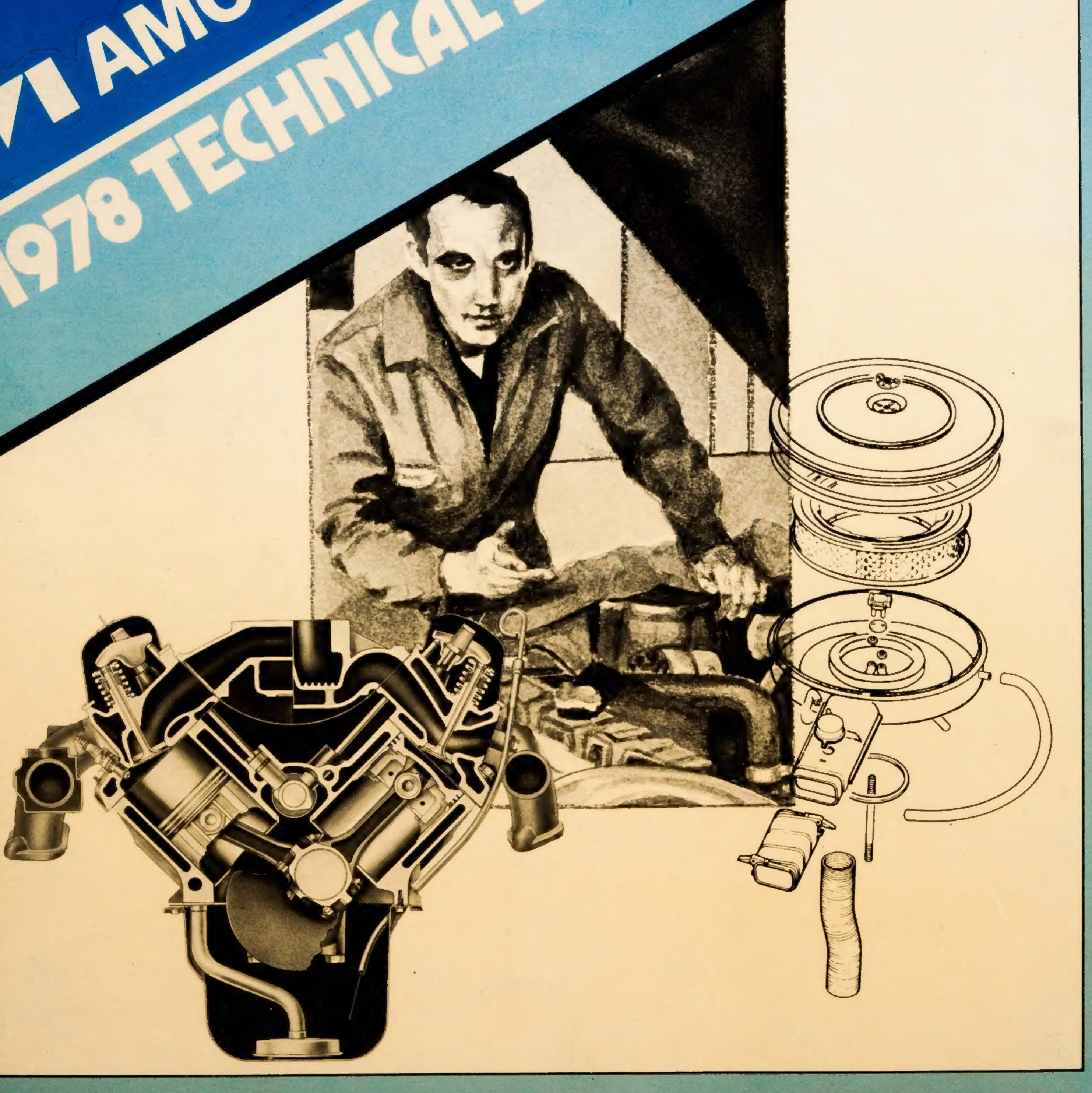
VOLUME I
POWER PLANT

AMC

1978 TECHNICAL SERVICE MANUAL



FOREWORD

This manual is one of three volumes which together comprise the 1978 American Motors Corporation Technical Service Manual. The three volumes are Volume 1—Power Plant, Volume 2—Chassis and Volume 3—Body. All three volumes provide a systems approach to servicing 1978 AMC cars, and each volume contains diagnosis and repair procedures, specifications and torque references for the system described.

The Chapter Index on the opposite page allows you to quickly locate any desired chapter. On the first page of each chapter there is a black tab in a position corresponding to the tab on the Chapter Index page. To locate a chapter, simply fold back the manual slightly to expose the outside edges of the pages. Find the tab that aligns with the index tab and open to that page. At the beginning of each chapter is an index of major subjects. An alphabetical index of major subjects within this volume is included in the back of this manual.

All information and specifications in this manual are based on the latest data available at the time of publication. American Motors Corporation reserves the right to discontinue models and change specifications or design without notice or incurring obligation.

Brand names mentioned in this manual are for convenience only and are not intended as a recommendation to use a specific brand of product. They are indicative of a class or type and may be substituted by their equivalent.

1978 TECHNICAL SERVICE MANUAL

VOLUME 1 POWER PLANT

Pacer. . . . . 60 Series
Gremlin. . . . . 40 Series
Concord & AMX 01 Series
Matador. . . . . 10-80 Series

Chapter Index

American Motors
Sales Corporation
Service Department

Litho in U.S.A.

GENERAL INFORMATION

A

SECTION INDEX

HOW TO USE THIS MANUAL

Organization

The first page of each chapter in this manual contains a black tab in a position corresponding to the tab on the chapter index page. To locate a desired chapter, simply fold back the manual slightly so that the outside edges of the pages are exposed. Find the black tab that aligns with the tab in the chapter index page and open to the desired chapter.

Each chapter begins with an alphabetical index of subjects. Locate the desired subject and turn to the appropriate page. If the subject is broad, the chapter is divided into sections and a subject index of each section is also included. An alphabetical index of all subjects is located at the back of this manual.

Each chapter ends with specifications, torque charts and special tools pertinent to that chapter.

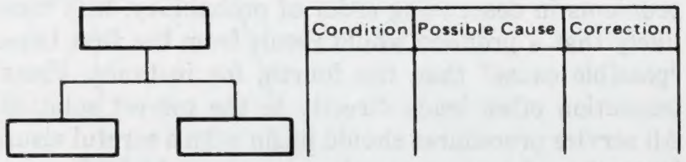
Warnings and Cautions

Detailed descriptions of standard workshop safety procedures are not included in this manual. This manual does contain WARNINGS for some service procedures that could cause personal injury, and CAUTIONS for some procedures that could damage the vehicle or its components. Please understand that these WARNINGS and CAUTIONS do not cover all conceivable ways which service might be done or all possible hazardous consequences of each conceivable way. Anyone using service procedures or tools (whether or not recommended by American Motors) must satisfy himself that neither personal nor vehicle safety will be jeopardized by the procedures or tools selected.

DARS Charts

In several places throughout this manual, American Motors new Diagnosis and Repair Simplification (DARS) charts provide a graphic method of diagnosis and troubleshooting through the use of pictures and symbols.

The DARS charts are different from the ones you have used before. They are not "go-no go" decision trees or tables.



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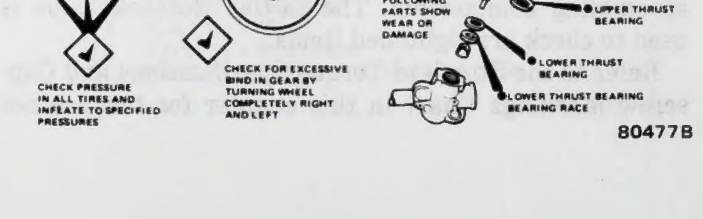
Instead, the new DARS charts use pictures plus a few words to help you solve a problem. . .



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and symbols and words help guide you through each step. . .

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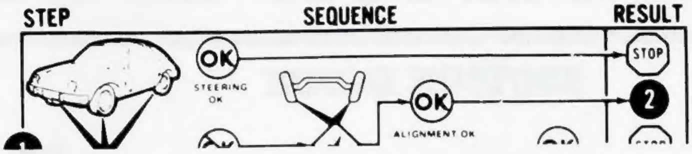
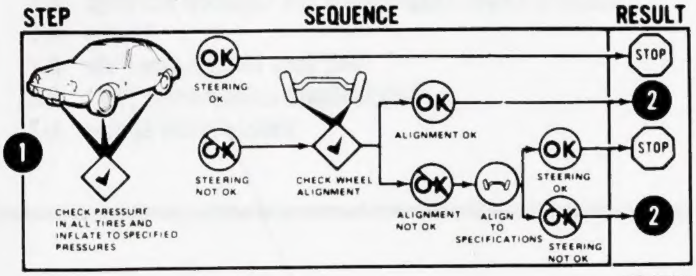
The charts are divided into three sections: **step, sequence** and **result**.



Always start at the first step and go through the complete sequence from left to right.



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A sequence could be checking pressure in all tires and inflating to specified pressures. If the problem is solved , the symbol OK will send you to STOP . If the problem is not solved, the symbol OK will send you through another sequence of checks which ends with a result and tells you the next step to go to.

Work through each step of the DARS charts until the system is repaired STOP .

Service Diagnosis Charts

You will also find Service Diagnosis Charts throughout this manual. These charts list causes of specific problems in descending order of probability. It is more likely that a problem would result from the first listed "possible cause" than the fourth, for instance. Visual inspection often leads directly to the correct solution. All service procedures should begin with a careful visual inspection of any suspected part or assembly.

Torque Information

Individual torque charts appear at the end of each chapter. Torque values are expressed two ways, Set-To and In-Use Recheck. The Set-To value is used when assembling components. The In-Use Recheck value is used to check pre-tightened items.

Refer to the Standard Torque Specifications and Capscrew Markings Chart in this chapter for torques not listed in individual torque charts. Note that torque specifications given in the chart are based on use of clean and dry threads. Reduce torque by 10 percent when threads are lubricated with engine oil and by 20 percent if new plated capscrews are used.

Torx-Head Fasteners

Various sizes of internal and external hex-lobular (Torx) head fasteners are used as attaching hardware on numerous components and assemblies in 1978 AMC cars. Due to the ever-changing usage and application of automotive fasteners, Torx-head fasteners may not be identified as such throughout this manual. However, these fasteners may be removed or installed using Tool Set J-25359-02.

Service Manual Improvements

You are encouraged to report any errors, omissions, or recommendations for improving this publication. A form provided for this purpose is included at the end of this chapter.

GENERAL INFORMATION—VOLUME ONE

This manual (Volume One) covers the various power plant components used in 1978 Pacer, Gremlin, Concord, AMX and Matador AMC cars. It provides diagnosis methods, repair procedures and specifications needed to service the engine, cooling system, battery, charging system, starting system, ignition system, Cruise Command system, fuel system, exhaust system and power plant instruments.

Chapters A, B and C contain general information related to vehicle identification, body styles, available power teams, general maintenance and fleet equipment.

Chapter 1A contains information necessary for routine engine tune-up and performance diagnosis. Chapters 1B through 1L are concerned with service procedures and specifications of individual power plant systems.

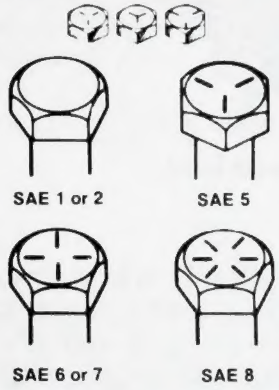
A new chapter, 1L—Power Plant Instrumentation, has been developed. It covers service procedures for power plant related gauges and indicators, such as: oil pressure gauge or indicator lamp, coolant temperature gauge or indicator lamp, ammeter or charging system indicator lamp, fuel gauge, tachometer, and vacuum gauge.

NEW POWER PLANT FEATURES FOR 1978

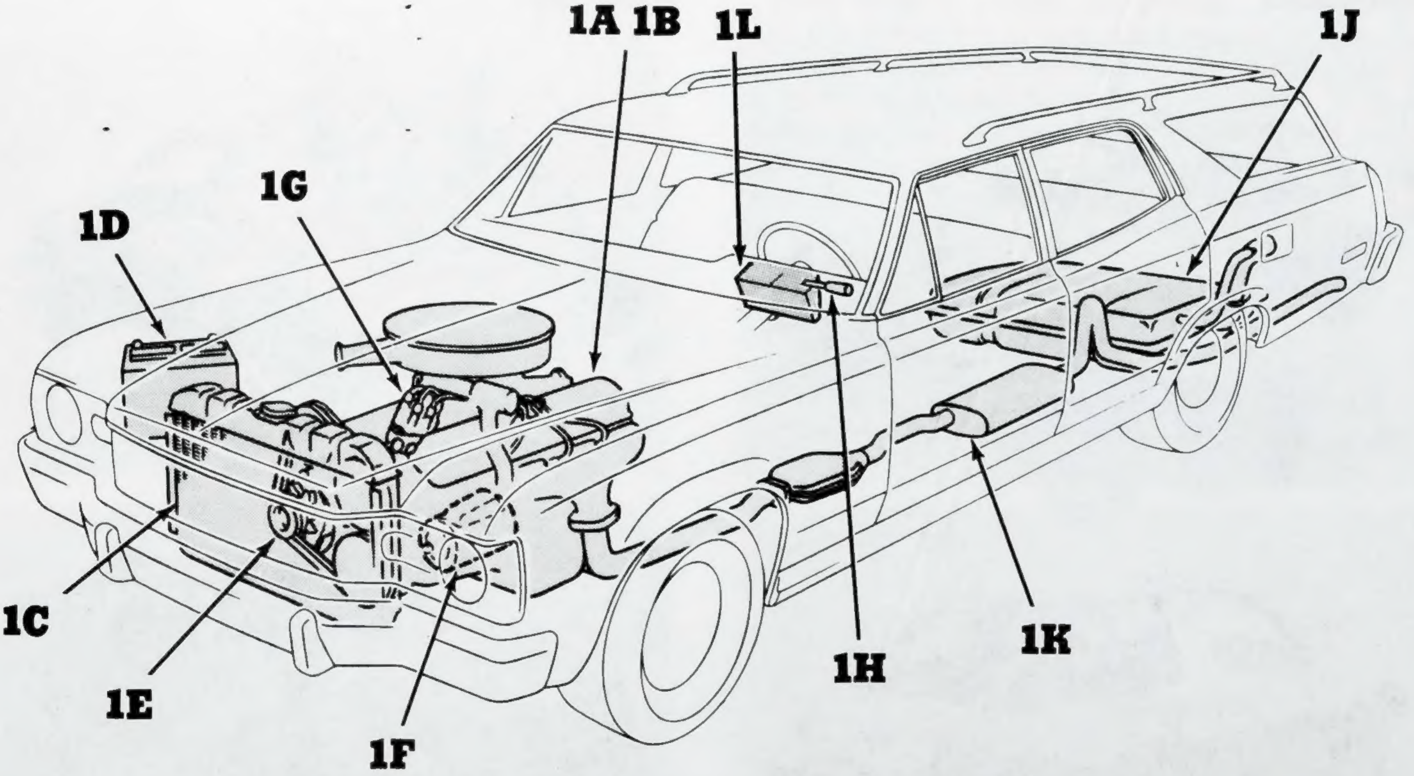
New power plant features for 1978 improve driveability, reduce emissions and simplify service of some power plant systems.

All six- and eight-cylinder engines have new solid-state ignition systems. This ignition system was introduced on certain Canadian cars during 1977. It is an entirely new system.

Standard Torque Specifications and Capscrew Markings Chart

CAPSCREW HEAD MARKINGS	CAPSCREW BODY SIZE Inches — Thread	SAE GRADE 1 or 2 (Used Infrequently)		SAE GRADE 5 (Used Frequently)		SAE GRADE 6 or 7 (Used at Times)		SAE GRADE 8 (Used Frequently)	
		Torque		Torque		Torque		Torque	
		Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm	Ft-Lb	Nm
Manufacturer's marks may vary. Three-line markings on heads shown below, for example, indicate SAE Grade 5.  	1/4-20	5	6.7791	8	10.8465	10	13.5582	12	16.2698
	-28	6	8.1349	10	13.5582			14	18.9815
	5/16-18	11	14.9140	17	23.0489	19	25.7605	24	32.5396
	-24	13	17.6256	19	25.7605			27	36 6071
	3/8-16	18	24.4047	31	42.0304	34	46.0978	44	59.6560
	-24	20	27.1164	35	47.4536			49	66.4351
	7/16-14	28	37.9629	49	66.4351	55	74.5700	70	94.9073
	-20	30	40.6745	55	74.5700			78	105.7538
	1/2-13	39	52.8769	75	101.6863	85	115.2445	105	142.3609
	-20	41	55.5885	85	115.2445			120	162.6960
	9/16-12	51	69.1467	110	149.1380	120	162.6960	155	210.1490
	-18	55	74.5700	120	162.6960			170	230.4860
	5/8-11	83	112.5329	150	203.3700	167	226.4186	210	284.7180
	-18	95	128.8027	170	230.4860			240	325.3920
	3/4-10	105	142.3609	270	366.0660	280	379.6240	375	508.4250
	-16	115	155.9170	295	399.9610			420	569.4360
	7/8- 9	160	216.9280	395	535.5410	440	596.5520	605	820.2590
	-14	175	237.2650	435	589.7730			675	915.1650
	1- 8	235	318.6130	590	799.9220	660	894.8280	910	1233.7780
	-14	250	338.9500	660	894.8280			990	1342.2420

70090



Volume One—Power Plant

CHAPTERS
1A GENERAL SERVICE AND DIAGNOSIS
1B ENGINES
1C COOLING SYSTEMS
1D BATTERIES
1E CHARGING SYSTEMS
1F STARTING SYSTEM
1G IGNITION SYSTEM
1H CRUISE COMMAND
1J FUEL SYSTEMS
1K EXHAUST SYSTEMS
1L POWER PLANT INSTRUMENTATION

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The Cruise Command speed control system also is entirely new for 1978. The system features a completely solid state electronic regulator with a vacuum servo to control throttle position.

A new low-maintenance battery is standard on all AMC cars. These batteries are rated in reserve capacity only.

Other features include: a viscous drive fan is available with some cooling systems; ambient air induction is standard on all AMC cars; all carburetors have external fuel bowl vents which are positively operated by either mechanical linkage or vacuum; the charcoal vapor canister is dual staged—purging more vapor under cruising conditions than during low speed operation.

1978 AMC CARS

Pacer—60 Series

Two Pacer models are offered: 2-door Hatchback [66] and 2-door Station Wagon [68] (fig. A-1). The 232 CID six-cylinder engine is standard. The 258 CID six-cylinder 2-barrel engine is optional. The six-cylinder engines may be teamed with a fully synchronized 3-speed or 4-speed manual transmission, or with an automatic transmission.

Fig. A-1 Pacer—60 Series

Gremlin—40 Series

Three Gremlin models are offered: a base six-cylinder model [46-5], a four-cylinder custom model [46-4], and a six-cylinder custom model [46-7] (fig. A-2). The 232 CID six-cylinder engine is standard on the model 46-5 and -7. The 2-liter four-cylinder engine is standard on the model 46-4. The 258 CID six-cylinder 2-barrel engine is optional on models 46-5 and 46-7. These engines may be teamed with a fully synchronized 3-speed or 4-speed manual transmission, or with an automatic transmission.

Fig. A-2 Gremlin—40 Series

Concord and AMX—01 Series

Four Concord models are offered: 2-door Hatchback [03], 2-door Sedan [06] and 4-door Sedan [05], and the 4-door Concord Wagon [08] (fig. A-3). The 232 CID six-sylinder engine is standard. The 258 CID six-cylinder 2-barrel engine and the 304 CID eight-cylinder engine are optional. The six-cylinder engines may be teamed with a fully synchronized 3-speed or 4-speed manual transmission, or with an automatic transmission. The eight-cylinder engine is available only with automatic transmission.

The AMX is available in one 2-door Hatchback model [03-9]. The standard engine is the 258 CID six-cylinder with 2-barrel carburetor. (The 258 CID engine with 1-barrel carburetor is standard in California and high altitude cars.) The 304 CID eight-cylinder is optional. The six-cylinder engines are available with either a 4-speed manual transmission or an automatic transmission. The eight-cylinder engine is available only with the automatic transmission.

Fig. A-3 Concord and AMX—01 Series

Matador—10-80 Series

Three Matador models are offered: 2-door Coupe [16], 4-door Sedan [85], and 4-door Station Wagon [88] (fig. A-4). The 258 CID six-cylinder engine with 2-barrel carburetor is standard for Sedans and Coupes. Optional engine for these models is the and 360 CID 2-barrel eight-cylinder. The 360 CID eight-cylinder is standard for all Station Wagons.

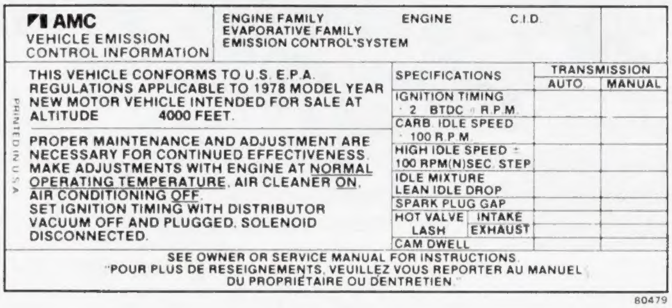
Fig. A-4 Matador—10-80 Series

VEHICLE IDENTIFICATION NUMBER (VIN)

A thirteen digit Vehicle Identification Number is embossed on a metal plate which is riveted to the upper corner of the instrument panel (between the left windshield wiper pivot and the left A-pillar). It can easily be seen by looking through the windshield. The VIN is decoded as shown in the VIN Decoding Chart.

EMISSION CONTROL MAINTENANCE INFORMATION LABEL

A nonremovable federal emission control information label is located in the engine compartment of all 1978 AMC cars. This sticker identifies the engine family determined by certification and outlines some basic tune-up specifications (fig. A-5).



AMC
VEHICLE EMISSION
CONTROL INFORMATION

ENGINE FAMILY ENGINE C.I.D.
EVAPORATIVE FAMILY
EMISSION CONTROL SYSTEM

THIS VEHICLE CONFORMS TO U.S. E.P.A. REGULATIONS APPLICABLE TO 1978 MODEL YEAR NEW MOTOR VEHICLE INTENDED FOR SALE AT ALTITUDE 4000 FEET.

PROPER MAINTENANCE AND ADJUSTMENT ARE NECESSARY FOR CONTINUED EFFECTIVENESS. MAKE ADJUSTMENTS WITH ENGINE AT NORMAL OPERATING TEMPERATURE, AIR CLEANER ON, AIR CONDITIONING OFF.
SET IGNITION TIMING WITH DISTRIBUTOR VACUUM OFF AND PLUGGED. SOLENOID DISCONNECTED.

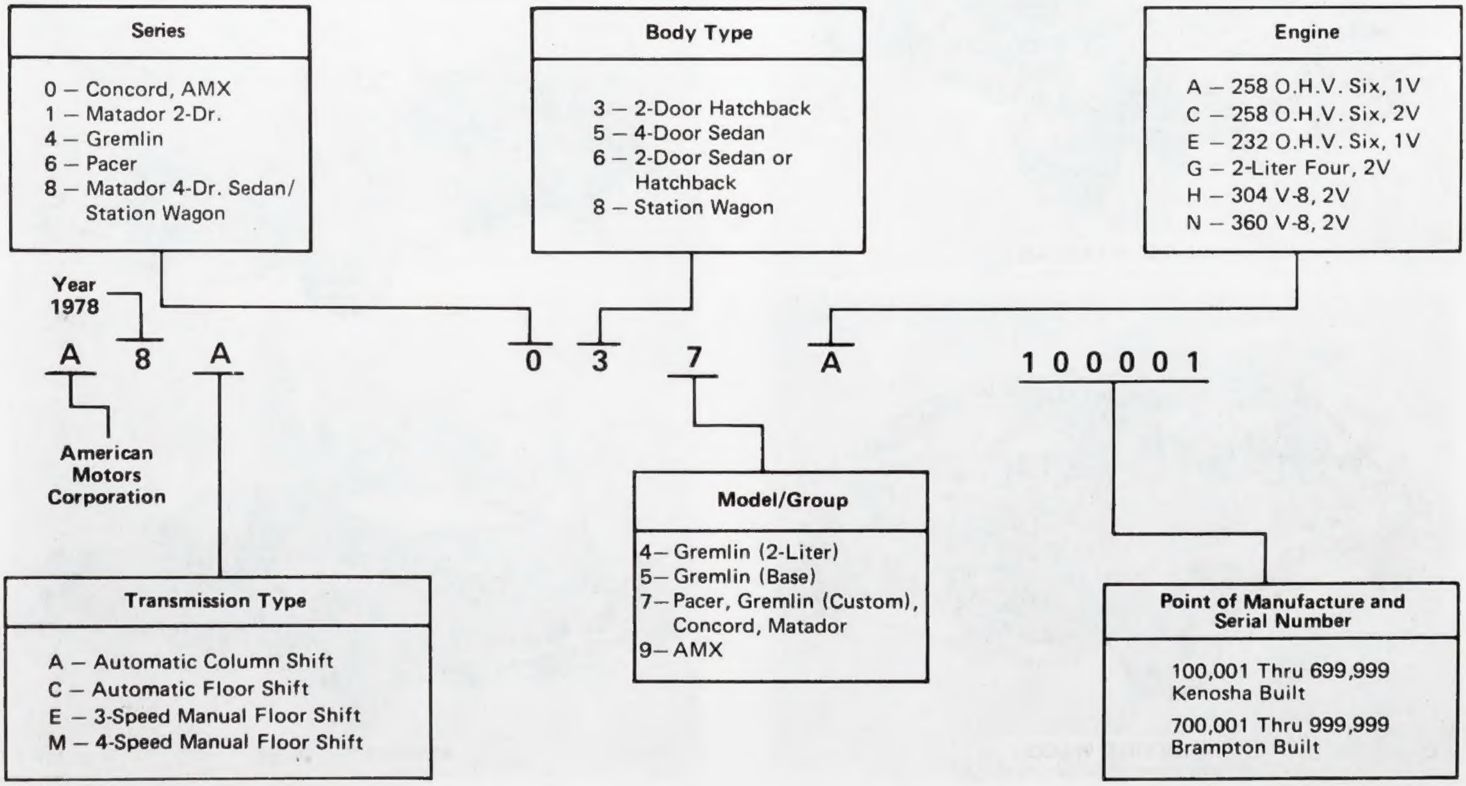
SPECIFICATIONS		TRANSMISSION AUTO	TRANSMISSION MANUAL
IGNITION TIMING ± 2 BTDC @ R.P.M.			
CARB. IDLE SPEED ± 100 R.P.M.			
HIGH IDLE SPEED ± 100 RPM(N)SEC. STEP			
IDLE MIXTURE LEAN IDLE DROP			
SPARK PLUG GAP			
HOT VALVE LASH	INTAKE		
	EXHAUST		
CAM DWELL			

SEE OWNER OR SERVICE MANUAL FOR INSTRUCTIONS.
"POUR PLUS DE RESEIGNEMENTS, VEUILLEZ VOUS REPORTER AU MANUEL DU PROPRIETAIRE OU DENTRETIEN."

PRINTED IN U.S.A.

Fig. A-5 Federal Emission Control Maintenance Information Label

VIN Decoding Chart



Series
- 0 — Concord, AMX
- 1 — Matador 2-Dr.
- 4 — Gremlin
- 6 — Pacer
- 8 — Matador 4-Dr. Sedan/Station Wagon

Body Type
- 3 — 2-Door Hatchback
- 5 — 4-Door Sedan
- 6 — 2-Door Sedan or Hatchback
- 8 — Station Wagon

Engine
- A — 258 O.H.V. Six, 1V
- C — 258 O.H.V. Six, 2V
- E — 232 O.H.V. Six, 1V
- G — 2-Liter Four, 2V
- H — 304 V-8, 2V
- N — 360 V-8, 2V

Transmission Type
- A — Automatic Column Shift
- C — Automatic Floor Shift
- E — 3-Speed Manual Floor Shift
- M — 4-Speed Manual Floor Shift

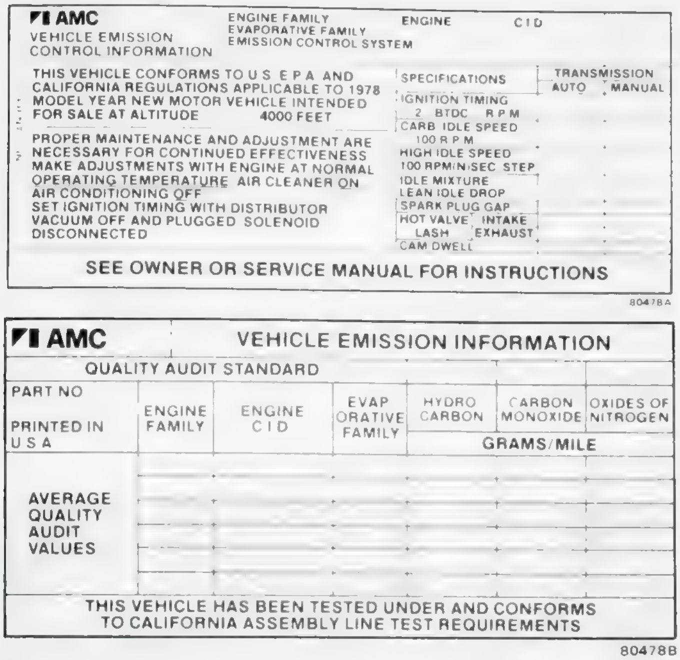
Model/Group
- 4— Gremlin (2-Liter)
- 5— Gremlin (Base)
- 7— Pacer, Gremlin (Custom), Concord, Matador
- 9— AMX

Point of Manufacture and Serial Number

100,001 Thru 699,999
Kenosha Built

700,001 Thru 999,999
Brampton Built

A different label is used for all cars built for sale in the state of California. This sticker replaces the federal sticker on California cars and reflects quarterly audit figures (fig. A-6).



AMC
VEHICLE EMISSION
CONTROL INFORMATION
ENGINE FAMILY
EVAPORATIVE FAMILY
EMISSION CONTROL SYSTEM
ENGINE
C I D

THIS VEHICLE CONFORMS TO U S E P A AND CALIFORNIA REGULATIONS APPLICABLE TO 1978 MODEL YEAR NEW MOTOR VEHICLE INTENDED FOR SALE AT ALTITUDE 4000 FEET

PROPER MAINTENANCE AND ADJUSTMENT ARE NECESSARY FOR CONTINUED EFFECTIVENESS MAKE ADJUSTMENTS WITH ENGINE AT NORMAL OPERATING TEMPERATURE AIR CLEANER ON AIR CONDITIONING OFF
SET IGNITION TIMING WITH DISTRIBUTOR VACUUM OFF AND PLUGGED SOLENOID DISCONNECTED

SPECIFICATIONS	TRANSMISSION AUTO	TRANSMISSION MANUAL
IGNITION TIMING 2 BTDC R P M		
CARB IDLE SPEED 100 R P M		
HIGH IDLE SPEED 100 RPM/N/SEC STEP		
IDLE MIXTURE LEAN IDLE DROP		
SPARK PLUG GAP		
HOT VALVE LASH INTAKE		
HOT VALVE LASH EXHAUST		
CAM DWELL		

SEE OWNER OR SERVICE MANUAL FOR INSTRUCTIONS

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AMC VEHICLE EMISSION INFORMATION

QUALITY AUDIT STANDARD

PART NO PRINTED IN U S A	ENGINE FAMILY	ENGINE C I D	EVAP ORATIVE FAMILY	HYDRO CARBON	CARBON MONOXIDE	OXIDES OF NITROGEN
				GRAMS/MILE		
AVERAGE QUALITY AUDIT VALUES						

THIS VEHICLE HAS BEEN TESTED UNDER AND CONFORMS TO CALIFORNIA ASSEMBLY LINE TEST REQUIREMENTS

80478B

Fig. A-6 California Emission Control Maintenance Information Label

VEHICLE SAFETY STICKER

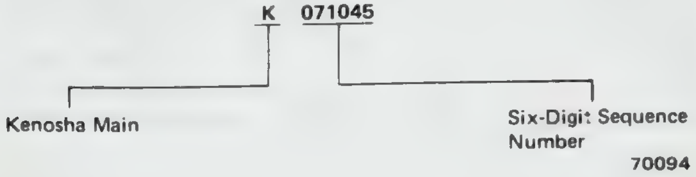
A nonremovable safety sticker is affixed to the edge of the left front door. It lists the month and year built, a safety compliance statement and the vehicle identification number. Some consumer information is included on the sticker, such as: vehicle class, acceleration and passing figures, tire reserve load and stopping distance. All operating information represents average figures for AMC cars (fig. A-7).

UNIT BODY IDENTIFICATION PLATE

A unit body identification plate is riveted to the edge of the left front door (fig. A-7). This plate includes a statement of compliance with federal safety standards and a statement of construction. Embossed on it are the vehicle body number, model number, trim number, paint code number and the vehicle build sequence number.

Body Number

The body number identifies the location where the body was built and the body sequence number.



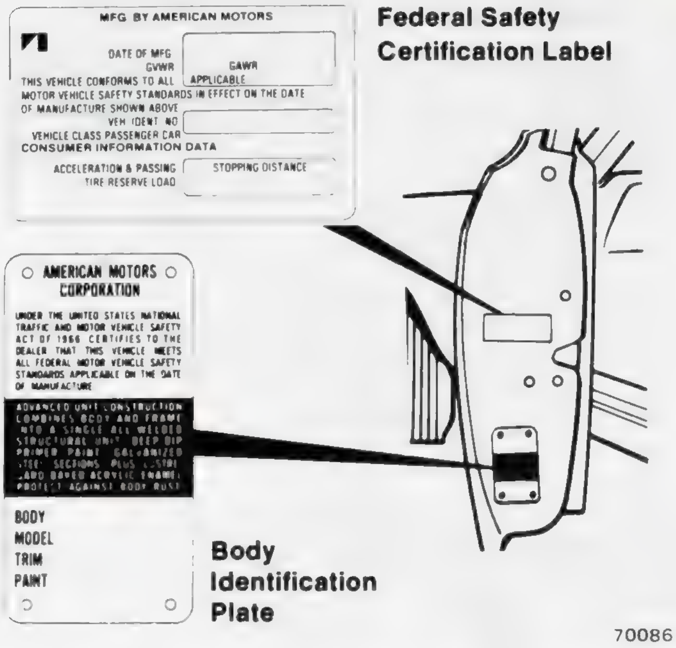
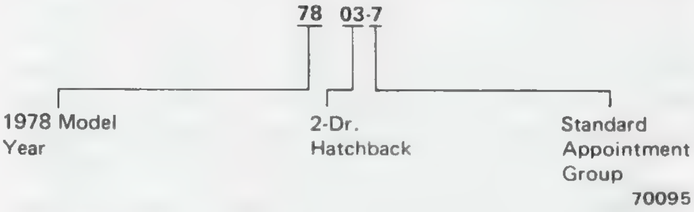


Fig. A-7 Safety Sticker and Unit Body ID Plate Location

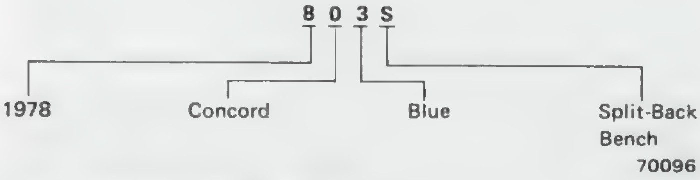
Model Number

The model number identifies the model year, body style, and body standard or custom appointment group number.



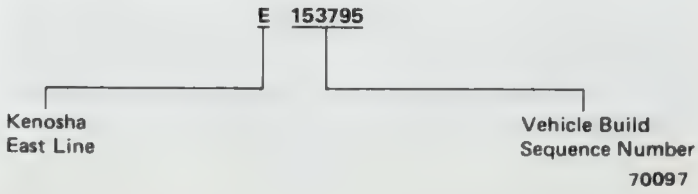
Trim Number

The trim number identifies the car trim and fabric color and type of seats.



Vehicle Build Sequence Number

The vehicle build sequence number (embossed at the bottom of the plate) lists the production line and number of the vehicle in the sequence in which it was built (sequence starts at 000, 001).



Paint Code Number

Colors corresponding to the paint code number on the unit body identification plate are as follows:

- P1—Black
- G7—Alpine White
- 6D—Sand Tan
- 6P—Firecracker Red
- 6V—Sunshine Yellow
- 7B—Mocha Brown Metallic
- 7D—Powder Blue
- 7K—Midnight Blue Metallic
- 7L—Loden Green Metallic
- 7M—Golden Ginger Metallic
- 7Z—Sun Orange
- 8A—Khaki
- 8B—British Bronze Metallic
- 8C—Quick Silver Metallic
- 8D—Claret Metallic

KEYS AND LOCKS

Four keys (two square-headed and two oval-headed) are provided with each vehicle. The square-headed key (code K) operates the ignition switch, front door locks and wagon tailgate (liftgate on Pacer, Gremlin, and Concord Wagon or Hatchback). The oval-headed key (code L) operates the glove box, console box, trunk and wagon hidden compartment locks. The keys have a code number stamped on the knockout plug. In the event a key is lost, a new key can be made by converting the key code number to a key bitting number. Key bitting numbers can be obtained from a key cutting machine manufacturer's cross-reference or by contacting your zone office.

NOTE: *The template shown in Figure A-8 may be used to determine the key bitting code of a key for which the key code number is unknown.*

If a key is lost and the key code number is unknown, the correct number can be obtained by the zone office from the vehicle identification number (VIN).

If the ignition key is lost and the key code number is not available, a new key can be made by removing a door lock and taking it to a locksmith. The locksmith can determine the key bitting by inserting a blank key into the lock cylinder and cutting the blank to match the tumblers.

If the ignition switch lock is defective and the key is available, the cylinder and individual tumblers can be ordered and matched to the existing key. To determine the tumbler arrangement, place the key over the template (fig. A-8). Starting with the number 1 position read across the visible line and record the first digit of the key code, continue this process for subsequent positions 2 through 5.

Fig. A-8 Key Coding Template

LIFT POINTS

Lift points are provided for lifting all AMC cars with either a floor jack or a frame contact-type lift.

CAUTION: *When lifting the car, be sure the floor jack or frame contact-type lift does not damage any fuel lines or brake lines (figs. A-9 and A-10).*

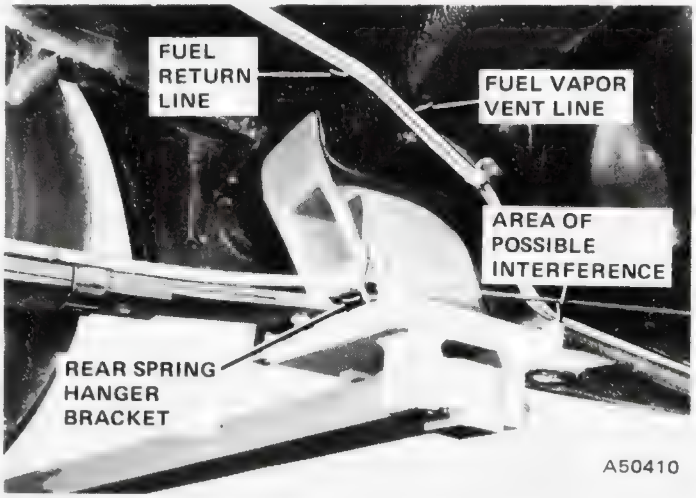


Fig. A-9 Left Rear Lift Point—Pacer Shown

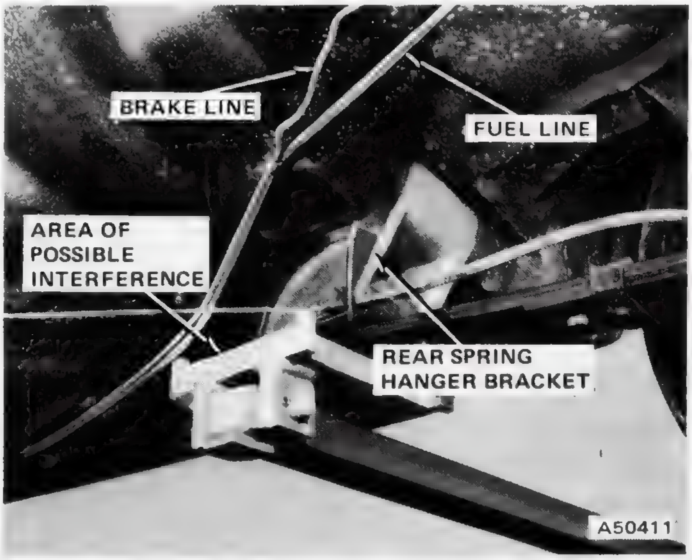


Fig. A-10 Right Rear Lift Point—Pacer Shown

NOTE: *Refer to Chapter B—Maintenance for lift point illustrations for all models.*

Pacer

The rear lift points are located ahead of the rear wheels at the rear spring hanger brackets (figs. A-9 and A-10).

The front lift points are located just to the rear of the dash panel at the front wheelhouse sills.

Gremlin, Concord and AMX

The rear lift points are located ahead of the rear wheels just forward of the rear spring hanger brackets.

The front lift points are located just to the rear of the strut rod-to-sill mounting brackets on the sills.

Matador

The rear lift points are located ahead of the rear wheels on the sills adjacent to the rear suspension lower control arm mountings.

The front lift points are located just to the rear of the strut rod-to-sill mounting brackets on the sills.

TOWING

General

A conventional towing sling is recommended for use on all AMC cars because of its stability and reduced likelihood of damage. The following instructions apply only to this device. When using other than sling-type towing equipment, be sure to follow the manufacturer's instructions.

A safety chain system that is completely independent of the lifting and towing attachment must be used. Be careful when installing safety chains so that they do not damage the car.

If additional ground clearance is required, a towing dolly may be used. The end of the car to be placed on the dolly should be lifted with the same equipment as when towing.

In some applications, auxilliary spacer blocks may be required to prevent damage to the car. Spacer blocks can be fabricated as shown in fig. A-11.

Front Towing

If ignition key is available, turn ignition off (to unlock transmission and steering column), place gearshift or selector lever in neutral. Be sure parking brake is released. The car may then be towed for a distance of 15 miles (24 km/h) and at speeds not to exceed 30 mph (48 km/h). If a distance of 15 miles (24 km/h) or a speed 30 mph (48 km/h) must be exceeded, the propeller shaft must be disconnected or the rear wheels placed on a dolly.

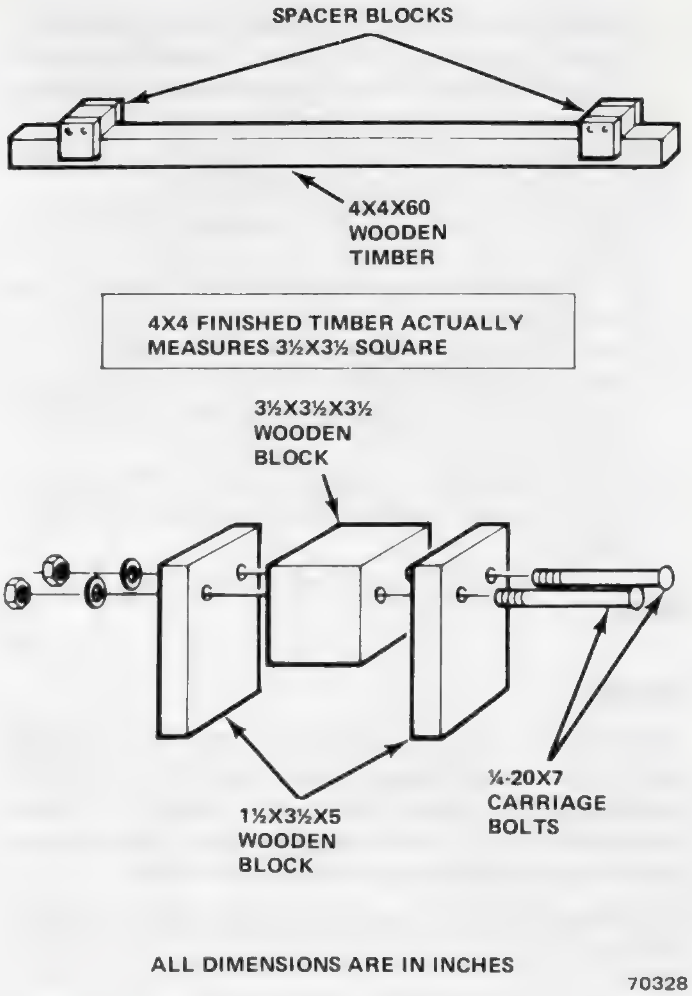


Fig. A-11 Spacer Block Construction

If ignition key is not available, disconnect propeller shaft or place rear wheels on a dolly.

CAUTION: *Transmission and rear axle must be in an operable condition and transmission must be filled to the proper level. If not, rear wheels must be placed on a dolly.*

NOTE: *If the propeller shaft must be disconnected, the transmission extension housing seal should be capped to prevent leakage when the car is lifted.*

Rear Towing

If ignition key is available, turn ignition off (to unlock transmission and steering column), place gearshift or selector lever in neutral and clamp the steering wheel in the straight-ahead position. Do not use the steering column lock as a substitute for a clamping device.

If ignition key is not available, place front wheels on a dolly.

Safety Precautions

- Whenever possible, tow the car from the rear to prevent damage to the transmission or rear axle.

- Secure loose or protruding parts of a damaged car.
- The end of the car being towed should be lifted a minimum of four inches off the ground. Check opposite end for adequate ground clearance.
- Always use a safety chain system that is independent of the lifting and towing attachment.
- Do not allow any of the towing equipment to bear on the fuel tank.
- Do not go under the car while it is lifted by the towing equipment.
- Do not allow passengers to ride in a towed car.
- Always observe all state and local laws regarding such items as warning signals, night illumination, speed, etc.
- Do not attempt a towing operation which could jeopardize the operator, any bystanders or other motorists.

Pacer

Front Towing

Position tow bar under front bumper. Wrap chains once around energy absorbers and secure in grab hooks at ends of sling lower bar. Insert padding between bumper and sling. Wrap separate safety chains around frame rails ahead of stabilizer bar (fig. A-12).

CAUTION: *Tow bar must be parallel with ground after lifting.*

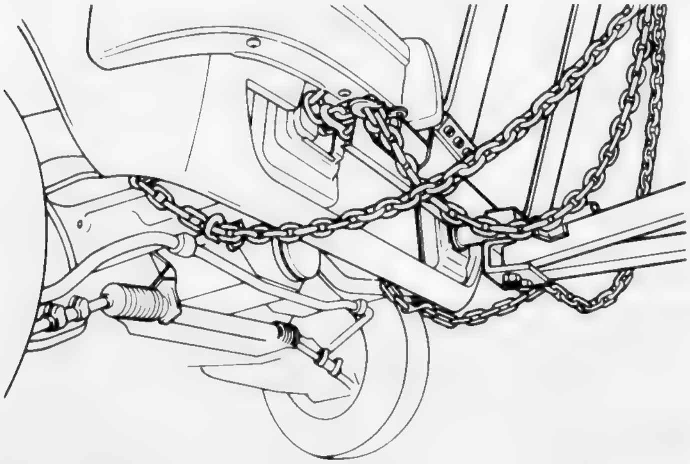


Fig. A-12 Front Towing—Pacer

Rear Towing

Position tow bar under rear bumper. Wrap chains once around energy absorbers and secure in grab hooks at ends of sling lower bar. Insert padding between bumper and sling. Wrap separate safety chains around rear spring shackles (fig. A-13).

CAUTION: *Tow bar must be parallel with ground after lifting.*

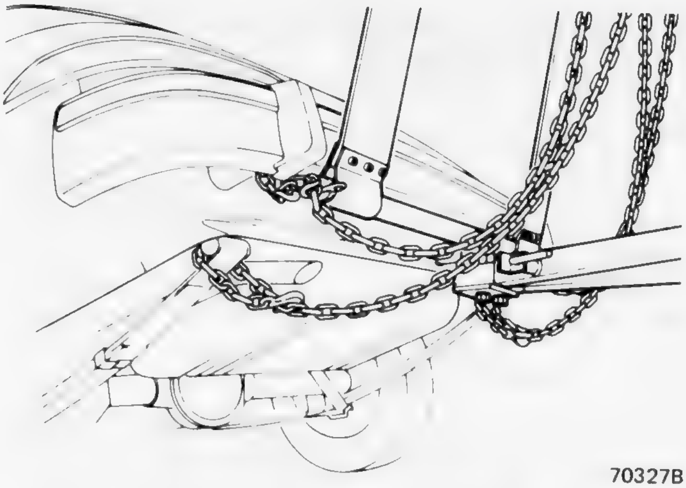


Fig. A-13 Rear Towing—Pacer

Gremlin

Front Towing

Attach J-hooks on the rear of the front crossmember near the lower control arms. Position the wood spacer block across sling chains with blocks contacting frame rails directly behind the radiator. Position the sling tow bar directly ahead of spacer.

Attach separate chains around outboard end of lower control arms (fig. A-14).

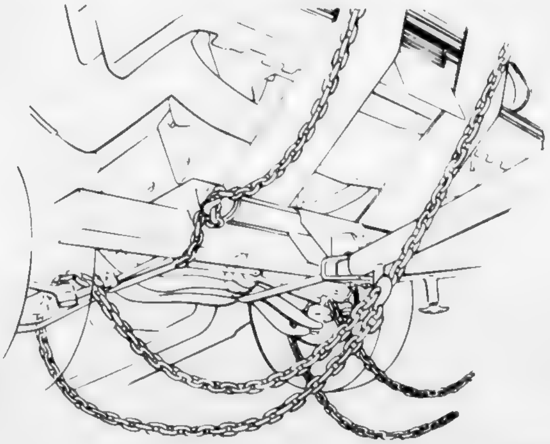


Fig. A-14 Front Towing—Gremlin

Rear Towing

Attach J-hooks on rear axle tubes between the shock absorber mounting bracket and wheel. Use caution to avoid damage to brake line on top of axle tubes.

A wood spacer block is not required. Be certain hooks are off the spring leaf to prevent shifting after the vehicle is lifted.

Attach separate safety chains around spring shackles (fig. A-15).

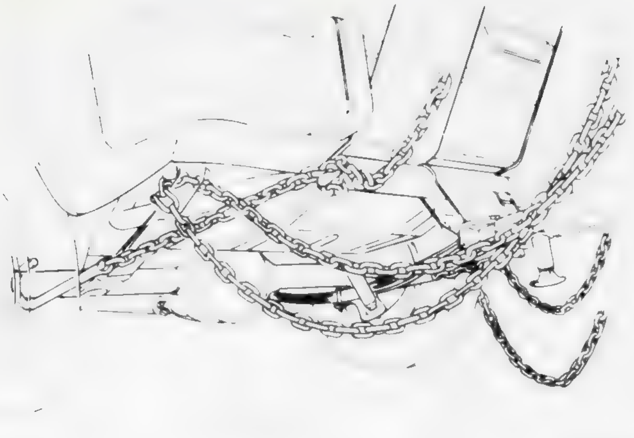


Fig. A-15 Rear Towing—Gremlin

Concord

Front Towing

Attach J-hooks on the rear of the front crossmember near the lower control arms. Position the wood spacer block against the front wheels with blocks contacting ends of frame horns. Position sling tow bar six to eight inches behind the bumper.

Attach separate safety chains around outboard end of lower control arms (fig. A-16).

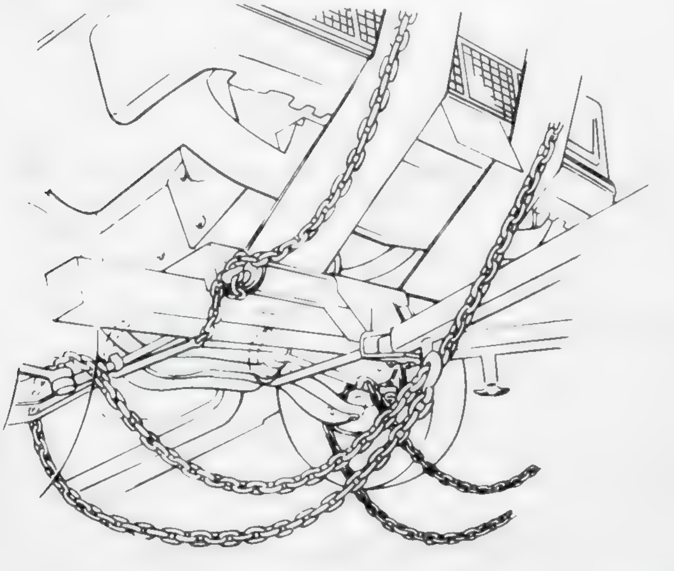


Fig. A-16 Front Towing—Concord

Rear Towing

Attach J-hooks on rear axle tubes between the springs and wheel. Use caution to avoid damage to brake line on top of axle tubes. Position the wood spacer block across sling chains with blocks contacting springs six to eight inches ahead of rear shackles. Position sling tow bar directly in front of spacer (fig. A-17).

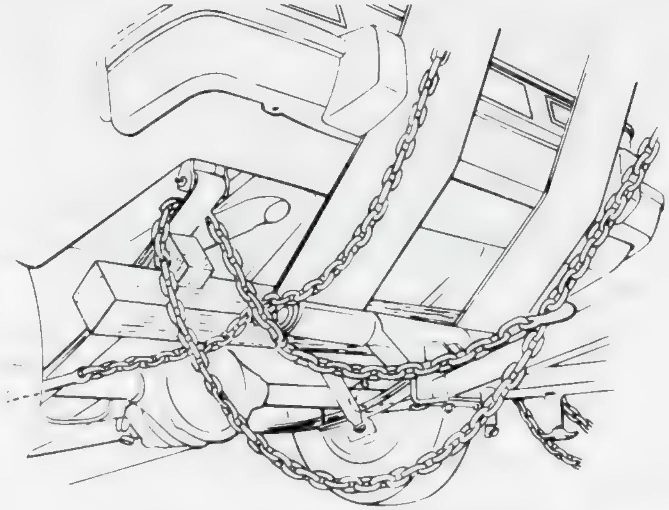


Fig. A-17 Rear Towing—Concord

AMX

Front Towing

Attach J-hooks on rear of front crossmember near lower control arm pivot bolts. Position a 4-inch by 4-inch by 60-inch long wood spacer block under the front bumper. Position sling tow bar 16 to 20 inches behind bumper.

Attach safety chains around energy absorber frame mounts (fig. A-18).

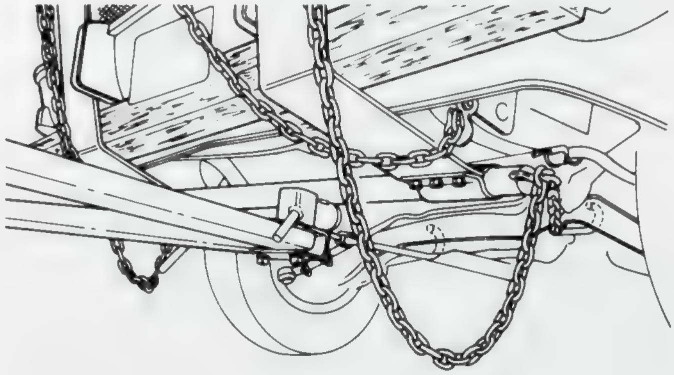


Fig. A-18 Front Towing—AMX

Rear Towing

Attach J-hooks on rear axle tubes between the springs and wheels. Position a 4-inch by 4-inch by 60-inch long wood spacer block across sling chains with blocks contacting springs 6 to 8 inches ahead od rear shackles. Position tow bar directly in front of spacer.

Attach safety chains around spring shackles (fig. A-19).

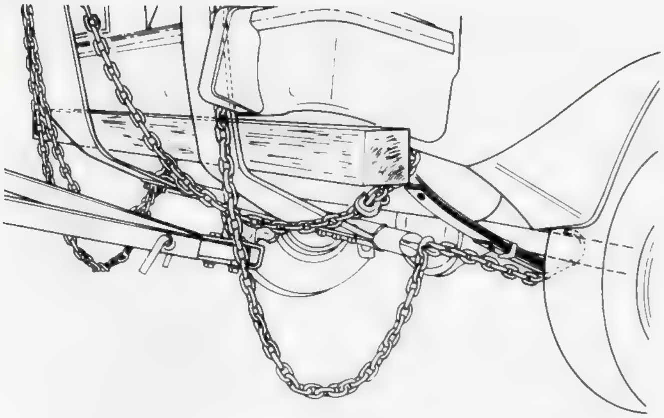


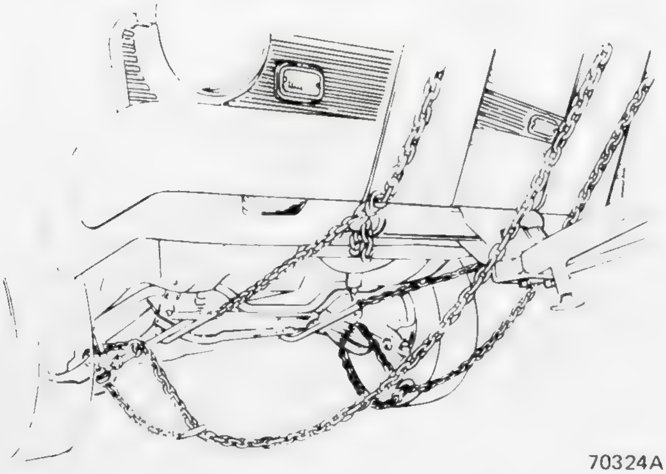
Fig. A-19 Rear Towing—AMX

Matador—2-Door Coupe

Front Towing

Attach J-hooks on the rear of the front crossmember at pivot pins. Position sling tow bar directly under the front bumper.

Attach separate safety chains around outboard end of lower control arms (fig. A-20).



70324A

Fig. A-20 Front Towing—Matador 2-Door

Rear Towing

Attach J-hooks on rear axle tubes between the shock absorber mounting bracket and wheel. Use caution to avoid damage to brake line on top of axle tubes. Position sling tow bar directly under the rear crossmember.

Attach separate safety chains around center portion of axle tubes (fig. A-21).

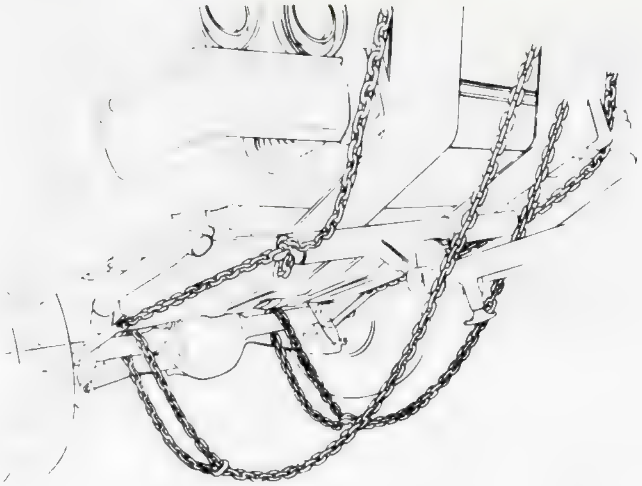


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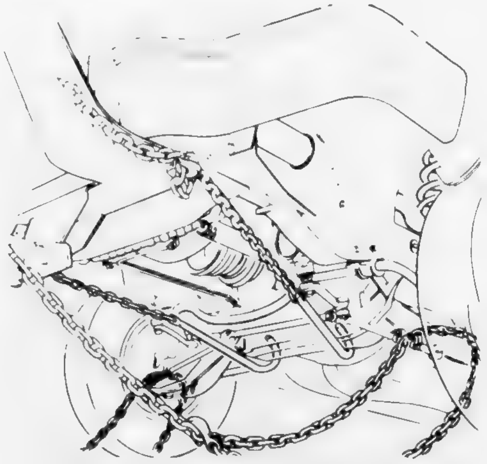
Fig. A-21 Rear Towing—Matador 2-Door

Matador—4-Door

Front Towing

Attach J-hooks on the rear of the front crossmember inside the motor mounts. Position sling tow bar two to three inches behind the front bumper.

Attach separate safety chains around outboard end of lower control arms (fig. A-22).



70325A

Fig. A-22 Front Towing—Matador 4-Door

Rear Towing

Attach J-hooks to the rear shock absorber mounting brackets on rear axle tubes. Position the wood spacer block across sling chains with blocks contacting angle brace at end of each side frame channel. Position the sling tow bar directly in front of the spacer.

Attach separate safety chains around ends of rear axle tubes. Use caution to avoid damage to brake line on top of axle tubes (fig. A-23).

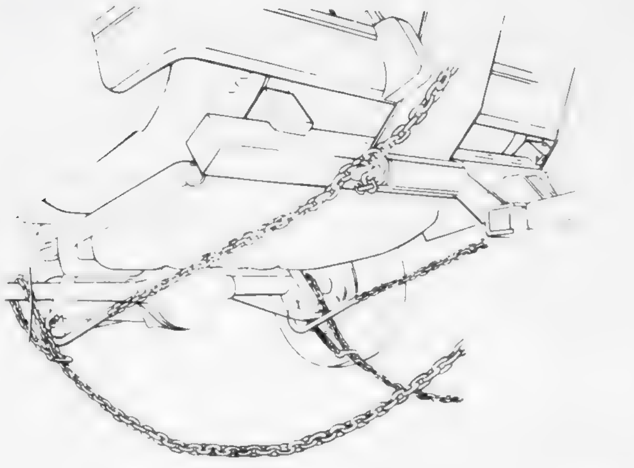


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Fig. A-23 Rear Towing—Matador 4-Door

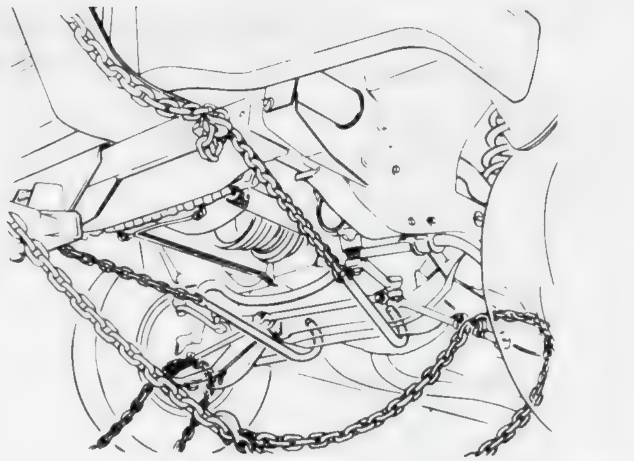

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Fig. A-24 Front Towing—Matador Station Wagon

Matador—Station Wagon

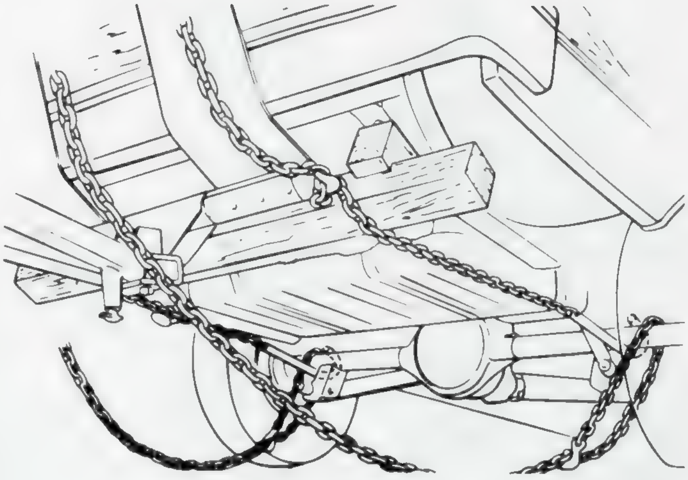
Front Towing

Attach J-hooks on the rear of the front crossmember inside the motor mounts. Position sling tow bar two to three inches behind the front bumper.

Attach separate safety chains around outboard end of lower control arms (fig. A-24).

Rear Towing

Attach J-hooks on rear axle tube between the shock absorber mounting bracket and wheel. Use caution to avoid damage to brake line on top of axle tubes. Position the wood spacer block across sling chains with blocks contacting angle brace at end of each side frame channel. Position the sling tow bar directly in front of the spacer (fig. A-25).



70326B

Fig. A-25 Rear Towing—Matador Station Wagon

General Dimensions (Inches)

	Pacer Hatchback	Pacer Wagon	Gremlin	Concord 2-Dr.	Concord 4-Dr.	Concord Hatchback AMX	Concord Wagon	Matador Coupe	Matador Sedan	Matador Wagon
Exterior										
Wheelbase	100.0	100.0	96.0	108.0	108.0	108.0	108.0	114.0	118.0	118.0
Length	172.1	177.0	166.6	183.6	183.6	183.6	183.6	209.9	218.3	219.3
Width	77.0	77.0	70.6	71.0	71.0	71.0	71.0	77.4	77.3	77.2
Height	52.8	53.2	51.5	51.7	51.3	51.7	51.3	51.6	53.9	56.0
Overhang: Front	33.3	33.3	34.7	34.7	34.7	34.7	34.7	46.2	44.3	44.3
Rear	38.8	43.7	35.9	40.9	40.9	40.9	40.9	49.8	56.0	56.9
Tread: Front	61.5	61.5	58.4	58.4	58.4	57.9	57.9	58.1	58.1	58.1
Rear	60.0	60.0	57.5	57.5	57.5	57.1	57.1	60.6	60.6	60.6
Interior										
Head Room: Front	38.3	38.5	38.1	38.1	38.1	38.1	38.1	37.6	39.6	39.9
Rear	37.0	38.4	36.5	37.5	37.9	36.7	37.9	36.0	37.5	38.5
Leg Room: Front	40.7	40.7	40.8	40.8	40.8	40.8	40.8	43.0	42.8	42.8
Rear	34.9	34.9	27.8	35.7	36.1	31.1	36.1	33.3	39.6	39.6
Hip Room: Front	55.8	55.8	54.8	54.3	54.4	54.3	54.4	57.1	59.9	59.9
Rear	42.2	44.2	42.6	52.5	53.6	51.7	53.6	51.0	59.8	59.8
Shoulder Room: Front	57.3	57.3	54.9	54.0	54.0	54.0	54.0	59.8	59.7	59.7
Rear	51.2	51.2	53.0	53.2	53.4	52.4	53.4	59.0	60.0	60.0
Luggage Capacity (cu. ft.)	31.1	50.4	26.5	10.8	10.8	31.7	59.4	14.3	19.7	87.4

70088

Metric System—SI

The International System of Units (Systeme International d'Unites) officially abbreviated "SI" in all languages – the modern metric system

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL
Length	Dimensions Tire rolling circumference Turning circle/radius Braking distance	meter	m
	Greater than 999 meter	kilometer	km
	Dimensions	millimeter	mm
	Depth of surface finish	micrometer	um
Area	Glass & Fabrics Brake & Clutch linings Radiator area etc.	square centimeter	cm^2
	Small areas	square millimeter	mm^2
Volume	Car Luggage Capacity	cubic meter	m^3
	Engine Capacity	liter	l
	Vehicle fluid capacity	cubic centimeter	cm^3
Volume Flow	Gas & Liquid	liter per second	l/s
Time Interval	Measurement of elapsed time	second minute hour day	s min h d
Velocity	General use	meter per second	m/s
	Road speed	kilometer per hour	km/h
Acceleration & Deceleration	General use	meter per second squared	m/s^2
Frequency	Electronics	hertz kilohertz megahertz	Hz kHz mHz
Rotational Speed	General use	revolution per minute revolution per second	rpm rps
Mass	Vehicle mass Legal load rating	megagram	t
	General use Small masses	kilogram gram milligram	kg g mg
Density	General use	kilogram per cubic meter gram per cubic centimeter kilogram per liter	kg/m^3 g/cm^3 kg/l
Force	Pedal effort Clutch spring force Handbrake lever effort etc.	newton	N
Moment of Force (Torque)	Torque	newton meter	N-m
Power, Heat Flow Rate	General use Bulbs Alternator output Engine performance Starter performance	watt kilowatt	W kW

QUANTITY	EXAMPLES OF APPLICATIONS	METRIC UNIT	SYMBOL
Celsius Temperature	General use	degree Celsius	°C
Thermodynamic Temperature	General use	kelvin	k
Electric Current	General use	ampere milliampere microampere	A mA μA
Potential Difference (Electromotive Force)	General use	kilovolt volt millivolt microvolt	kV V mV μV
Electric Resistance	General use	megohm kilohm ohm	MΩ kΩ Ω
Electric Capacitance	General use	farad microfarad picofarad	F μF pF
Fuel Consumption	Vehicle performance	liter per 100 kilometer	l/100 km
Oil Consumption	Vehicle performance	liter per 1000 kilometer	l/1000 km
Stiffness	Linear stiffness	kilonewton meter	kN/m
Tire Revolutions	Tire Data	revolution per kilometer	rev/km
Pressure	Tire Coolant Lubricating oil Fuel pump delivery Engine compression Manifold Brake line (hydraulic) Car heating & ventilation Barometric pressure	kilopascal	kPa
Luminous Intensity	Bulbs	candela	cd
Accumulator Storage Rating	Battery	ampere hour	A-h

U.S.A./METRIC COMPARISON

QUANTITY	USA	METRIC – SYMBOL	
Length	Inch-Foot-Mile	Meter	m
Weight (mass)	Ounce-Pound	Kilogram	Kg
Area	Square inch/Foot	Square Meter	m^2
Volume-Dry	Cubic inch/Foot	Cubic Meter	m^3
-Liquid	Ounce-Pint-Quart-Gallon	Liter	l
Velocity	Feet Per Second	Meter per Second	m/s
Road Speed	Miles Per Hour	Kilometer per Hour	km/h
Force	Pound-Force	Newton	N
Torque	Foot-Pounds	Newton meter	N-m
Power	Horsepower	Kilowatt	kW
Pressure	Pounds Per Square Inch	Kilopascal	kPa
Temperature	Degrees Fahrenheit	Degrees Kelvin and Celsius	K °C

Decimal Equivalents

Millimeter	Decimal	Fraction	Drill Size	Millimeter	Decimal	Fraction	Drill Size	Millimeter	Decimal	Fraction	Drill Size	Millimeter	Decimal	Fraction	Drill Size	Millimeter	Decimal	Fraction
1	0039			1.75	.0689				.1570		22	6.8	.2677			10.72	.4219	27/64
15	.0059				.0700		50	4.0	.1575			6.9	.2716			11.0	.4330	
2	.0079			1.8	.0709				.1590		21		2720		I	11.11	.4375	7/16
25	.0098			1.85	.0728				.1610		20	7.0	.2756			11.5	.4528	
3	.0118				.0730		49	4.1	.1614				.2770		J	11 51	.4531	29/64
	0135		80	1 9	.0748			4.2	.1654			7.1	2795			11 91	.4687	15/32
35	.0138				.0760		48		.1660		19		.2811		K	12.0	.4724	
	0145		79	1 95	0767			4 25	.1673			7.14	.2812	9/32		12.30	.4843	31/64
39	.0156	1/64		1 98	.0781	5/64		4 3	.1693			7.2	.2835			12.5	.4921	
4	.0157				.0785		47		.1695		18	7.25	.2854			12.7	.5000	1/2
	0160		78	2.0	.0787			4.37	.1719	11/64		7 3	.2874			13.0	.5118	
45	.0177			2.05	.0807				1730		17		.2900		L	13.10	.5156	33/64
	0180		77		.0810		46	4.4	.1732			7.4	.2913			13.49	.5312	17/32
5	.0197				.0820		45		.1770		16		2950		M	13.5	.5315	
	0200		76	2.1	.0827			4.5	.1771			7.5	2953			13 89	.5469	35/64
	.0210		75	2.15	.0846				.1800		15	7.54	2968	19/64		14.0	.5512	
55	.0217				.0860		44	4.6	.1811			7.6	.2992			14.29	.5625	9/16
	0225		74	2.2	.0866				.1820		14		.3020		N	14.5	.5709	
6	.0236			2.25	.0885			4.7	.1850		13	7 7	3031			14.68	5781	37/64
	0240		73		.0890		43	4.75	.1870			7.75	3051			15 0	5906	
	.0250		72	2.3	.0905			4 76	.1875	3/16		7.8	.3071			15.08	5937	19/32
.65	.0256			2.35	.0925			4 8	1890		12	7.9	.3110			15.48	.6094	39/64
	0260		71		.0935		42		.1910		11	7 94	3125	5/16		15.5	.6102	
	0280		70	2.38	.0937	3/32		4.9	.1929			8.0	.3150			15 88	6250	5/8
.7	.0276			2 4	.0945				1935		10		.3160		O	16.0	.6299	
	0292		69		.0960		41		.1960		9	8 1	3189			16.27	.6406	41/64
.75	.0295			2.45	.0964			5.0	.1968			8.2	.3228			16.5	.6496	
	.0310		68		.0980		40		.1990		8		3230		P	16.67	.6562	21/32
79	.0312	1/32		2.5	.0984			5.1	.2008			8.25	3248			17.0	.6693	
8	.0315				.0995		39		.2010		7	8.3	3268			17 06	.6719	43/64
	.0320		67		.1015		38	5.16	.2031	13/64		8.33	3281	21/64		17.46	.6875	11/16
	0330		66	2.6	.1024				.2040		6	8.4	.3307			17.5	.6890	
.85	.0335				1040		37	5.2	.2047				.3320		Q	17 86	.7031	45/64
	0350		65	2.7	.1063				.2055		5	8.5	3346			18 0	.7087	
9	.0354				.1065		36	5.25	.2067			8.6	.3386			18 26	.7187	23/32
	.0360		64	2.75	.1082			5.3	.2086				.3390		R	18.5	.7283	
	0370		63	2.78	.1094	7/64			.2090		4	8.7	.3425			18 65	.7344	47/64
95	.0374				.1100		35	5.4	.2126			8.73	.3437	11/32		19.0	.7480	
	0380		62	2.8	.1102				.2130		3	8.75	.3445			19 05	.7500	3/4
	0390		61		.1110		34	5.5	.2165			8.8	.3465			19.45	.7656	49/64
1.0	.0394				.1130		33	5.56	.2187	7/32			.3480		S	19.5	.7677	
	0400		60	2.9	.1141			5.6	.2205			8.9	.3504			19.84	.7812	25/32
	.0410		59		.1160		32		.2210		2	9.0	.3543			20.0	.7874	
1.05	.0413			3.0	.1181			5.7	.2244				.3580		T	20.24	.7969	51/64
	.0420		58		.1200		31	5.75	.2263			9.1	.3583			20.5	.8071	
	.0430		57	3.1	.1220				.2280		1	9.13	.3594	23/64		20.64	.8125	13/16
1.1	.0433			3.18	.1250	1/8		5.8	.2283			9.2	.3622			21.0	.8268	
1.15	.0452			3.2	.1260			5.9	.2323			9.25	.3641			21.03	.8281	53/64
	.0465		56	3.25	.1279				.2340		A	9.3	.3661			21.43	.8437	27/32
1.19	.0469	3/64			.1285		30	5.95	.2344	15/64			.3680		U	21.5	.8465	
1.2	.0472			3.3	.1299			6.0	.2362			9.4	.3701			21.83	.8594	55/64
1.25	.0492			3.4	.1338				.2380		B	9.5	.3740			22.0	.8661	
1.3	.0512				.1360		29	6.1	.2401			9.53	.3750	3/8		22.23	.8750	7/8
	.0520		55	3.5	.1378				.2420		C		.3770		V	22.5	.8858	
1.35	.0531				.1405		28	6.2	.2441			9.6	.3780			22.62	.8906	57/64
	.0550		54	3.57	.1406	9/64		6.25	.2460		D	9.7	.3819			23.0	.9055	
1.4	.0551			3.6	.1417			6.3	.2480			9.75	.3838			23.02	.9062	29/32
1.45	.0570				.1440		27	6.35	.2500	1/4	E	9.8	.3858			23.42	.9219	59/64
1.5	.0591			3.7	.1457			6.4	.2520				.3860		W	23.5	.9252	
	.0595		53		.1470		26	6.5	.2559			9.9	.3898			23.81	.9375	15/16
1.55	.0610			3.75	.1476				.2570		F	9.92	.3906	25/64		24.0	.9449	
1.59	.0625	1/16			.1495		25	6.6	.2598			10.0	.3937			24.21	.9531	61/64
1.6	.0629			3.8	.1496				.2610		G		.3970		X	24.5	.9646	
	.0635		52		.1520		24	6.7	.2638				.4040		Y	24.61	.9687	31/32
1.65	.0649			3.9	.1535			6.75	.2657	17/64		10.32	.4062	13/32		25.0	.9843	
1.7	.0669				.1540		23	6.75	.2657				.4130		Z	25.03	.9844	63/64
	.0670		51	3.97	.1562	5/32			.2660		H	10.5	.4134			25.4	1.0000	1

80280

FOOT-POUNDS TO NEWTON-METERS CONVERSION CHART

FT-LB	NEWTON-METER	FT-LB	NEWTON-METER	FT-LB	NEWTON-METER	FT-LB	NEWTON-METER
1	1.36	51	69.15	101	136.94	151	204.73
2	2.71	52	70.50	102	138.29	152	206.08
3	4.07	53	71.86	103	139.65	153	207.44
4	5.42	54	73.21	104	141.01	154	208.80
5	6.78	55	74.57	105	142.36	155	210.15
6	8.13	56	75.93	106	143.72	156	211.51
7	9.49	57	77.28	107	145.07	157	212.86
8	10.85	58	78.64	108	146.43	158	214.22
9	12.20	59	79.99	109	147.78	159	215.58
10	13.56	60	81.35	110	149.14	160	216.93
11	14.91	61	82.70	111	150.50	161	218.29
12	16.27	62	84.06	112	151.85	162	219.64
13	17.63	63	85.42	113	153.21	163	221.00
14	18.98	64	86.77	114	154.56	164	222.35
15	20.34	65	88.13	115	155.92	165	223.71
16	21.69	66	89.48	116	157.27	166	225.07
17	23.05	67	90.84	117	158.63	167	226.42
18	24.40	68	92.20	118	159.99	168	227.78
19	25.76	69	93.55	119	161.34	169	229.13
20	27.12	70	94.91	120	162.70	170	230.49
21	28.47	71	96.26	121	164.05	171	231.84
22	29.83	72	97.62	122	165.41	172	233.20
23	31.18	73	98.97	123	166.77	173	234.56
24	32.54	74	100.33	124	168.12	174	235.91
25	33.90	75	101.69	125	169.48	175	237.27
26	35.25	76	103.04	126	170.83	176	238.62
27	36.61	77	104.40	127	172.19	177	239.98
28	37.96	78	105.75	128	173.54	178	241.34
29	39.32	79	107.11	129	174.90	179	242.69
30	40.67	80	108.47	130	176.26	180	244.05
31	42.03	81	109.82	131	177.61	181	245.40
32	43.39	82	111.18	132	178.97	182	246.76
33	44.74	83	112.53	133	180.32	183	248.11
34	46.10	84	113.89	134	181.68	184	249.47
35	47.45	85	115.24	135	183.04	185	250.83
36	48.81	86	116.60	136	184.39	186	252.18
37	50.17	87	117.96	137	185.75	187	253.54
38	51.52	88	119.31	138	187.10	188	254.89
39	52.88	89	120.67	139	188.46	189	256.25
40	54.23	90	122.02	140	189.81	190	257.61
41	55.59	91	123.38	141	191.17	191	258.96
42	56.94	92	124.74	142	192.53	192	260.32
43	58.30	93	126.09	143	193.88	193	261.67
44	59.66	94	127.45	144	195.24	194	263.03
45	61.01	95	128.80	145	196.59	195	264.38
46	62.37	96	130.16	146	197.95	196	265.74
47	63.72	97	131.51	147	199.31	197	267.10
48	65.08	98	132.87	148	200.66	198	268.45
49	66.44	99	134.23	149	202.02	199	269.81
50	67.79	100	135.58	150	203.37	200	271.16

80750

READER'S COMMENTS
1978 AMC Technical Service Manual
Volume I—Power Plant

American Motors Corporation needs user feedback — your critical evaluation of this manual. Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our service manual.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written? Is it easy to use? ______

What features are most useful? ______

What faults do you find with the manual? ______

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MAINTENANCE B

SECTION INDEX

GENERAL

This section describes the service procedures required by the 1978 Four-Cylinder and Six- and Eight-Cylinder Maintenance Schedules to keep AMC cars in good running condition. These services are based on changes in driving conditions, accumulated odometer mileage or time intervals, whichever comes first, or are unscheduled as required by changes in usage, handling or performance. The section is subdivided into three parts: (1) Services Required by Driving Conditions or Time Intervals, (2) Services Scheduled by Accumulated Mileage and (3) Unscheduled Maintenance.

Maintenance Schedule

Two maintenance schedules are listed: one for cars with four-cylinder engines, and one for cars with six- or eight-cylinder engines. Each schedule is followed by detailed service charts. Be sure to refer to the correct maintenance schedule or chart for the car being serviced.

The services listed are those which experience and testing have indicated are the most likely needed at the mileage or time interval shown. When a car operates under the conditions listed, perform the maintenance described under "Required Services." Refer to the service charts for the list of maintenance items, and use the information in this section for service procedures.

Canadian Fuel and Maintenance Requirements

All service requirements in the Maintenance Schedules apply to cars sold in Canada. Canadian cars should receive the following additional maintenance services:

Cars equipped with six-cylinder engine and single-barrel carburetor may use regular, low-lead or unleaded fuels. All other models should use unleaded fuel only.

- All cars equipped with six- or eight-cylinder engine, lubricate exhaust heat valve at each oil change—every 7 months or 7,500 miles (12,000 km), whichever comes first.

- All cars equipped with six-cylinder engine and one-barrel carburetor, perform an engine tune-up every 15 months or 15,000 miles (24,000 km), whichever comes first.

1978 AMC FOUR-CYLINDER MAINTENANCE SCHEDULE

OWNER RESPONSIBILITY	It is the owner's responsibility to determine driving conditions, to have the car serviced according to the Maintenance Schedule, and to pay for necessary parts and labor.
INSTRUCTIONS	Read "CONDITIONS" and determine which apply to your driving situation. Under the conditions listed, perform the maintenance described under "REQUIRED SERVICES."
CONDITIONS	**REQUIRED SERVICES**
SHORT-TRIP DRIVING	For proper engine protection, check engine oil level every 500 to 600 miles (800 to 960 km). Change oil and filter every 5,000 miles (8,000 km) or 5 months, whichever comes first. When most driving involves trips of less than 6 miles (10 km), change oil once between scheduled oil and filter changes.
HEAVY-DUTY DRIVING	In police, taxi, commercial load-carrying or delivery use, change automatic transmission fluid and filter, and adjust bands every 15,000 miles (24,000 km) or 15 months, whichever comes first. For standard duty, no automatic transmission maintenance is required except regular fluid level checks.
START OF WINTER	Inspect battery condition and clean battery cables. Change engine coolant (antifreeze/water mixture) after 25,000 miles (40,000 km) or 25 months, whichever comes first, and then at the start of every winter season.
ACCUMULATED MILEAGE OR KILOMETERS	At each mileage interval shown, perform the service checked below. Four charts follow that list the maintenance items for each service.

km	MILES	CHART 1 • OIL CHANGE SERVICE • EMISSION CONTROL INSPECTION	CHART 2 • OIL CHANGE SERVICE • ENGINE DRIVE BELT INSPECTION	CHART 3 • OIL CHANGE SERVICE • ENGINE MAINTENANCE • BRAKE AND CHASSIS INSPECTION • BODY LUBRICATION	CHART 4 • OIL CHANGE SERVICE • ENGINE TUNE-UP • BRAKE AND CHASSIS INSPECTION • CHASSIS LUBRICATION • BODY LUBRICATION
8,000	5,000	✓			
16,000	10,000		✓		
24,000	15,000			✓	
32,000	20,000		✓		
40,000	25,000		✓		
48,000	30,000				✓
56,000	35,000		✓		
64,000	40,000		✓		
72,000	45,000			✓	
80,000	50,000		✓		
88,000	55,000		✓		
96,000	60,000				✓
104,000	65,000		✓		
112,000	70,000		✓		
120,000	75,000			✓	
128,000	80,000		✓		
136,000	85,000		✓		
144,000	90,000				✓

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CHART 1 — FOUR-CYLINDER
• OIL CHANGE SERVICE
• EMISSION CONTROL INSPECTION

- **OIL CHANGE SERVICE**

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:
- engine coolant
- brake master cylinder
- manual steering gear
- power steering pump
- manual transmission
- automatic transmission
- rear axle differential
- windshield washer reservoir

Clean windshield wiper blade elements.

- **EMISSION CONTROL INSPECTION**

Retorque cylinder head bolts.
Adjust engine valves.
Check condition and tension of fan/alternator, power steering and air pump drive belts, and adjust if necessary.
Check and adjust curb and high idle speeds.

80258A

CHART 2 — FOUR-CYLINDER
• OIL CHANGE SERVICE
• ENGINE DRIVE BELT INSPECTION

- **OIL CHANGE SERVICE**

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:
- engine coolant
- brake master cylinder
- power steering pump
- manual transmission
- automatic transmission
- rear axle differential
- windshield washer reservoir

Clean windshield wiper blade elements.

- **ENGINE DRIVE BELT INSPECTION**

Check condition and tension of fan/alternator, power steering and air pump drive belts, and adjust if necessary.

80258B

CHART 3 — FOUR-CYLINDER
• OIL CHANGE SERVICE
• ENGINE MAINTENANCE
• BRAKE AND CHASSIS INSPECTION
• BODY LUBRICATION

- **OIL CHANGE SERVICE**

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:
- battery
- engine coolant
- brake master cylinder
- power steering pump
- manual transmission
- automatic transmission
- rear axle differential
- windshield washer reservoir

Clean windshield wiper blade elements.

- **ENGINE MAINTENANCE**

Retorque cylinder head bolts.
Adjust engine valves.
Check condition and tension of fan/alternator, power steering and air pump drive belts, and adjust if necessary.
Replace fuel filter, ignition points and condenser.
Check and adjust ignition timing.

- **BRAKE AND CHASSIS INSPECTION**

Inspect the following items as indicated. Correct to specifications as necessary:

Brakes

Front and rear brakelinings for wear.
Rear brake self-adjusting mechanism for proper operation.
Master cylinder, calipers, wheel cylinders and differential warning valve for leaks.
Brake lines, fittings, hoses and other parts for condition and leaks.
Parking brake for proper operation.
Overall brake condition and action.

Steering/Suspension

Manual or power steering gear and linkage for leaks, looseness or wear.
Springs, shock absorbers and bushings for leaks, looseness or wear.
Tire condition.
Overall steering/suspension condition and action.

Also:

Lubricate front disc brake caliper abutment surfaces.
Adjust parking brake, if necessary.
Adjust tire pressures to specifications.
Adjust manual transmission clutch free play, if necessary.

- **BODY LUBRICATION**

Lubricate the following items with the recommended lubricant:
- ashtray slides
- door, hood and liftgate latches
- door, hood and liftgate hinges
- door, window and liftgate weatherseals
- key lock cylinders

80258C

CHART 4 — FOUR-CYLINDER

- OIL CHANGE SERVICE
- ENGINE TUNE-UP
- BRAKE AND CHASSIS INSPECTION
- CHASSIS LUBRICATION
- BODY LUBRICATION

• OIL CHANGE SERVICE

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:

- battery
- engine coolant
- brake master cylinder
- manual steering gear
- power steering pump
- automatic transmission
- manual transmission
- rear axle differential
- windshield washer reservoir

Clean windshield wiper blade elements.

• ENGINE TUNE-UP

Examine the components listed under each system for proper assembly, condition and operation. Correct, adjust or service to specifications as necessary.

Engine Mechanical Systems

Inspect:
- Air Guard system hoses
- condition and tension of fan/alternator, power steering and air pump drive belts
- vacuum lines and fittings, Exhaust Gas Recirculation lines, hoses and connections

Also:

Retorque cylinder head bolts.
Adjust engine valves.
Adjust drive belts, if necessary.

Ignition System

Inspect:
- coil and spark plug wires
- distributor — cap and rotor, vacuum and centrifugal advance mechanisms, distributor shaft and cam lobes
- transmission controlled spark system (TCS), if equipped

Replace ignition points, condenser and spark plugs.

Fuel System

Inspect:
- fuel tank, cap, lines and connections
- air cleaner thermostatic control system (TAC)
- choke linkage for free movement
- PCV system hoses and solenoid (solenoid on manual transmission only)

Clean PCV filter in air cleaner.
Replace PCV valve, fuel filter, air filter element and charcoal canister air inlet filter.

Final Adjustment

Ignition timing.
Idle mixture.
Curb and high idle speeds.

• BRAKE AND CHASSIS INSPECTION

Inspect the following items as indicated. Correct to specifications as necessary:

Brakes

Front and rear brakelinings for wear.
Rear brake self-adjusting mechanism for proper operation.
Master cylinder, calipers, wheel cylinders and differential warning valve for leaks.
Brake lines, fittings, hoses and other parts for condition and leaks.
Parking brake for proper operation.
Overall brake condition and action.

Steering/Suspension

Manual or power steering gear and linkage for leaks, looseness or wear.
Springs, shock absorbers and bushings for leaks, looseness or wear.
Tire condition.
Overall steering/suspension condition and action.

Also:

Lubricate front disc brake caliper abutment surfaces.
Adjust parking brake, if necessary.
Adjust tire pressure to specifications.
Adjust manual transmission clutch free play, if necessary.

• CHASSIS LUBRICATION

Replace torn or ruptured grease seals and/or damaged steering/suspension components, and lubricate the following:
- clutch lever and linkage
- front ball joints (4)
- turning stops (2 places)
- tie rod inner ball joints (2)

Also:

Repack front wheel bearings.
Drain and refill rear axle lubricant.

Note: U-joints and rear wheel bearings do not require periodic or scheduled lubrication.

• BODY LUBRICATION

Lubricate the following items with the recommended lubricant:
- ashtray slides
- door, hood and liftgate latches
- door, hood and liftgate hinges
- door, window and liftgate weatherseals
- key lock cylinders

80258D

1978 AMC SIX- AND EIGHT-CYLINDER MAINTENANCE SCHEDULE

OWNER RESPONSIBILITY	It is the owner's responsibility to determine driving conditions, to have the car serviced according to the Maintenance Schedule, and to pay for necessary parts and labor.
INSTRUCTIONS	Read "CONDITIONS" and determine which apply to your driving situation. Under the conditions listed, perform the maintenance described under "REQUIRED SERVICES."
CONDITIONS	**REQUIRED SERVICES**
SHORT-TRIP DRIVING	For proper engine protection, check engine oil level every 500 to 600 miles (800 to 960 km). Change oil and filter every 7,500 miles (12,000 km) or 7 months, whichever comes first. When most driving involves trips of less than 6 miles (10 km), change oil once between scheduled oil and filter changes.
HEAVY-DUTY DRIVING	In police, taxi, commercial load-carrying or delivery use, change automatic transmission fluid and filter, and adjust bands every 15,000 miles (24,000 km) or 15 months, whichever comes first. For standard duty, no automatic transmission maintenance is required except regular fluid level checks.
START OF WINTER	Inspect battery condition and clean cables. Change engine coolant (antifreeze/water mixture) after 25,000 miles (40,000 km) or 25 months, whichever comes first, and then at the start of every winter season.
ACCUMULATED MILEAGE OR KILOMETERS	At each mileage interval shown, perform the service checked below. Four charts follow that list the maintenance items for each service.

km	MILES	CHART 1 • EMISSION CONTROL INSPECTION	CHART 2 • OIL CHANGE SERVICE *	CHART 3 • OIL CHANGE SERVICE * • ENGINE MAINTENANCE * • BRAKE AND CHASSIS INSPECTION • BODY LUBRICATION	CHART 4 • OIL CHANGE SERVICE * • ENGINE TUNE-UP * • BRAKE AND CHASSIS INSPECTION • CHASSIS LUBRICATION • BODY LUBRICATION
8,000	5,000	✓			
12,000	7,500		✓		
24,000	15,000			✓	
36,000	22,500		✓		
48,000	30,000				✓
60,000	37,500		✓		
72,000	45,000			✓	
84,000	52,500		✓		
96,000	60,000				✓
108,000	67,500		✓		
120,000	75,000			✓	
132,000	82,500		✓		
144,000	90,000				✓

*For cars sold in Canada, refer to Canadian Fuel and Maintenance Requirements.

80259

CHART 1 – SIX- AND EIGHT-CYLINDER

• EMISSION CONTROL INSPECTION

Check and adjust fan/alternator, power steering, air pump and air conditioning drive belts.

Check and adjust curb and high idle speeds.

80259A

CHART 2 – SIX- AND EIGHT-CYLINDER

• OIL CHANGE SERVICE

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:

- engine coolant
- brake master cylinder
- manual steering gear*
- power steering pump
- manual transmission
- automatic transmission
- rear axle differential
- windshield washer reservoir

Check pressure on compact spare tire (if equipped).

Clean windshield wiper blade elements.

*Check at first service, at 30,000 miles, then every 30,000 miles.

80259B

CHART 3 – SIX- AND EIGHT-CYLINDER

• OIL CHANGE SERVICE
• ENGINE MAINTENANCE
• BRAKE AND CHASSIS INSPECTION
• BODY LUBRICATION

• OIL CHANGE SERVICE

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:

- battery
- engine coolant
- brake master cylinder
- power steering pump
- manual transmission
- automatic transmission
- rear axle differential
- windshield washer reservoir

Check pressure on compact spare tire (if equipped).

Clean windshield wiper blade elements.

• ENGINE MAINTENANCE

Check and adjust fan/alternator, power steering, air pump and air conditioning drive belts.

Replace fuel filter.

Note: On Pacer, Concord, AMX with eight-cylinder engine, also perform the following services. Correct as necessary.

Inspect:

- choke linkage for free movement
- vacuum fittings, Exhaust Gas Recirculation lines, hoses and connections

Check idle mixture.

Check curb and high idle speeds.

Check ignition timing.

• BRAKE AND CHASSIS INSPECTION

Inspect the following items as indicated. Correct to specifications as necessary:

Brakes

Front and rear brakelinings for wear.

Rear brake self-adjusting mechanism for proper operation.

Master cylinder, calipers, wheel cylinders and differential warning valve for leaks.

Brake lines, fittings, hoses and other parts for condition and leaks.

Parking brake for proper operation.

Overall brake condition and action.

Steering/Suspension

Manual or power steering gear and linkage for leaks, looseness or wear.

Springs, shock absorbers and bushings for leaks, looseness or wear.

Tire condition

Overall steering/suspension condition and action.

Also:

Lubricate front disc brake caliper abutment surfaces.

Adjust parking brake, if necessary.

Adjust tire pressures to specifications.

Adjust manual transmission clutch free play, if necessary.

• BODY LUBRICATION

Lubricate the following items with the recommended lubricant:

- ashtray slides
- door, hood, trunk, tailgate and liftgate latches
- door, hood, trunk, tailgate and liftgate hinges
- door, window, trunk, tailgate and liftgate weatherseals
- key lock cylinders

80259C

CHART 4 — SIX- AND EIGHT-CYLINDER

- OIL CHANGE SERVICE
- ENGINE TUNE-UP
- BRAKE AND CHASSIS INSPECTION
- CHASSIS LUBRICATION
- BODY LUBRICATION

• OIL CHANGE SERVICE

Drain engine oil, replace oil filter and refill engine.

Check fluid levels:

- battery
- engine coolant
- brake master cylinder
- manual steering gear
- power steering pump
- automatic transmission
- manual transmission
- rear axle differential
- windshield washer reservoir

Check pressure on compact spare tire (if equipped).
Clean windshield wiper blade elements.

• ENGINE TUNE-UP

Examine the components listed under each system for proper assembly, condition and operation. Correct, adjust or service to specifications as necessary.

Engine Mechanical Systems

Inspect:

- Air Guard system hoses
- condition and tension of fan/alternator, power steering, air pump and air conditioning drive belts
- vacuum lines and fittings, Exhaust Gas Recirculation lines, hoses and connections

Also:

Adjust drive belts, if necessary.*
Lubricate exhaust heat valve.

Ignition System

Inspect:

- coil and spark plug wires
- distributor — cap and rotor, vacuum and centrifugal advance mechanisms
- transmission controlled spark system (TCS), if equipped

Replace spark plugs.

Fuel System

Inspect:

- fuel tank, cap, lines and connections
- air cleaner thermostatic control system (TAC)
- choke linkage for free movement
- PCV system hoses

Clean PCV filter (6-cylinder in air cleaner, V-8 in oil filler cap).
Replace PCV valve, fuel filter, air cleaner element and charcoal canister air inlet filter.

Final Adjustment

Ignition timing
Idle mixture
Curb and high idle speeds.

* During extended high temperature and extensive air conditioner operation, the drive belts may require more frequent inspection and adjustment.

• BRAKE AND CHASSIS INSPECTION

Inspect the following items as indicated.
Correct to specifications as necessary.

Brakes

Front and rear brakelinings for wear.
Rear brake self-adjusting mechanism for proper operation.
Master cylinder, calipers, wheel cylinders and differential warning valve for leaks.
Brake lines, fittings, hoses and other parts for condition and leaks.
Parking brake for proper operation.
Overall brake condition and action.

Steering/Suspension

Manual or power steering gear and linkage, for leaks, looseness or wear.
Springs, shock absorbers and bushings for leaks, looseness or wear.
Tire condition.
Overall steering/suspension condition and action.

Also:

Lubricate front disc brake caliper abutment surfaces.
Adjust parking brake, if necessary.
Adjust manual transmission clutch free play, if necessary.

• CHASSIS LUBRICATION

Replace torn or ruptured grease seals and/or damaged steering/suspension components, and lubricate the following:

- clutch lever and linkage
- front ball joints (4)
- turning stops (2 places)
- tie rod inner ball joints (2)

Also:

Repack front wheel bearings.
Drain and refill rear axle lubricant.

Note: U-joints and rear wheel bearings do not require periodic or scheduled lubrication.

• BODY LUBRICATION

Lubricate the following items with the recommended lubricant:

- ashtray slides
- door, hood, trunk, tailgate and liftgate latches
- door, hood, trunk, tailgate and liftgate hinges
- door, window, trunk, tailgate and liftgate weatherseals
- key lock cylinders

80259D

SERVICES SCHEDULED BY CONDITIONS OR TIME

SHORT-TRIP DRIVING

When most driving involves trips of less than six miles (10 km), change engine oil once between scheduled oil and filter changes. Replace oil filter every other oil change.

HEAVY-DUTY DRIVING

Heavy-duty driving refers to fleet or police use and commercial delivery or load-carrying. For cars in heavy-duty use, change automatic transmission fluid and filter and adjust bands every 15,000 miles (24,000 km) or 15 months, whichever comes first. Owners should also arrange for service upon signs of changing shift patterns.

NOTE: *The automatic transmission torque converter has no drain plug.*

For commercial load-carrying applications, owners should be careful not to overload or operate the car in a manner that would cause brake, engine, axle, steering, suspension or other failure.

AT START OF WINTER

Perform the following maintenance services at the start of every winter season:

Battery Service

WARNING: *Do not service the battery without wearing safety glasses, rubber gloves and protective clothing. Battery electrolyte contains sulfuric acid and must be kept away from skin, eyes, clothing and painted surfaces. If acid contacts any of these,* **flush immediately with large amounts of water. Get medical attention.** *Don't smoke while checking or servicing the battery and keep open flames or sparks away from battery filler caps since explosive gas is always present.*

(1) Disconnect battery negative cable and then the positive cable.

(2) Clean the cables and terminal posts with a wire brush terminal cleaner.

(3) Check the battery fluid level and replenish if necessary (fig. B-1).

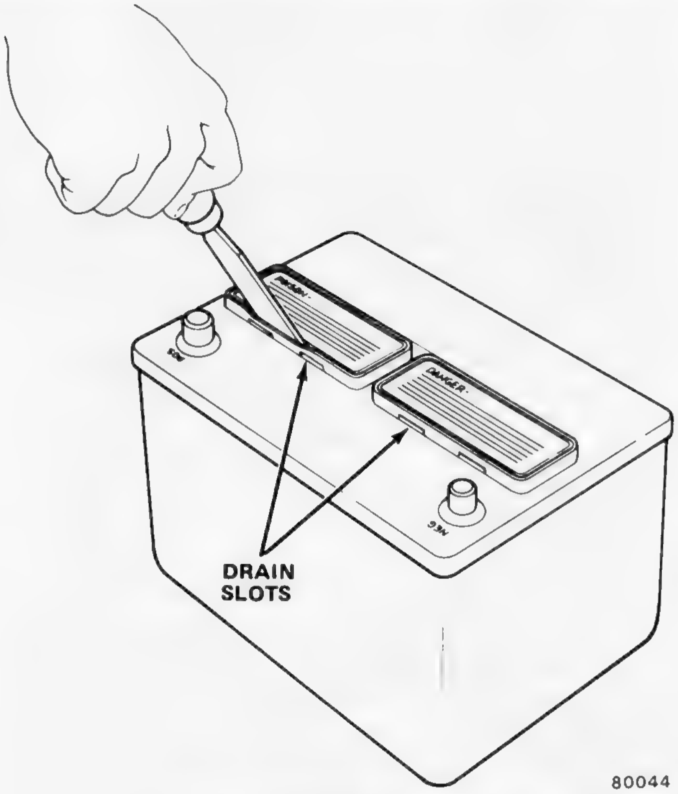


Fig. B-1 Removing Battery Filler Caps

(4) Remove the battery holddown and clean the battery and battery box, if necessary, with a solution of baking soda and water, then rinse thoroughly.

(5) Tip the battery slightly to drain dirty water through the slots provided.

(6) Fasten the battery holddown, but do not overtighten.

(7) Attach positive cable and then the negative cable.

(8) Apply a small amount of grease or protective coating to the cable ends to minimize corrosion.

Engine Coolant

Change engine coolant after the first 25,000 miles or 25 months, whichever comes first, and then at the start of every winter season. Refer to Chapter 1C—Cooling Systems, Volume 1—Power Plant for draining and refilling procedures.

SERVICES SCHEDULED BY ACCUMULATED MILEAGE

BODY LUBRICATION

Lubricate the items listed using the product specified in the Recommended Fluids and Lubricants Chart at the end of this section. When lubricating weatherseals, apply the lubricant to a rag and wipe it on the seal to prevent dust-collecting overspray which can soil passenger clothing.

BRAKE AND CHASSIS INSPECTION

Brakes

Inspect linings for wear, cracks, charred surfaces or broken rivets, and for contamination by brake fluid, axle lubricant or other contaminants.

Front Brakelinings

Check both ends of the outboard lining by looking in at each end of the caliper (fig. B-2). These are the points at which the highest rate of wear normally occurs. At the same time, check the lining thickness of the inboard shoe to make sure that it has not worn prematurely. Look through the inspection port to view the inboard shoe and lining. Whenever the thickness of any lining is worn to the approximate thickness of the metal shoe, all shoe and lining assemblies on both brakes should be replaced.

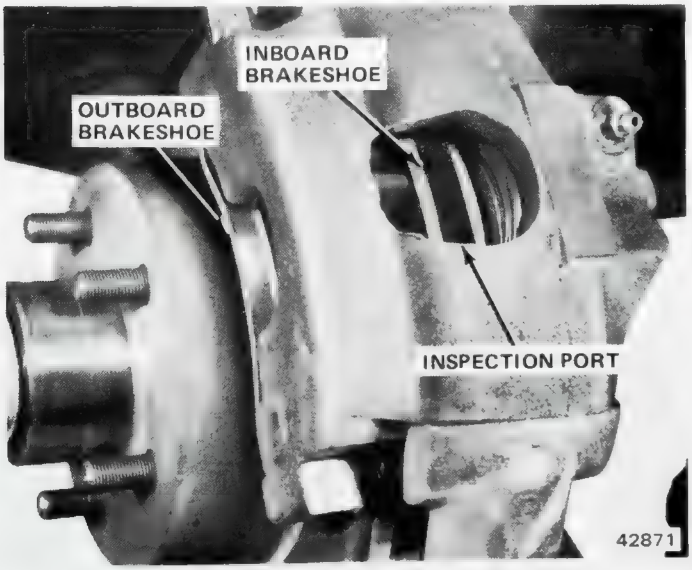


Fig. B-2 Disc Brake Inspection Port

Rear Brakelinings

Replace linings worn to within 1/32-inch (0.8 mm) of rivet head.

Rear Self-Adjusting Mechanism

Operate the adjuster cable and check for ease of operation of the adjuster screw assembly. Check condition of the adjuster components for bending, frayed cables, loose or overheated springs, or binding.

Master Cylinder

Inspect the cap bail for proper tension and fit. The cap should maintain a tight seal. Check the rubber diaphragm seal for cracks, cuts or distortion. Check fittings and housing for signs of leakage. If internal leaks are suspected, or if fluid loss occurs but a leak is not evident, check for leaks at the rear of the master cylinder. Correct as required.

Disc Brake Calipers

Check dust boot for correct installation, tears or signs of leakage. Check caliper abutment surfaces for binding or corrosion. Apply recommended lubricant to caliper abutment surfaces.

Rear Wheel Cylinders

Pull the dust boot back and inspect for leaks. Check the condition of the pistons and cylinder bores.

Differential Warning Valve

Check the valve and housing for signs of leaks, kinked lines or loose fittings.

Brake Lines, Fittings and Hoses

Check for cracks, swelling, kinks, distortion or leaks. Also check position to be sure no lines are rubbing against exhaust system parts or other components.

Parking Brake

Operate the parking brake pedal and brake release and check for smooth operation and brake holding ability. Inspect cables for binds, kinks or frays. With the brake released, the rear wheels should turn freely. Adjust the parking brake, if necessary, as described in Chapter 2—Brakes, Volume 2—Chassis.

Overall Brake Condition and Action

Check for improper brake action, performance complaints or signs of overheating, dragging or pulling. Correct as required.

Steering/Suspension

Inspect condition and functioning of car front suspension and steering system components. The inspection procedure should consist of a visual and manual (hands-on) check of all parts followed by a road test to verify steering action and response. Do not check or correct front suspension alignment angles unless an inspection and road test indicate adjustment may be necessary.

Visual and Manual Inspections

A visual-manual inspection should include these items:

- Upper and lower control arms
- Steering linkage and tie rod ends
- Strut rods and brackets
- Ball joint nuts and cotter keys
- Sway stabilizer-to-lower control arm links
- Shock absorbers and mounting hardware
- Steering arms
- Pitman arm
- Steering gear box
- Steering shafts and flex coupling
- Power steering pump belt and hoses
- Wheels and tires

During the visual-manual inspection, check for:

- Loose attaching bolts and nuts
- Worn or loose bushings (control arms, sway stabilizer, idler arm, strut rods)
- Bent control arms or tie rods
- Leaking shock absorbers, power steering pump or hoses, and steering gear
- Broken coil springs
- Frayed or torn power steering pump drive belt
- Bent or cracked wheels
- Prematurely or abnormally worn tires
- Incorrect tire pressures
- Mismatched tire types or sizes

Road Test

Prior to road testing, check and correct tire inflation pressures. Refer to glove box sticker or Chapter 2G—Wheels and Tires, Volume Two—Chassis for recommended pressures. Then, check for any of the following conditions:

- Wander or erratic steering
- Hard Steering
- Improper steering recovery (return from center) on turns
- Bind when turning steering wheel from lock to lock while car is at a standstill (cars with power steering only)

NOTE: *Transmission in Neutral or Park, parking brake applied, foot brake released and engine running.*

- Any abnormal noises that may indicate loose or worn suspension or steering components

Correct any problems that show up as a result of the visual-manual inspection and road test.

Manual Transmission Clutch Inspection and Adjustment

Inspect clutch by driving vehicle and checking for clutch chatter, grabbing, slippage, and incomplete release. Check clutch pedal free play: four-cylinder engine 1/2 to 1-inch (12.7 to 25.4 mm); six-cylinder engine 7/8 to 1 1/8 inches (22.2 to 28.6 mm). Correct or adjust as required. Refer to Chapter 2A—Clutch, Volume Two—Chassis for detailed procedures.

CHASSIS LUBRICATION

Inspect suspension grease seals for leaks or tears, and replace if necessary. Also inspect steering/suspension components for damage that requires replacement. Lubricate the following components every 30,000 miles (48,000 km), every 15,000 miles (24,000 km) for components (as determined by inspection) affected by abnormally wet or dusty driving conditions.

NOTE: *Universal joints and rear wheel bearings do not require periodic or scheduled lubrication.*

Always clean lube fittings before applying lubricant to prevent dirt from entering the unit. For types and grades of lubricants, refer to Recommended Fluids and Lubricants chart.

Six-Cylinder Clutch Bellcrank Pivot

On cars with six-cylinder engine and manual transmission, lubricate the clutch bellcrank pivot ball studs using AMC All-Purpose lubricant, or Multi-Purpose Chassis Lubricant (lithium base) or equivalent (fig. B-3). The bellcrank assembly must be disassembled for access to the ball studs. Refer to Chapter 2A—Clutch, Volume Two—Chassis for procedure.

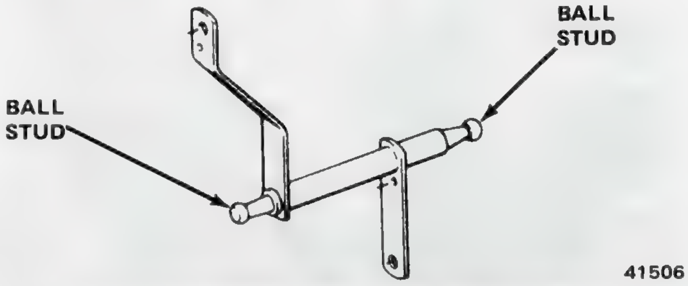


Fig. B-3 Six-Cylinder Clutch Bellcrank Pivot Ball Studs

Front Suspension Ball Joints

Remove lube plugs (fig. B-4 and B-5) and temporarily install lube fittings. Lubricate using Manual Lubrication Gun Tool J-9670 with lithium-base cartridge lubricant. The manual lube gun is designed to deliver lubricant at low pressure (6 to 8 psi) to avoid damaging the ball joint lube seals.

CAUTION: *Use of guns which deliver lube at high pressure could rupture ball joint seals. Apply lube slowly. There should be no visual evidence of lube escaping past seals.*

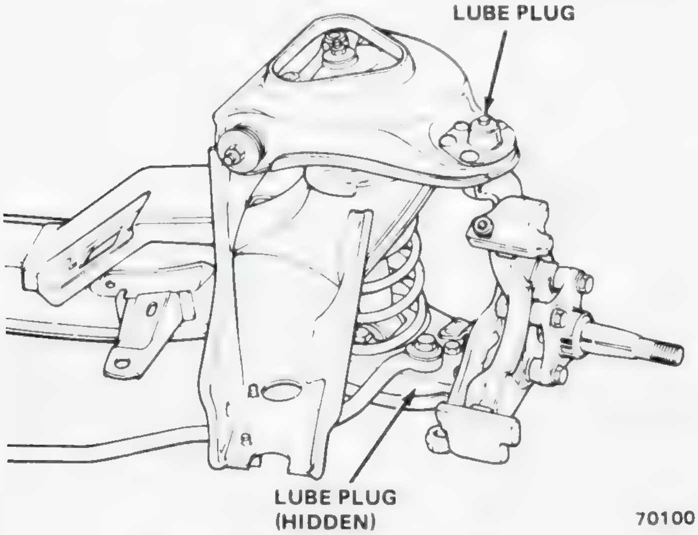


Fig. B-4 Ball Joint Lube Plugs—Pacer

When lubrication is completed, remove lube fittings and install lube plugs.

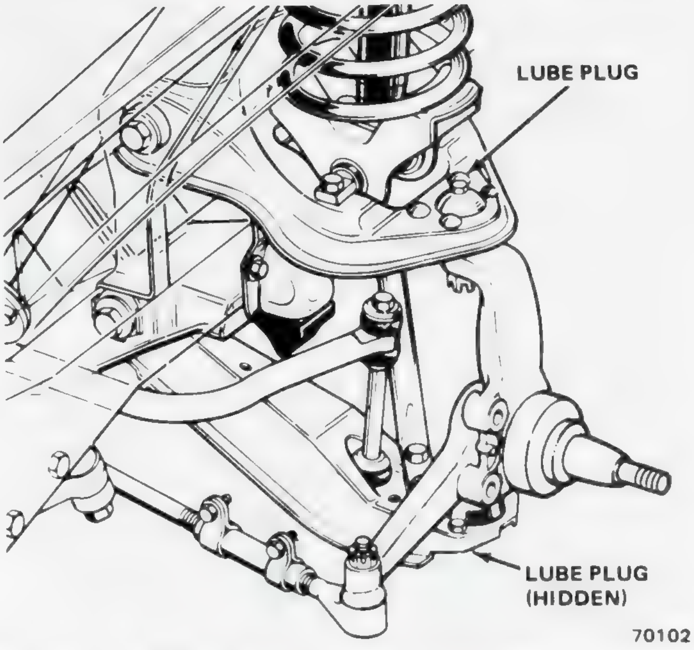


Fig. B-5 Ball Joint Lube Plugs—Gremlin-Concord-AMX-Matador

Tie Rod Inner Ball Joints

Remove lube plugs (fig. B-6 and B-7) and temporarily install lube fittings. Lubricate with lithium base lubricant. Remove lube fittings and install lube plugs.

Turning Radius (Steering Arm) Stops

The turning radius of the front wheels is controlled by a steering stop on Gremlin, Concord, AMX and Matador models. On full turns the steering stop contacts the strut rod, resulting in a creaking sound. To eliminate this noise apply a daub of Multi-Purpose Chassis Lubricant to the stop (fig. B-8).

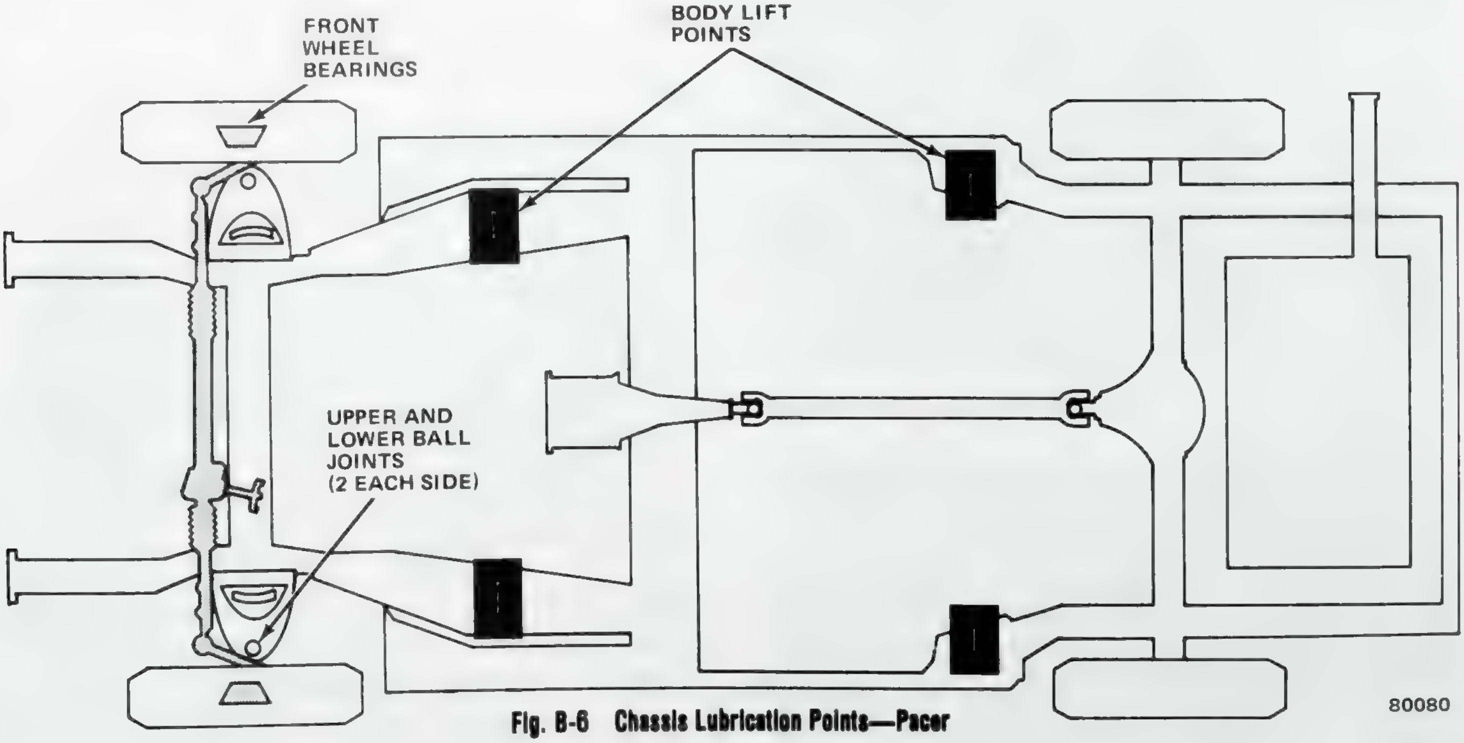


Fig. B-6 Chassis Lubrication Points—Pacer

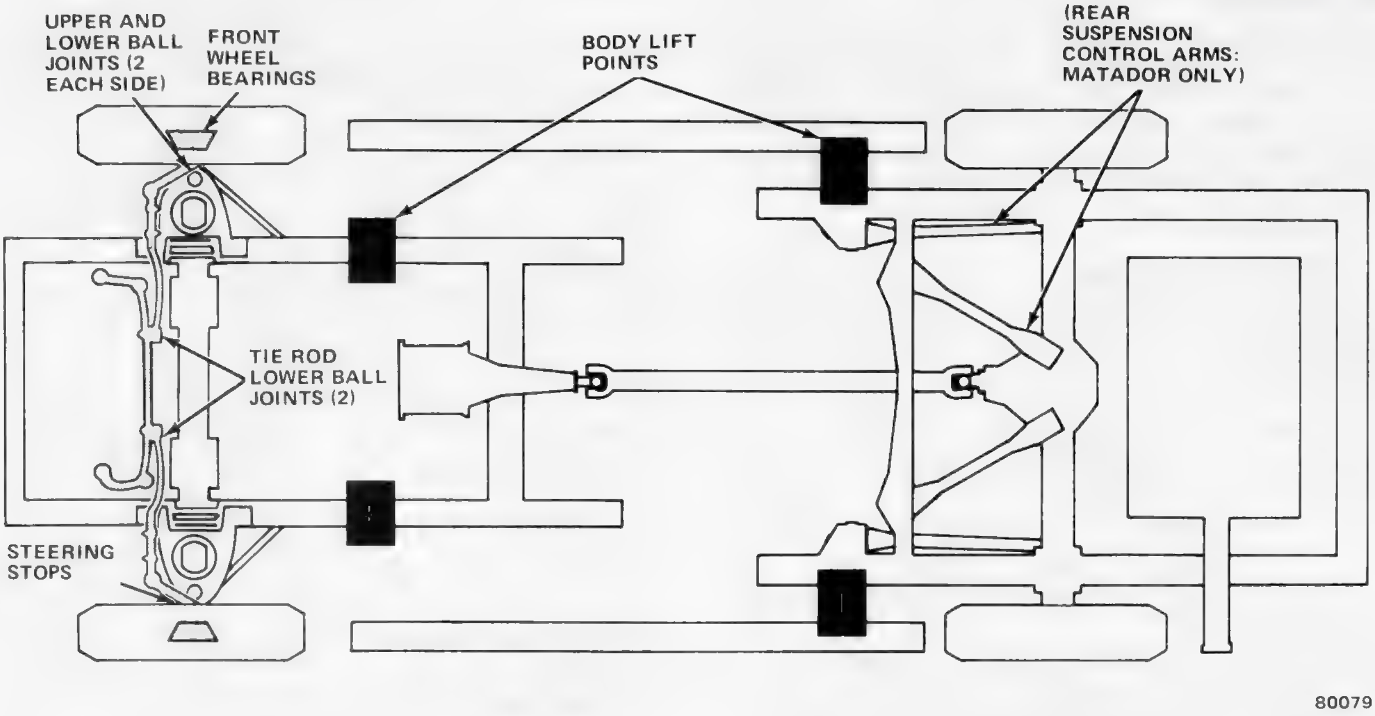


Fig. B-7 Chassis Lubrication Points—Gremlin-Concord-AMX-Matador

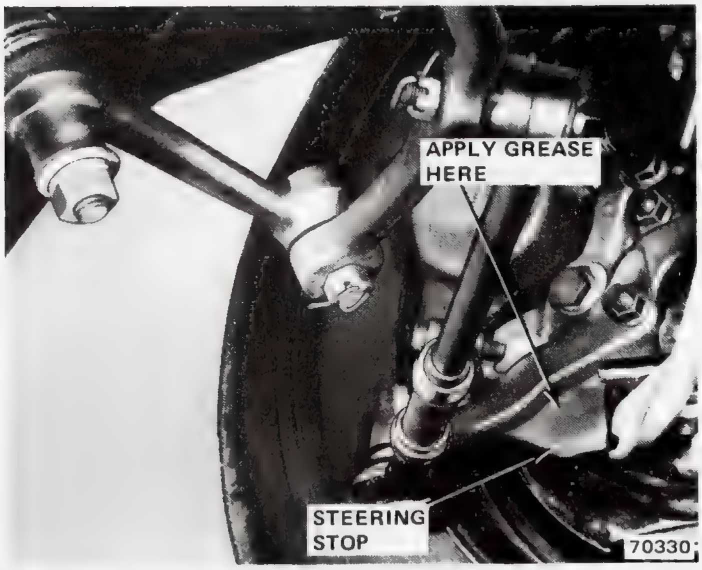


Fig. B-8 Turning Radius Stop—Gremlin-Concord-AMX-Matador

Front Wheel Bearings

The front wheel bearings are the tapered roller bearing type (fig. B-9). Clean all parts in a suitable solvent. Inspect bearings and cups for signs of excessive wear, pitting, brinelling or overheating, and replace if necessary. Lubricate the bearings with exteme-pressure (EP), lithium-base, waterproof, wheel bearing grease. Be sure to force grease between rollers.

NOTE: *The bearings are designed to fit closely on the spindle, but loose enough to creep so bearing rollers do not always wear in one spot. Polish the spindle with fine crocus cloth if necessary for proper fit. Always wipe the spindle clean and apply a small amount of grease for lubrication and to prevent rust.*

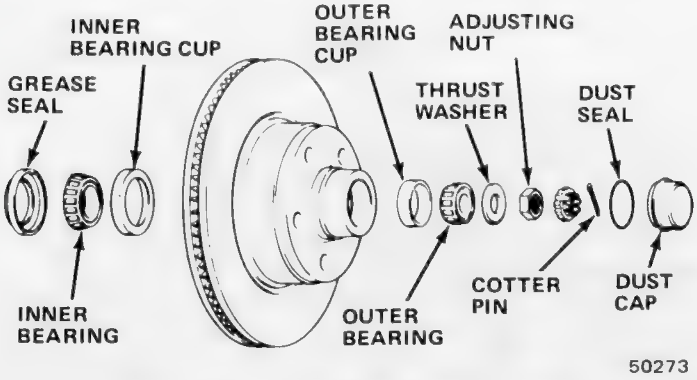


Fig B-9 Typical Front Wheel Bearing Assembly

Wipe the wheel hub clean and apply a small amount of grease inside the hub.

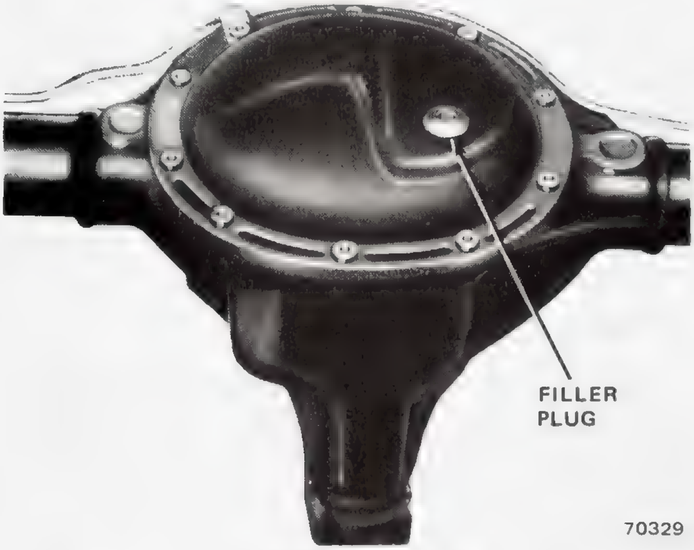
CAUTION: *Do not overfill the wheel hub. Too much grease can cause overheating and bearing damage, and it can leak and contaminate brakelinings.*

Install the inner bearing and a replacement grease seal. Assemble the hub assembly and adjust bearings as described in Chapter 2G—Wheels and Tires, Volume 2—Chassis. Inspect bearings, and clean and repack if necessary, when they are removed for other services.

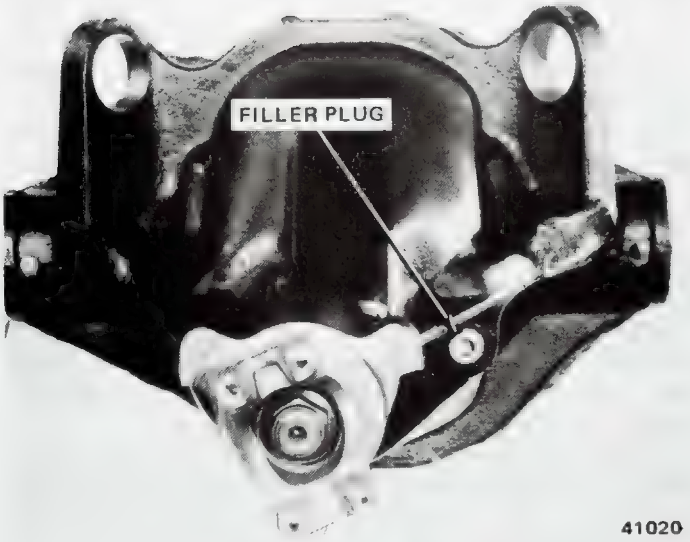
Rear Axle Fluid Change

Change the rear axle fluid at 30,000-mile (48,000 km) intervals. To drain the fluid, remove the rear axle housing cover. Use a new gasket when installing the housing cover.

Fill to level of fill plug (fig. B-10) with AMC Rear Axle Lubricant or SAE 80W-90 Gear Lubricant of API GL-5 quality, or equivalent. For Twin-Grip rear axle, use AMC Rear Axle lubricant or SAE 80W-90 Limited Slip Gear Lubricant of API GL-5 quality, or equivalent.



7-9/16 Inch Rear Axle



8-7/8 Inch Rear Axle

Fig. B-10 Rear Axle Filler Plugs

EMISSION CONTROL INSPECTION

Four-Cylinder Engine

After the first 5,000 miles (8,000 km) of operation, retorque cylinder head bolts and adjust engine valves. Refer to Chapter 1B—Engines, Volume One—Power Plant for procedures. Also do the following.

Drive Belts

Check belts driving fan, air pump, alternator, power steering pump, and air conditioning compressor for cracks, fraying, wear, and general condition. Use Tension Gauge J-23600 to check drive belt tension. Compare reading obtained against the tension specified for used belts in the following chart. If installing a new belt, use the new belt setting shown in the chart. Refer to Chapter 1C—Cooling, Volume One—Power Plant for replacement or adjustment procedures.

Drive Belt Tension

	Initial Newtons New Belt	Reset Newtons Used Belt	Initial Pounds New Belt	Reset Pounds Used Belt
Air Conditioner				
Four-Cylinder	556-689	400-512	125-155	90-115
Six-Cylinder	556-689	400-512	125-155	90-115
Eight-Cylinder	556-689	400-512	125-155	90-115
Air Pump				
Four-Cylinder	178-267	118-267	40-60	40-60
Six-Cylinder w/PS	289-334	267-311	65-75	60-70
Other Six-Cylinder and all Eight-Cylinder	556-689	400-512	125-155	90-115
Fan — All Engines	556-689	400-512	125-155	90-115
Power Steering — All Engines	556-689	400-512	125-155	90-115

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Engine Idle Speeds

Check curb idle speed and mixture and fast idle speed using equipment known to be accurate. For curb idle speed and mixture, refer to Tune-Up Specifications (On Car) chart in Chapter 1A—General Service and Diagnosis, Volume One—Power Plant. For fast idle speed, refer to Carburetor Service Specifications chart in Chapter 1J—Fuel Systems, Volume One—Power Plant.

Six- and Eight-Cylinder Engines

After the first 5,000 miles (8,000 km) of operation, perform a Drive Belts inspection and check Engine Idle Speeds and adjust if necessary, as described above.

ENGINE DRIVE BELT INSPECTION

On models with four-cylinder engines, check condition and tension of engine drive belts every 5,000 miles (8,000 km) as described above under Drive Belts.

ENGINE MAINTENANCE

Four-Cylinder Engine

Retorque cylinder head bolts, adjust engine valves and inspect engine Drive Belts as described above under Emission Control Inspection. Also perform the following services.

Fuel Filter

Replace the fuel filter at the carburetor. Be sure to position the fuel return line at the top of the filter (fig. B-11).

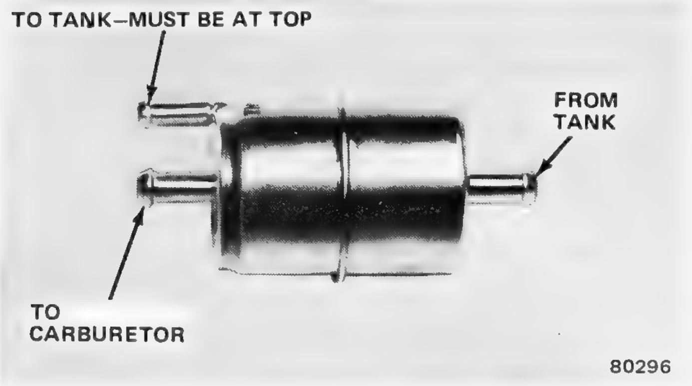

Fig. B-11 Correct Fuel Filter Installation

Ignition System

Replace ignition points and condenser, then check and adjust ignition timing if necessary. Refer to Chapter 1A—General Service and Diagnosis, Volume One—Power Plant, for service procedures and specifications.

Six- and Eight-Cylinder Engines

On all models, perform a Drive Belt inspection as described above and also replace the fuel filter at the carburetor. Be sure to position fuel return line at the top of the filter (fig. B-11).

On Pacer, Concord and AMX models with eight-cylinder engines, perform an engine Drive Belt Inspection and replace the Fuel Filter as described above, and also do the following.

Choke Linkage

Open the carburetor to part throttle position and move the choke valve by hand from fully close to fully open. The choke mechanism should move freely. Correct as required.

Vacuum Connections

Inspect vacuum fittings, exhaust gas recirculation lines, hoses and connections for integrity and correct assembly. Replace or repair as required.

Idle Speeds

Check carburetor idle mixture and adjust if necessary. Also check curb idle and high idle speeds, adjust if required. Refer to Chapter 1A—General Service and Diagnosis, Volume One—Power Plant for procedures and specifications.

Ignition Timing

Check ignition timing and adjust if necessary as described in Chapter 1A—General Service and Diagnosis, Volume One—Power Plant.

ENGINE TUNE-UP

Perform a complete precision tune-up at the scheduled interval. Perform a precision electronic diagnosis whenever questionable engine performance occurs between scheduled tune-ups.

Refer to Chart 4 of the 1978 Four-Cylinder or Six- and Eight-Cylinder Maintenance Schedules for a complete listing of items requiring attention during the tune-up. Refer to Chapter 1A—General Service and Diagnosis, Volume One—Power Plant for detailed procedures and specifications. Procedures for air cleaner servicing and fuel filter replacement are located in Chapter 1J—Fuel Systems, Volume One—Power Plant.

OIL CHANGE SERVICE

The Oil Change Service is a complete service including oil and filter change, fluid level checks and other important maintenance items. Read the details and perform the services as follows.

Engine Oil Change

On four-cylinder engines, change engine oil after the first 5,000 miles (8,000 km) and every 5,000 miles (8,000 km) thereafter. For six- and eight-cylinder engines, change engine oil after the first 7,500 miles (12,000 km) and every 7,500 miles (12,000 km) thereafter.

As periods for oil changes are affected by a variety of conditions, no single mileage figure applies for all types of driving. Five-thousand miles (8,000 km) is the maximum amount of miles that should elapse between changes for four-cylinder engines (7,500 miles or 12,000 km for six- and eight-cylinder engines); more frequent changes are beneficial, and for this reason, oil should be changed every 5 months even though 5,000 miles (8,000 km) may not have elapsed on the car odometer (7 months for six- and eight-cylinder engines).

Drain crankcase only after engine has reached normal operating temperature to ensure complete drainage of used oil.

For maximum engine protection under all driving conditions, fill crankcase only with engine oil meeting API Engine Oil Service Classification "SE." These letters must appear on the oil container singly or in combination with other letters. SE engine oils protect against oil oxidation, high-temperature engine deposits, rust and corrosion.

Single viscosity or multi-viscosity oils are equally acceptable. Oil viscosity number, however, should be determined by the lowest anticipated temperature before the next oil change.

Engine Oil Viscosity

Lowest Temperature Anticipated	Recommended Single Viscosity	Recommended Multi-Viscosity
Above +40° F	SAE 30 or SAE 40	SAE 10W-30, 20W-40, or 10W-40
Above 0° F	SAE 20W-20	SAE 10W-30 or 10W-40
Below 0° F	SAE 10W*	SAE 5W-20 or 5W-30

*Sustained high speeds (above 55 mph) should be avoided when using SAE 10W engine oil since oil consumption may be greater under this condition

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Crankcase capacity is 3.5 quarts (3.4 l) for four-cylinder engines, and 4 quarts (3.8 l) for six- and eight-cylinder engines. Add an additional 0.5 quart (0.5 l) when the filter is changed on four-cylinder engines, 1 full quart (0.96 l) for six- and eight-cylinder engines.

Oil Filter Change

Change the oil filter every 5,000 miles (8,000 km) or every 5 months, whichever comes first, with four-cylinder engines, every 7,500 miles (12,000 km) or every 7 months whichever comes first for six- and eight-cylinder engines.

A full-flow oil filter is mounted on the lower center right side of six-cylinder engines and on the lower right side on four- and eight-cylinder engines.

Remove the throwaway filter unit from the adapter with Oil Filter Removal Tool J-22700, or equivalent. To install, turn the replacement unit by hand until the gasket contacts the seat and then tighten an additional one-half turn.

CAUTION: *Four-cylinder oil filters have a built-in bypass valve to permit oil flow if the filter should clog. Failure to use the correct filter can result in engine damage.*

NOTE: *Long and short oil filter elements are currently being used on six- and eight-cylinder engines. When the short element is used, a slight overfill condition is indicated on the dipstick on some engines. This does not affect engine operation.*

Fluid Level Checks—All Models

Battery

Check electrolyte level every 15,000 miles (24,000 km) under normal operation, or every 10,000 miles (16,000 km) when operated in hot climates, and always before every winter season. Lift the battery cell caps and check the fluid level in each filler well. Add distilled water, if necessary, to bring level to bottom of ring in filler wells (fig. B-1).

Engine Coolant

Check coolant level when the engine is cold. Fluid level should be approximately 1-1/2 to 2 inches (38.1 to 50.8 mm) below the filler neck when cold, or 1/2 to 1 inch (12.7 to 25.4 mm) when hot. Add a 50/50 mixture of ethylene glycol antifreeze and pure water. In an emergency, water alone may be used. Check the freeze protection at the earliest opportunity, as the addition of water will reduce the antifreeze and corrosion protection of the coolant mixture. Do not overfill, as loss of coolant—due to expansion—will result.

Brake Master Cylinder

Fluid level in the brake master cylinder should be just below the reservoir top rim (fig. B-12). Use AMC Brake Fluid, or equivalent, conforming to SAE Standard J1703 and FMVSS No. 116, DOT 3 Brake Fluid.

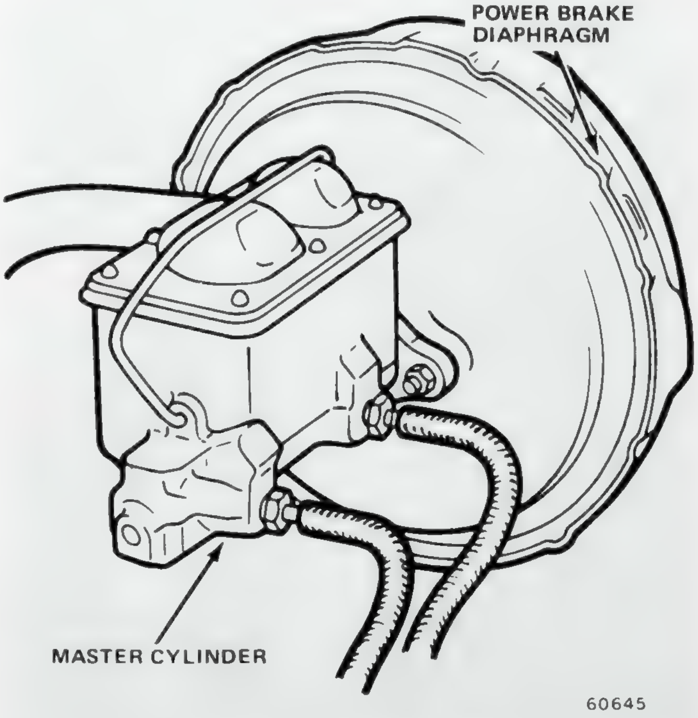


Fig. B-12 Brake Master Cylinder

Manual Steering Gear

Check manual steering gear fluid level at the first oil change service, then at 30,000 miles (48,000 km) and every 30,000 miles (48,000 km) thereafter. Remove the side cover bolt opposite the adjuster screw (fig. B-13). Lubricant should be to level of bolt hole. If not, add make-up fluid such as AM All-Purpose Lubricant or Multi-Purpose Chassis Lubricant (Lithium Base).

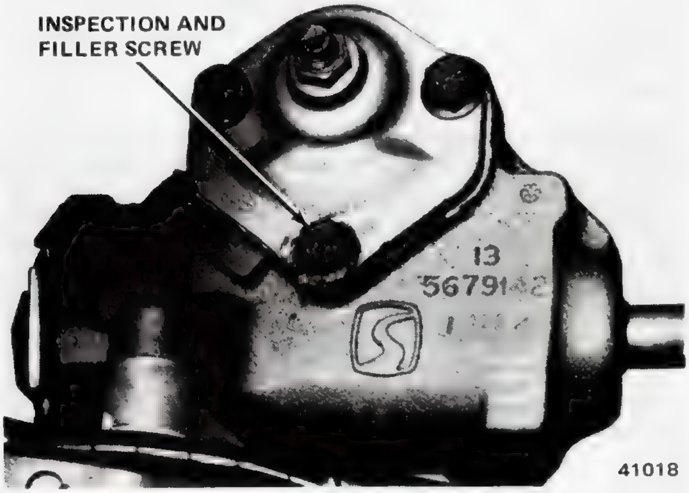


Fig. B-13 **Manual Steering Gear Fill Hole Location**

Power Steering Pump

Lubricant level can be checked with fluid either hot or cold. If below the FULL HOT or FULL COLD marking on the dipstick attached to the reservoir cap (fig. B-14), add AMC/Jeep Power Steering Fluid or equivalent.

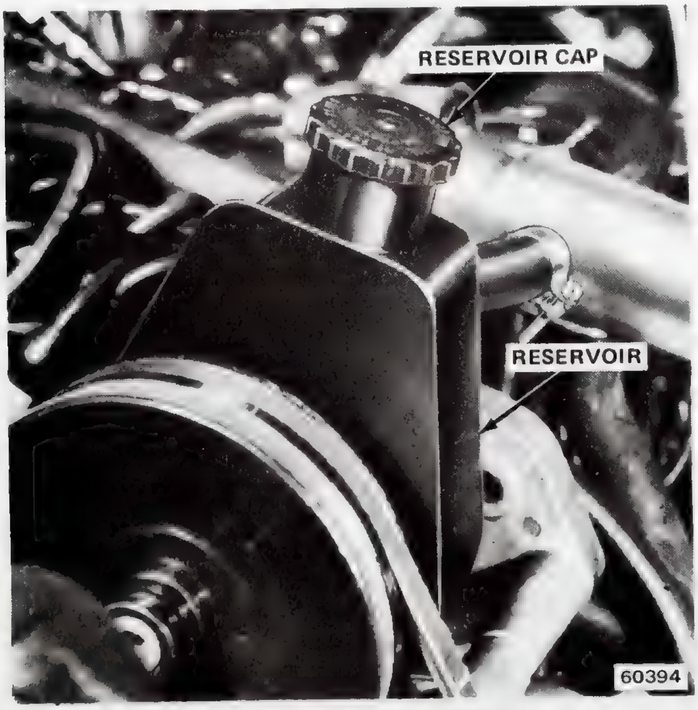


Fig. B-14 **Power Steering Pump Dipstick Location**

Automatic Transmission

To make an accurate fluid level check perform the following steps:

(1) Bring transmission up to normal operating temperature.

(2) Place car on level surface.

(3) Have engine running at idle speed at normal operating temperature.

(4) Apply parking brake.

(5) Move gearshift lever through all gears, leaving it in Neutral.

(6) Remove dipstick, located in fill tube at right rear of engine near dash panel, and wipe clean.

(7) Insert dipstick until cap seats.

(8) Remove dipstick and note reading. The fluid level should be between the ADD and FULL marks. If at or below the ADD mark, add sufficient fluid to raise level to FULL mark.

Use AMC Automatic Transmission Fluid, Dexron®, Dexron II®, or equivalent.

CAUTION: *Do not overfill. Overfilling can cause foaming which can lead to overheating, fluid oxidation, or varnish formation. These conditions can cause interference with normal valve, clutch, and servo operation. Foaming can also cause fluid to escape from the transmission vent where it may be mistaken for a leak.*

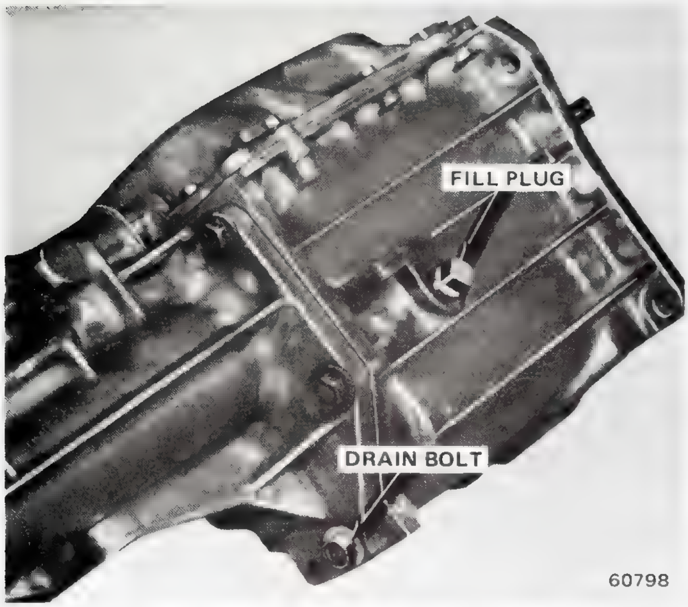
When checking fluid level, also check fluid condition. If fluid smells burned or is full of metal or friction material particles, a complete transmission overhaul may be needed. Examine the fluid closely. If doubtful about its condition, drain out a sample for a doublecheck.

Manual Transmission

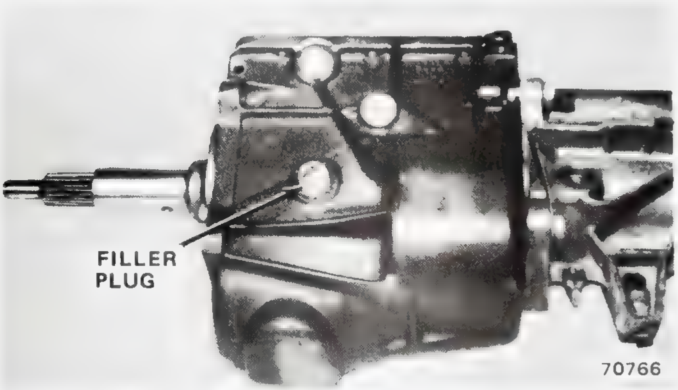
To check lubricant level, remove the fill plug located on the right side of transmission (fig. B-15). Lubricant should be level with fill plug hole. If not, raise level with lubricant and install fill plug. Refer to Recommended Fluids and Lubricants chart and Fluid Capacities chart at the end of this section.

Rear Axle Differential

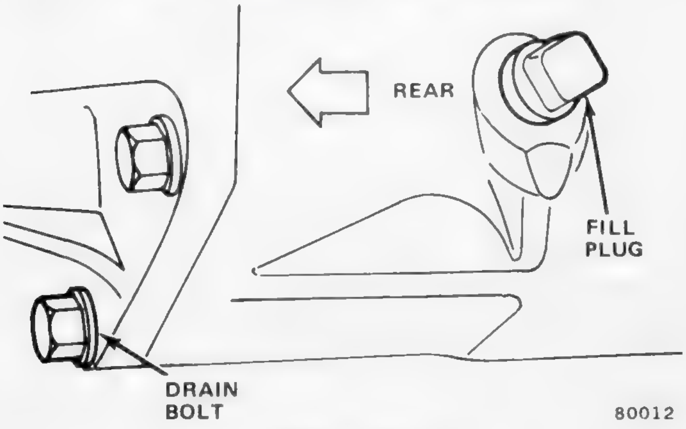
The lubricant level should be at the level of the fill hole (fig. B-10). If not, bring to level by adding the recommended lubricant.



SR4—4-Speed with six-cylinder engine



HR-1—4-Speed with four-cylinder engine



150T—3-Speed

Fig. B-15 Manual Transmission Filler Plugs

Windshield Washer Solution

The use of washer solvent mixed with water is recommended year-round. In addition to the ice inhibitor, it contains detergent effective in removing road film. Do not use engine antifreeze or other solutions that can damage the paint.

Windshield and Wiper Blade Elements

Dry windshield glass accumulates road film which will result in hazing and/or smearing when the wipers are first turned on. This film is not readily washed with water. For this reason, it is important that both the glass as well as the wiper blade rubber element is washed with mild detergent solution regularly.

Compact Spare Tire Pressure

On models equipped with a compact spare tire, check tire pressure at every Oil Change Service. Tire pressure should be 60 psi (413 kPa) when cold. Be sure to use a pressure gauge large enough to indicate 60 psi (413 kPa).

WARNING: *Do not confuse the compact spare tire with the collapsible spare tire. The compact spare tire is stored inflated. The collapsible spare is deflated when stored and requires use of a special inflator can.*

Fig. B-16 Compact Spare Tire

WARNING: *Add air only in small amounts and check tire pressure frequently until 60 psi (413 kPa) is reached. Tire pressure rises quickly with only a small amount of air added.*

UNSCHEDULED MAINTENANCE

GENERAL

Services detailed in this subsection are not listed in the Maintenance Schedule for performance at a specified interval. They are to be performed as required to restore car to original specifications. Unscheduled maintenance services include such items as fuel system cleaning, engine carbon deposit removal, retightening loose parts and connections, replacement of manual transmission clutch components, brakelinings, shock absorbers, light bulbs, wiper blades, belts, hoses, soft trim, bright metal trim, painted parts, other appearance items plus other rubber and rubber-like parts. Need for these unscheduled services is usually indicated by a change in performance, handling, or the appearance of the car or a particular component. Owners, users and service mechanics should be alert for indications that service or replacement is needed.

Fluid Capacities

REFILL CAPACITIES — APPROXIMATE (U.S. Measure/Imperial Measure/SI Metric Measure)

Item	Pacer & Pacer Wagon	Gremlin	All Concord & AMX Models	Matador 2-Dr Coupe	Matador 4-Dr Sedan & Wagon
Fuel Tank (gal/gal/liters)	20.0/16.6/76	21.0/17.5/80① 15.0/12.5/57②	22.0/18.3/83	25.0/20.8/95	25.0/20.8/95③ 21.0/17.5/80④
Engine Oil (qt./qts/liters)					
4 cyl - includes 0.5/0.4/0.5 for filter	—	4.0/3.4/3.8	—	—	—
6 & 8 cyl - includes 1.0/0.8/0.9 for filter	5.0/4.2/4.7	5.0/4.2/4.7	5.0/4.2/4.7	5.0/4.2/4.7	5.0/4.2/4.7
Cooling Systems (qts/qts/liters)					
4 cyl	—	6.5/5.5/6.1	—	—	—
6 cyl					
Without AC	14.0/11.6/13.2	11.0/9.2/10.3	11.0/9.2/10.3	13.5/11.2/12.7	11.5/9.6/10.8
With AC	14.0/11.6/13.2	14.0/11.6/13.2	14.0/11.7/13.2	13.5/11.2/12.7	11.5/9.6/10.8
304 CID V-8 All	18.0/15.0/17.0	—	18.0/15.0/17.0	—	—
360 CID V-8 All	—	—	—	17.5/14.6/16.5	15.5/12.9/14.6⑤
Transmissions					
Manual (pts/pts/liters)					
3 speed	3.0/2.5/1.4	3.0/2.5/1.4	3.0/2.5/1.4	—	—
4 speed (w/4 cyl)	—	2.4/2.0/1.1	—	—	—
4 speed (w/6 cyl)	3.3/2.8/1.6	3.3/2.8/1.6	3.3/2.8/1.6	—	—
Automatic (qts/qts/liters)					
4 cyl	—	7.1/6.0/6.7	—	—	—
6 cyl and 304 CID V-8	8.5/7.1/8.0	8.5/7.1/8.0	8.5/7.1/8.0	8.5/7.1/8.0	8.5/7.1/8.0
360 CID V-8	—	—	—	8.2/6.2/7.7	8.2/6.9/7.7
Rear Axle (pts/pts/liters)					
4 & 6 cyl	3.0/2.5/1.4	3.0/2.5/1.4	3.0/2.5/1.4	4.0/3.3/1.9	4.0/3.3/1.9
8 cyl	4.0/3.3/1.9	—	4.0/3.3/1.9	4.0/3.3/1.9	4.0/3.3/1.9

① W/6 cyl engine

② W/4-cyl. engine auto.trans.
W/4-cyl. engine man.trans., 13.0/10.8/49.2

③ 4-Dr sedan

④ Wagon

⑤ Add 2 quarts with coolant recovery

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Recommended Fluids and Lubricants

POWER PLANT

COMPONENT	SPECIFICATION
Distributor cam lobes (4 cyl. only)	Molydisulfide grease.
Distributor rotor tip (6 and 8 cyl. only)*	AMC Silicone Dielectric Compound or equivalent.
Engine coolant	High quality ethylene glycol (permanent antifreeze) and clean water in 50/50 mixture.
Engine oil	API classification "SE." Refer to oil viscosity chart for correct SAE grade.
Exhaust manifold heat valve	AMC Heat Valve Lubricant or equivalent.

CHASSIS

COMPONENT	SPECIFICATION
Automatic transmission	AMC Automatic Transmission Fluid or equivalent labeled Dexron® or Dexron II®.
Brake master cylinder*	AMC Brake Fluid or equivalent marked FMVSS No. 116, DOT-3 and SAE J-1703. CAUTION: Use only recommended brake fluids.
Clutch lever and linkage	Multi-Purpose chassis lubricant.
Conventional rear axle	AMC Rear Axle Lubricant or gear lubricant of SAE 80W-90 (API-GL5) quality.
Disc brake caliper abutment surfaces	AMC Brake Support Plate Lubricant or equivalent molydisulfide lubricant.
Drum brake support plate ledges*	AMC Brake Support Plate Lubricant or equivalent molydisulfide lubricant.
Front suspension ball joints, tie rod inner ball joints, turning stop plate and bracket	AMC All-Purpose Lubricant or equivalent lithium base chassis lubricant.
Front wheel bearings	Wheel Bearing Lubricant EP lithium base.
Gearshift linkage*	Multi-Purpose chassis lubricant.
Manual steering gear*	AMC All-Purpose Lubricant or equivalent lithium base chassis lubricant.
Manual transmission*	SAE 80W-90 gear lubricant (API-GL5).
Parking brake cables*	Multi-Purpose chassis lubricant.
Parking brake pedal mechanism	AMC Lubriplate or equivalent.
Power steering pump and gear*	AMC Power Steering Fluid or equivalent.
Twin Grip rear axle	AMC Rear Axle Lubricant or limited slip gear lubricant of SAE 80W-90 (API-GL5) quality.

BODY

COMPONENT	SPECIFICATION
Ashtray slides	AMC Lubriplate or equivalent.
Front seat tracks*	AMC Lubriplate or equivalent.
Hinges: door, hood, trunk, liftgate, tailgate	AMC Motor Oil or equivalent.
Key lock cylinders	Powdered graphite, AMC Silicone Lubricant Spray or light oil.
Latches: door, hood, trunk, liftgate, tailgate	AMC Lubriplate or equivalent.
Weatherseals: door, window, trunk, liftgate, tailgate	AMC Silicone Lubricant Spray or equivalent.

*No routine drain and refill or application of lubricant is required. Specification is for maintaining fluid levels or reassembling components. Refer to the Maintenance Schedule for intervals.

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NOTES

FLEET EQUIPMENT C

SECTION INDEX

GENERAL

This chapter describes the optional power plant equipment available on fleet cars. The chapter is divided into sections titled to correspond with the main chapters in this volume. Each section contains the latest information available at the time of publication.

Unless outlined in this chapter, service procedures for fleet equipment are the same as for corresponding regular production AMC cars.

ENGINES

General

One fleet engine is available. The 360 CID eight-cylinder engine with two-barrel carburetor is identical to regular production, including emission controls. It is equipped with a heavy-duty automatic transmission.

Oil and Ammeter Gauges

Oil and ammeter gauges on Matador fleet cars are installed in the clock opening. The wiring harness for these gauges is a separate harness and is installed behind the instrument panel. Regular production warning lamps function in normal manner.

Removal

(1) Disconnect battery negative cable.

CAUTION: *Before removing bezel, place a protective cloth over the steering column to avoid scratching the column.*

(2) Remove instrument cluster bezel.

(a) Remove radio control knobs and nuts, if equipped.

(b) Remove bezel attaching screws.

(c) Tilt bezel forward and disconnect electrical connections.

(d) Remove bezel.

(3) Remove oil pressure and ammeter gauge panel attaching screws.

(4) Tilt gauge panel forward and remove bulbs and electrical conponents.

(5) Remove gauge panel assembly from instrument panel.

Installation

(1) Position gauge panel in instrument panel.
(2) Insert light bulbs and connect electrical wires.
(3) Install gauge panel attaching screws.
(4) Position bezel and connect electrical components.
(5) Install bezel attaching screws.
(6) Install radio control knobs and nuts, if removed.
(7) Connect battery negative cable.

COOLING SYSTEMS

General

The cooling systems for all fleet cars operate the same as those used on regular production cars. This also applies to the coolant recovery systems used on fleet cars. **See Engine Drive Belt arrangements at the end of this chapter for fleet engine belt arrangement. Refer to Chapter 1C for description and service procedures.**

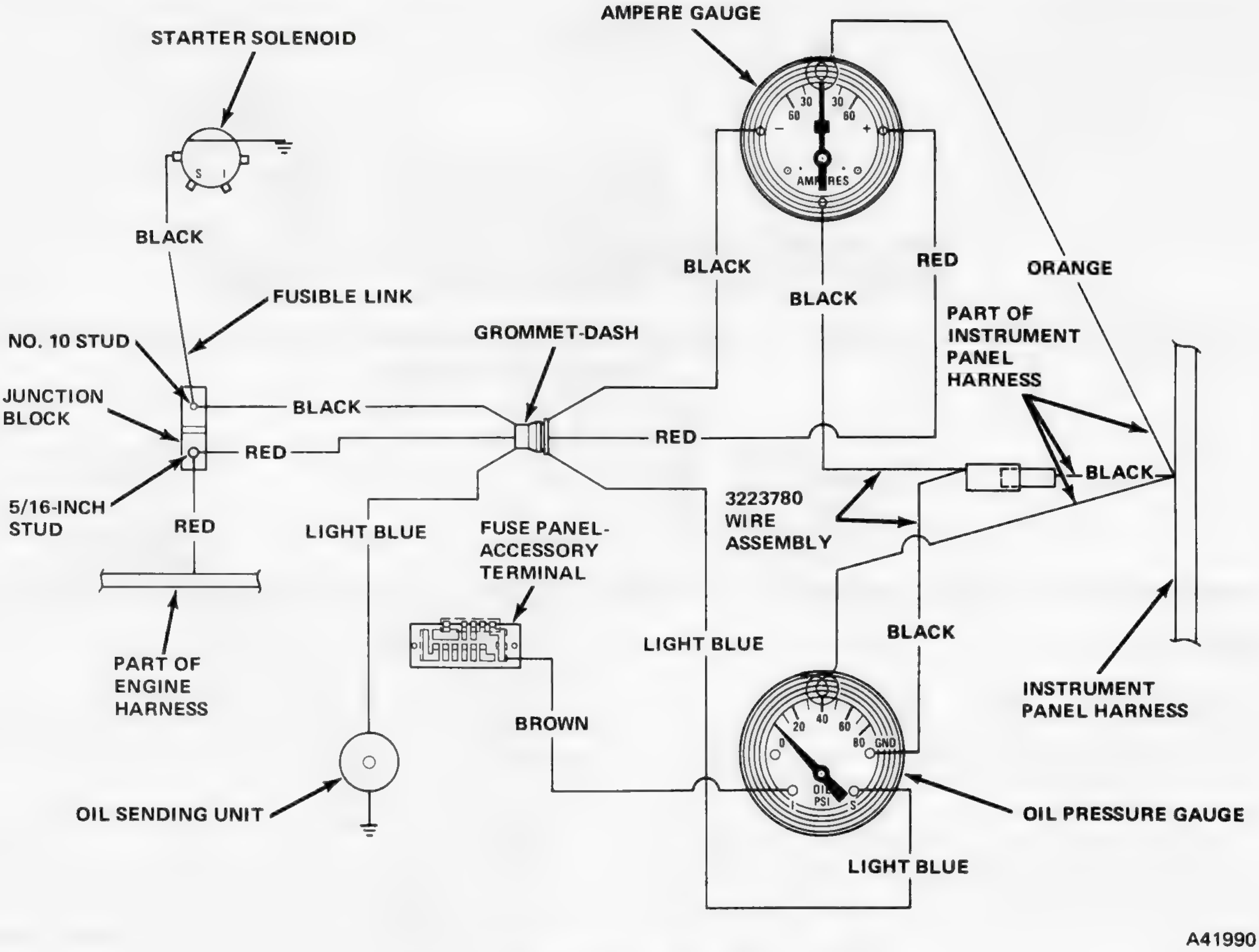


Fig. C-1 Wiring Diagram—Oil and Ammeter Gauges

Freeze Protection Data

A protection sticker (-34°F) is attached to some fleet cars to indicate the freeze protection temperature. The temperature listed applies to that car regardless of final assembly point.

BATTERIES

Some Concord and Matador fleet cars are equipped with an 80-amp battery.

- **Rating:** 80 amp
- **Number of plates:** 78
- **Specific Gravity at Full Charge:** 1.260 at 80°F
- **Ampere Rating:** 440 amperes, 135 minute reserve capacity at 0°F cold cranking

CHARGING SYSTEMS

In addtion to expanded availability of regular production alternators, a 90-amp alternator is available on eight-cylinder Matadors. Refer to Chapter 1E for service procedures.

The 90-amp alternator package includes a transistorized voltage regulator which has a voltage adjustment. This regulator is diagnosed like the regular production mechanical regulator. If the transistorized regulator must be replaced, be sure to install another transistorized regulator. **Do not install a mechanical regulator with the 90-amp alternator.** Since the alternator cases are nearly identical, be sure to check part numbers carefully.

NOTE: *Refer to Engines above for details on fleet equipment ammeters available on Matador models.*

STARTING SYSTEM

Service procedures for components in this system are the same as for standard production models. Refer to Chapter 1F.

IGNITION SYSTEM

Service procedures for components in this system are the same as for standard production models. Refer to Chapter 1G.

CRUISE COMMAND

Service procedures for components in this system are the same as for standard production models. Refer to Chapter 1H.

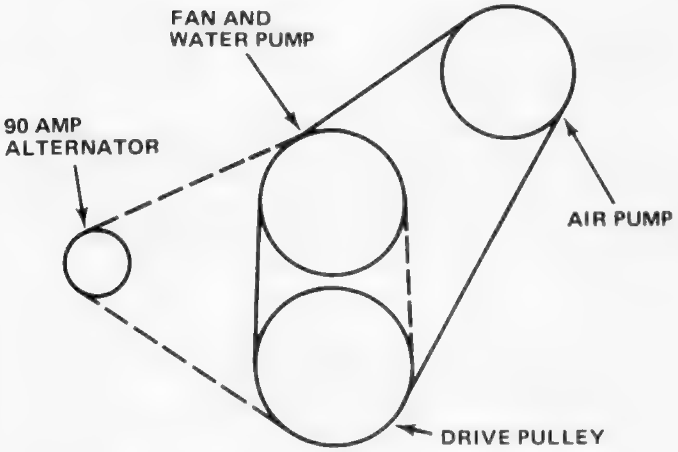
FUEL SYSTEMS

Service procedures for components in this system are the same as for standard production models. Refer to Chapter 1J.

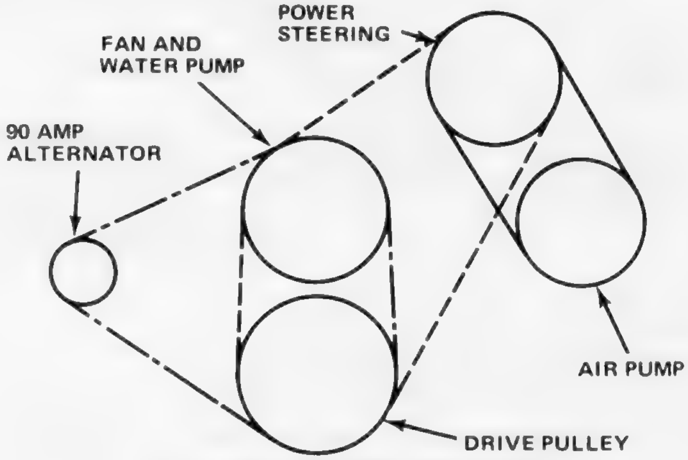
EXHAUST SYSTEMS

Service procedures for components in this system are the same as for standard production models. Refer to Chapter 1K.

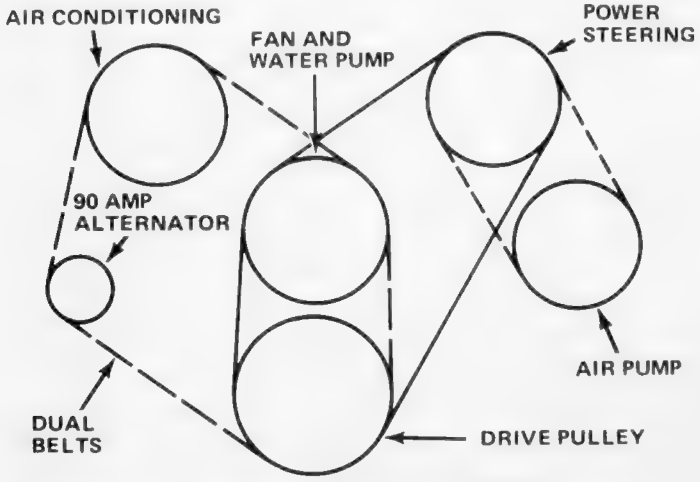
Engine Drive Belt Arrangements



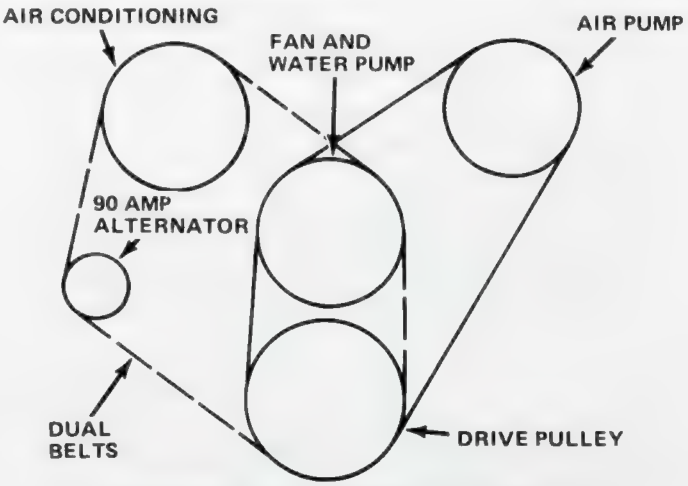
BASIC BELT ARRANGEMENT WITH AIR GUARD — EIGHT-CYLINDER MATADOR ONLY



AIR GUARD AND POWER STEERING WITHOUT ALTITUDE COMPENSATION EIGHT-CYLINDER MATADOR ONLY

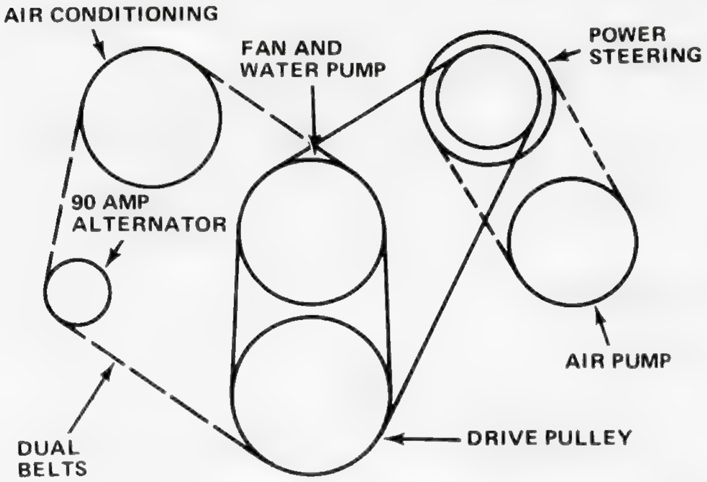


AIR GUARD, AIR CONDITIONING, AND POWER STEERING — WITHOUT ALTITUDE COMPENSATION MATADOR ONLY EIGHT-CYLINDER

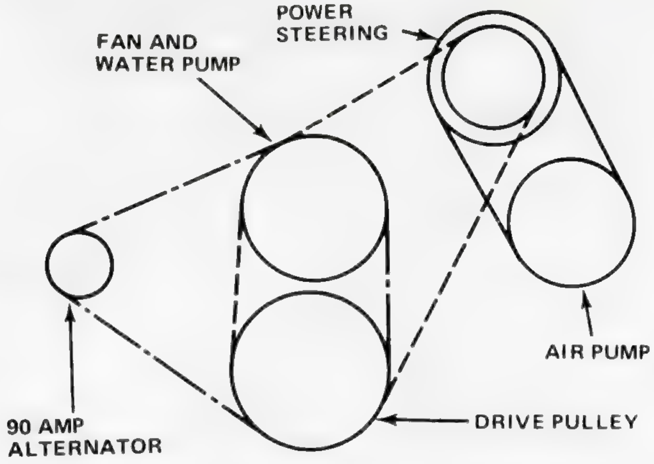


AIR GUARD, AIR CONDITIONING — WITHOUT ALTITUDE COMPENSATION EIGHT-CYLINDER MATADOR ONLY

Engine Drive Belt Arrangements (Continued)



AIR GUARD, AIR CONDITIONING, AND POWER STEERING WITH ALTITUDE COMPENSATION — EIGHT-CYLINDER MATADOR ONLY



AIR GUARD AND POWER STEERING WITH ALTITUDE COMPENSATION EIGHT-CYLINDER MATADOR ONLY

LEGEND
FRONT BELT ————
MIDDLE BELT — - —
REAR BELT – – – –

80415E

GENERAL SERVICE AND DIAGNOSIS 1A

SECTION INDEX

GENERAL INFORMATION

This chapter contains **general** information which applies to all AMC engines: 2-liter four-cylinder, 232 CID six-cylinder, 258 CID six-cylinder (both 1V and 2V carburetion), 304 CID eight-cylinder and 360 CID eight-cylinder. Refer to Chapter 1B—Engines for **specific** procedures for engine replacement, engine disassembly, internal component repairs and replacement, and mechanical specifications.

The section of this chapter titled Power Plant Diagnosis presents information and procedures useful in locating problems not normally encountered in routine maintenance and routine tune-ups.

The section of this chapter titled Power Plant Tune-Up presents a systematic approach to the performing of a complete, precision tune-up required every 30,000 miles.

It is frequently helpful to know at a glance which emission-related components are installed on a particular car. This information is contained in four emission component charts. Cars designated Canadian are certified for sale only in Canada (models from other categories also may be sold in Canada). Cars designated Altitude are certified for operation at altitudes over 4000 feet. Cars designated California are the only ones certified for sale in the state of California. Cars designated 49-state are certified for sale in all states except California.

Emission Components—Canadian Cars①

Displacement and Venturis	Series	Trans.	Air Guard	Cat. Conv.	EGR	EGR CTO Temp.	Fuel Tank Vapor Control	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid
232 CID 1V	Pacer	M	●	–	●	115°F	●	●	V	●	●	160°F	●	–	●
	Pacer	A	–	–	●	115°F	●	●	V	●	●	160°F	●	–	●
	Gremlin	M	●	–	●	115°F	●	●	V	●	●	160°F	●	–	●
	Gremlin	A	–	–	●	115°F	●	●	V	●	●	160°F	●	–	●
	Concord	M	●	–	●	115°F	●	●	V	●	●	160°F	●	–	●
	Concord	A	–	–	●	115°F	●	●	V	●	●	160°F	●	–	●

① Leaded Fuel, unrestricted filler necks

Trans. – Transmission Type (manual or automatic)
Cat. Conv. – Catalytic Converter
CTO – Coolant Temperature Override
EGR – Exhaust Gas Recirculation
PCV – Positive Crankcase Ventilation
TCS – Transmission Controlled Spark
TAC – Thermostatically Controlled Air Cleaner (vacuum or mechanical)
● – On all models in series specified

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Emission Components—Altitude Cars

Displacement and Venturis	Series	Trans.	Air Guard	Cat. Conv.	EGR	EGR CTO Temp.	Fuel Tank Vapor Control	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid
2-Liter 2V	Gremlin	M	●	●	●	115°F	●	●①	V	–	●	160°F	●	●	●
258 CID 1V	Pacer	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Pacer	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Gremlin	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Gremlin	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Concord	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Concord	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
304 CID 2V	Concord	A	●②	●	●	160°F	●	●	V	–	●	160°F	●	●	●
360 CID 2V	Matador	A	●②	●	●	160°F	●	●	V	–	●	160°F	●	●	●

① Anti-Diesel Solenoid ② High Flow Diverter

Trans. — Transmission Type (manual or automatic)
Cat. Conv. — Catalytic Converter
CTO — Coolant Temperature Override
EGR — Exhaust Gas Recirculation
PCV — Positive Crankcase Ventilation
TCS — Transmission Controlled Spark
TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)
● — On all models in series specified

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Emission Components—California Cars

Displacement and Venturis	Series	Trans.	Air Guard	Cat. Conv.	EGR	EGR CTO Temp.	Fuel Tank Vapor Control	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid
2-Liter 2V	Gremlin	M	●①	●	●	115°F	●	●②	V	–	●	160°F	●	●	●
	Gremlin	M	●①	●	●	115°F	●	●②	V	–	●	160°F	●	●	●
	Gremlin	A	●①	●	●	115°F	●	●	V	–	●	160°F	●	●	●
258 CID 1V	Pacer	M	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
	Pacer	A	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
	Gremlin	M	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
	Gremlin	A	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
	Concord	M	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
	Concord	A	●④	Dual	●	115°F	●	●	V	●	●③	160°F	●	–	●
360 CID 2V	Matador	A	●⑤	Quad	●	115°F	●	●	V	●	●	160°F	●	●	●

① High Flow Diverter, Plumbed to Exhaust Manifold
② Anti-Diesel Solenoid
③ Trapped Vacuum Check Valve
④ High Flow Diverter, Diverter Delay Valve
⑤ High Flow Diverter

Trans. — Transmission Type (manual or automatic)
Cat. Conv. — Catalytic Converter
CTO — Coolant Temperature Override
EGR — Exhaust Gas Recirculation
PCV — Positive Crankcase Ventilation
TCS — Transmission Controlled Spark
TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)
● — On all models in series specified

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Emission Components—49-State Cars

Displacement and Venturis	Series	Trans.	Air Guard	Cat. Conv.	EGR	EGR CTO Temp.	Fuel Tank Vapor Control	PCV	TAC Type	TCS	Spark CTO	Spark CTO Temp.	Carb. Vent to Can.	Elect. Choke	Throttle Solenoid
2-Liter 2V	Gremlin	M	●	●	●	115°F	●	●①	V	–	●	160°F	●	●	●
	Gremlin	A	●	●	●	115°F	●	●	V	–	●	160°F	●	●	●
232 CID 1V	Pacer	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Pacer	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Gremlin	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Gremlin	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Concord	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Concord	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
258 CID 2V	Pacer	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Pacer	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●
	Gremlin	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Gremlin	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●
	Concord	M	●	●	●	115°F	●	●	V	–	●	160°F	●	–	–
	Concord	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●
	Matador	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●
304 CID 2V	Concord	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●
360 CID 2V	Matador	A	●	●	●	115°F	●	●	V	–	●	160°F	●	–	●

① Anti-Diesel Solenoid

Trans. — Transmission Type (manual or automatic)
Cat. Conv. — Catalytic Converter
CTO — Coolant Temperature Override
EGR — Exhaust Gas Recirculation
PCV — Positive Crankcase Ventilation
TCS — Transmission Controlled Spark
TAC — Thermostatically Controlled Air Cleaner (vacuum or mechanical)
● — On all models in series specified

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POWER PLANT DIAGNOSIS PROCEDURES

GENERAL

Power plant diagnosis is helpful in finding the causes of problems not remedied by normal tune-ups. These problems may be classified as **mechanical** (a strange noise, for instance), or **performance** (engine idles rough and stalls, for instance). Refer to the Service Diagnosis—Mechanical chart and the Service Diagnosis—Performance chart.

Other tests and diagnostic procedures may be necessary to pinpoint a particular problem. Information is provided under Diagnosis With Scope Analyzer, Compression Test, Cylinder Leakage Test, Blown Cylinder Head Gasket Diagnosis and Intake Leak Diagnosis.

Service Diagnosis—Mechanical

Condition	Possible Cause	Correction
EXTERNAL OIL LEAKS	(1) Fuel pump gasket broken or improperly seated.	(1) Replace gasket.
	(2) Cylinder head cover gasket broken or improperly seated.	(2) Replace gasket; check cylinder head cover gasket flange and cylinder head gasket surface for distortion.
	(3) Camshaft oil seal(s) broken or improperly seated (4-cylinder only).	(3) Replace seal(s). Check cylinder head and camshaft bearing cap seal grooves for cracks or distortion.
	(4) Oil filter gasket broken or improperly seated.	(4) Replace oil filter.
	(5) Oil pan side gasket broken or improperly seated.	(5) Replace gasket; check oil pan gasket flange for distortion.
	(6) Oil pan front oil seal broken or improperly seated.	(6) Replace seal; check timing case cover and oil pan seal flange for distortion.
	(7) Oil pan rear oil seal broken or improperly seated.	(7) Replace seal; check oil pan rear oil seal flange; check rear main bearing cap for cracks, plugged oil return channels, or distortion in seal groove.
	(8) Timing case cover oil seal broken or improperly seated (6- and 8-cylinder only).	(8) Replace seal.
	(9) Oil pump housing not seated to block, loose, or gasket leaking (4-cylinder only).	(9) Check for loose bolts. Replace gasket if required.
	(10) Oil pan drain plug loose or has stripped threads.	(10) Repair as necessary and tighten.
	(11) Rear oil gallery plug loose.	(11) Use appropriate sealant on gallery plug and tighten.
	(12) Rear camshaft plug loose or improperly seated.	(12) Seat camshaft plug or replace and seal, as necessary.
EXCESSIVE OIL CONSUMPTION	(1) Oil level too high.	(1) Lower oil level to specifications.
	(2) Oil too thin.	(2) Replace with specified oil.
	(3) Valve stem oil deflectors are damaged, missing, or incorrect type.	(3) Replace valve stem oil deflectors.
	(4) Valve stems or valve guides worn.	(4) Check stem-to-guide clearance and repair as necessary.

80651A

Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
EXCESSIVE OIL CONSUMPTION (Continued)	(5) Piston rings broken, missing.	(5) Replace missing or broken rings.
	(6) Incorrect piston ring gap.	(6) Check ring gap, repair as necessary.
	(7) Piston rings sticking or excessively loose in grooves.	(7) Check ring side clearance, repair as necessary.
	(8) Compression rings installed upside down.	(8) Repair as necessary.
	(9) Cylinder walls worn, scored, or glazed.	(9) Repair as necessary.
	(10) Piston ring gaps not properly staggered.	(10) Repair as necessary.
	(11) Excessive main or connecting rod bearing clearance.	(11) Check bearing clearance, repair as necessary.
NO OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Oil Pressure Indicator in Chapter 1L.
	(3) Oil pump malfunction.	(3) Refer to Oil Pump in Chapter 1B.
	(4) Oil pressure relief valve sticking.	(4) Remove and inspect oil pressure relief valve assembly.
	(5) Oil passages on pressure side of pump obstructed.	(5) Inspect oil passages for obstructions.
	(6) Oil pickup screen or tube obstructed.	(6) Inspect oil pickup for obstructions.
	(7) Loose oil inlet tube.	(7) Tighten or seal inlet tube.
LOW OIL PRESSURE	(1) Low oil level.	(1) Add oil to correct level.
	(2) Oil excessively thin due to dilution, poor quality, or improper grade.	(2) Drain and refill crankcase with recommended oil.
	(3) Oil pressure relief spring weak or sticking.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Oil pickup tube and screen assembly has restriction or air leak.	(4) Remove and inspect oil inlet tube and screen assembly. (Fill pickup with lacquer thinner to find leaks.)
	(5) Excessive oil pump clearance.	(5) Check clearances; refer to Oil Pump in Chapter 1B.

Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
LOW OIL PRESSURE (Continued)	(6) Excessive main, rod, or camshaft bearing clearance.	(6) Measure bearing clearances, repair as necessary.
HIGH OIL PRESSURE	(1) Improper grade oil.	(1) Drain and refill crankcase with correct grade oil.
	(2) Oil pressure gauge or sending unit inaccurate.	(2) Refer to Oil Pressure Indicator in Chapter 1L.
	(3) Oil pressure relief valve sticking closed.	(3) Remove and inspect oil pressure relief valve assembly.
	(4) Oil pressure relief valve anti-lock port blocked (8-cylinder only).	(4) Check for obstruction; repair as necessary.
MAIN BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Main bearing clearance excessive.	(2) Check main bearing clearance, repair as necessary.
	(3) Crankshaft end play excessive.	(3) Check end play, repair as necessary.
	(4) Loose flywheel or torque converter.	(4) Tighten flywheel or converter attaching bolts.
	(5) Loose or damaged vibration damper (6- and 8-cylinder only).	(5) Repair as necessary.
CONNECTING ROD BEARING NOISE	(1) Insufficient oil supply.	(1) Check for low oil level or low oil pressure.
	(2) Bearing clearance excessive or bearing missing.	(2) Check clearance, repair as necessary.
	(3) Crankshaft connecting rod journal out-of-round.	(3) Check journal measurements, repair or replace as necessary.
	(4) Misaligned connecting rod or cap.	(4) Repair as necessary.
	(5) Connecting rod bolts tightened improperly.	(5) Tighten bolts to specified torque.
PISTON NOISE	(1) Piston-to-cylinder wall clearance excessive.	(1) Check clearance, repair as necessary.
	(2) Cylinder walls excessively tapered or out-of-round.	(2) Check cylinder wall measurements, rebore cylinder.
	(3) Piston ring broken.	(3) Replace all rings on that piston.

80651C

Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
PISTON NOISE (Continued)	(4) Loose or seized piston pin.	(4) Check piston-to-pin clearance, repair as necessary.
	(5) Connecting rods misaligned.	(5) Check rod alignment, straighten or replace.
	(6) Piston ring side clearance excessively loose or tight.	(6) Check ring side clearance, repair as necessary.
	(7) Carbon build-up on piston is excessive.	(7) Clean carbon from piston.
VALVE TRAIN NOISE	(1) Valve adjustment too loose (4-cylinder only).	(1) Adjust valves to specifications.
	(2) Insufficient oil supply.	(2) Check for: (a) Low oil level. (b) Low oil pressure. (c) Plugged pushrods (6- and 8-cylinder only). (d) Wrong hydraulic tappets (6- and 8-cylinder only). (e) Plugged oil gallery. (f) Excessive tappet to bore clearance.
	(3) Push rods worn or bent (6- and 8-cylinder only).	(3) Replace worn or bent push rods.
	(4) Rocker arms or bridged pivots worn (6- and 8-cylinder only).	(4) Replace worn rocker arms or bridged pivots.
	(5) Dirt or chips in hydraulic tappets (6- and 8-cylinder only).	(5) Clean tappets.
	(6) Excessive tappet leak-down (6- and 8-cylinder only).	(6) Replace valve tappet.
	(7) Tappet face worn.	(7) Replace tappet; check corresponding cam lobe for wear.
	(8) Broken or cocked valve springs.	(8) Properly seat cocked springs; replace broken springs.
	(9) Stem-to-guide clearance excessive.	(9) Check stem-to-guide clearance, repair as required.
	(10) Valve bent.	(10) Replace valve.
	(11) Loose rocker arms (6- and 8-cylinder only).	(11) Tighten bolts to specified torque.
	(12) Valve seat runout excessive.	(12) Regrind valve seat/valves.

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Service Diagnosis—Mechanical (Continued)

Condition	Possible Cause	Correction
VALVE TRAIN NOISE (Continued)	(13) Missing valve lock.	(13) Install valve lock.
	(14) Push rod rubbing or contacting cylinder head (6- and 8-cylinder only).	(14) Remove cylinder head and remove obstruction in head.

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Service Diagnosis—Performance

Condition	Possible Cause	Correction
HARD STARTING (ENGINE CRANKS NORMALLY)	(1) Binding linkage, choke valve or choke piston.	(1) Repair as necessary.
	(2) Restricted choke vacuum and hot air passages, where applicable.	(2) Clean passages.
	(3) Improper fuel level.	(3) Adjust float level.
	(4) Dirty, worn or faulty needle valve and seat.	(4) Repair as necessary.
	(5) Float sticking.	(5) Repair as necessary.
	(6) Exhaust manifold heat valve stuck. (6- and 8-cylinder only).	(6) Lubricate or replace.
	(7) Faulty fuel pump.	(7) Replace fuel pump.
	(8) Incorrect choke cover adjustment.	(8) Adjust choke cover.
	(9) Inadequate unloader adjustment.	(9) Adjust unloader.
	(10) Faulty ignition coil.	(10) Test and replace as necessary.
	(11) Improper spark plug gap.	(11) Adjust gap.
	(12) Incorrect initial timing.	(12) Adjust timing.
	(13) Incorrect dwell (4-cylinder only).	(13) Adjust dwell.
	(14) Incorrect valve timing.	(14) Check valve timing; repair as necessary.
ROUGH IDLE OR STALLING	(1) Incorrect curb or fast idle speed.	(1) Adjust curb or fast idle speed.
	(2) Incorrect initial timing.	(2) Adjust timing to specifications.
	(3) Incorrect dwell (4-cylinder only).	(3) Adjust dwell.
	(4) Improper idle mixture adjustment.	(4) Adjust idle mixture.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
ROUGH IDLE OR STALLING (Continued)	(5) Damaged tip on idle mixture screw.	(5) Replace mixture screw.
	(6) Improper fast idle cam adjustment.	(6) Adjust fast idle cam.
	(7) Faulty EGR valve operation.	(7) Test EGR system and replace as necessary.
	(8) Faulty PCV valve air flow.	(8) Test PCV valve and replace as necessary.
	(9) Exhaust manifold heat valve inoperative.	(9) Lubricate or replace heat valve as necessary.
	(10) Choke binding.	(10) Locate and eliminate binding condition.
	(11) Improper choke setting.	(11) Adjust choke.
	(12) Faulty TAC unit.	(12) Repair as necessary.
	(13) Vacuum leak.	(13) Check manifold vacuum and repair as necessary.
	(14) Improper fuel level.	(14) Adjust fuel level.
	(15) Faulty distributor rotor or cap.	(15) Replace rotor or cap.
	(16) Leaking engine valves.	(16) Check cylinder leakdown rate or compression, repair as necessary.
	(17) Incorrect ignition wiring.	(17) Check wiring and correct as necessary.
	(18) Faulty coil.	(18) Test coil and replace as necessary.
	(19) Clogged air bleed or idle passages.	(19) Clean passages.
	(20) Restricted air cleaner.	(20) Clean or replace air cleaner.
	(21) Faulty choke vacuum diaphragm.	(21) Repair as necessary.
FAULTY LOW-SPEED OPERATION	(1) Clogged idle transfer slots.	(1) Clean transfer slots.
	(2) Restricted idle air bleeds and passages.	(2) Clean air bleeds and passsages.
	(3) Restricted air cleaner.	(3) Clean or replace air cleaner.
	(4) Improper fuel level.	(4) Adjust fuel level.
	(5) Faulty spark plugs.	(5) Clean or replace spark plugs.
	(6) Dirty, corroded, or loose secondary circuit connections.	(6) Clean or tighten secondary circuit connections.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
	(7) Faulty ignition cable.	(7) Replace ignition cable.
	(8) Faulty distributor cap.	(8) Replace cap.
	(9) Incorrect dwell (4-cylinder only).	(9) Adjust dwell.
FAULTY ACCELERATION	(1) Improper pump stroke.	(1) Adjust pump stroke.
	(2) Incorrect ignition timing.	(2) Adjust timing.
	(3) Inoperative pump discharge check ball or needle.	(3) Clean or replace as necessary.
	(4) Faulty elastomer valve.	(4) Replace valve.
	(5) Worn or damaged pump diaphragm or piston.	(5) Replace diaphragm or piston.
	(6) Leaking main body cover gasket.	(6) Replace gasket.
	(7) Engine cold and choke too lean.	(7) Adjust choke.
	(8) Improper metering rod adjustment (YF Model carburetor or BBD Model carburetor).	(8) Adjust metering rod.
	(9) Faulty spark plug(s).	(9) Clean or replace spark plug(s).
	(10) Leaking engine valves.	(10) Check cylinder leakdown rate or compression, repair as necessary.
	(11) Faulty coil.	(11) Test coil and replace as necessary.
FAULTY HIGH SPEED OPERATION	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Excessive ignition point gap (4-cylinder only).	(2) Adjust dwell.
	(3) Defective TCS system.	(3) Test TCS system; repair as necessary.
	(4) Faulty distributor centrifugal advance.	(4) Check centrifugal advance and repair as necessary.
	(5) Faulty distributor vacuum advance.	(5) Check vacuum advance and repair as necessary.
	(6) Low fuel pump volume.	(6) Replace fuel pump.
	(7) Wrong spark plug gap; wrong plug.	(7) Adjust gap; install correct plug.
	(8) Faulty choke operation.	(8) Adjust choke.
	(9) Partially restricted exhaust manifold, exhaust pipe, muffler or tailpipe.	(9) Eliminate restriction.
	(10) Clogged vacuum passages.	(10) Clean passages.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
FAULTY HIGH SPEED OPERATION (Continued)	(11) Improper size or obstructed main jet.	(11) Clean or replace as necessary.
	(12) Restricted air cleaner.	(12) Clean or replace as necessary.
	(13) Faulty distributor rotor or cap.	(13) Replace rotor or cap.
	(14) Faulty coil.	(14) Test coil and replace as necessary.
	(15) Leaking engine valve(s).	(15) Check cylinder leakdown rate or compression, repair as necessary.
	(16) Faulty valve spring(s).	(16) Inspect and test valve spring tension and replace as necessary.
	(17) Incorrect valve timing.	(17) Check valve timing and repair as necessary.
	(18) Intake manifold restricted.	(18) Remove restriction or replace manifold.
	(19) Worn distributor shaft.	(19) Replace shaft.
MISFIRE AT ALL SPEEDS	(1) Faulty spark plug(s).	(1) Clean or replace spark plug(s).
	(2) Faulty spark plug cable(s).	(2) Replace as necessary.
	(3) Faulty distributor cap or rotor.	(3) Replace cap or rotor.
	(4) Faulty coil.	(4) Test coil and replace as necessary.
	(5) Trigger wheel too high (6- and 8-cylinder only).	(5) Set to specifications.
	(6) Incorrect dwell (4-cylinder only).	(6) Adjust dwell.
	(7) Faulty condenser (4-cylinder only).	(7) Replace condenser.
	(8) Primary circuit shorted or open intermittently.	(8) Trace primary circuit and repair as necessary.
	(9) Leaking engine valve(s).	(9) Check cylinder leakdown rate or compression, repair as necessary.
	(10) Faulty hydraulic tappet(s) (6- and 8-cylinder only).	(10) Clean or replace tappet(s).
	(11) Incorrect valve adjustment (4-cylinder only).	(11) Adjust valves.
	(12) Out-of-round or cracked tappets (4-cylinder only).	(12) Replace tappets.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
MISFIRE AT ALL SPEEDS (Continued)	(13) Faulty valve spring(s).	(13) Inspect and test valve spring tension, repair as necessary.
	(14) Worn lobes on camshaft.	(14) Replace camshaft.
	(15) Vacuum leak.	(15) Check manifold vacuum and repair as necessary.
	(16) Improper carburetor settings.	(16) Adjust carburetor.
	(17) Fuel pump volume or pressure low.	(17) Replace fuel pump.
	(18) Blown cylinder head gasket.	(18) Replace gasket.
	(19) Intake or exhaust manifold passage(s) restricted.	(19) Pass chain through passages.
	(20) Wrong trigger wheel.	(20) Install correct wheel.
POWER NOT UP TO NORMAL	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Faulty distributor rotor.	(2) Replace rotor.
	(3) Incorrect dwell (4-cylinder only).	(3) Adjust dwell.
	(4) Trigger wheel positioned too high or loose on shaft (6- and 8-cylinder only).	(4) Reposition or replace trigger wheel.
	(5) Incorrect spark plug gap.	(5) Adjust gap.
	(6) Faulty fuel pump.	(6) Replace fuel pump.
	(7) Incorrect valve timing.	(7) Check valve timing and repair as necessary.
	(8) Faulty coil.	(8) Test coil and replace as necessary.
	(9) Faulty ignition.	(9) Test cables and replace as necessary.
	(10) Leaking engine valves.	(10) Check cylinder leakdown rate or compression and repair as necessary.
	(11) Blown cylinder head gasket.	(11) Replace gasket.
	(12) ·Leaking piston rings.	(12) Check compression and repair as necessary.
	(13) Worn distributor shaft.	(13) Replace shaft.

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Service Diagnosis—Performance (Continued)

Condition	Possible Cause	Correction
INTAKE BACKFIRE	(1) Improper ignition timing.	(1) Adjust timing.
	(2) Incorrect dwell (4-cylinder only).	(2) Adjust dwell.
	(3) Faulty accelerator pump discharge.	(3) Repair as necessary.
	(4) Improper choke operation.	(4) Repair as necessary.
	(5) Defective EGR CTO.	(5) Replace EGR CTO.
	(6) Defective TAC unit.	(6) Repair as necessary.
	(7) Lean fuel mixture.	(7) Check float level or manifold vacuum for vacuum leak. Remove sediment from bowl.
EXHAUST BACKFIRE	(1) Vacuum leak.	(1) Check manifold vacuum and repair as necessary.
	(2) Faulty diverter valve.	(2) Test diverter valve and replace as necessary.
	(3) Faulty choke operation.	(3) Repair as necessary.
	(4) Exhaust leak.	(4) Locate and eliminate leak.
PING OR SPARK KNOCK	(1) Incorrect ignition timing.	(1) Adjust timing.
	(2) Distributor centrifugal or vacuum advance malfunction.	(2) Check advance and repair as necessary.
	(3) Excessive combustion chamber deposits.	(3) Use combustion chamber cleaner.
	(4) Carburetor set too lean.	(4) Adjust carburetor.
	(5) Vacuum leak.	(5) Check manifold vacuum and repair as necessary.
	(6) Excessively high compression.	(6) Check compression and repair as necessary.
	(7) Fuel octane rating excessively low.	(7) Try alternate fuel source.
	(8) Heat riser stuck in heat ON position (6- and 8-cylinder only).	(8) Free-up or replace heat riser.
	(9) Sharp edges in combustion chamber.	(9) Grind smooth.

Condition	Possible Cause	Correction
SURGING (CRUISING SPEEDS TO TOP SPEEDS)	(1) Low fuel level.	(1) Adjust fuel level.
	(2) Low fuel pump pressure or volume.	(2) Replace fuel pump.
	(3) Metering rod(s) not adjusted properly (YF Model Carburetor or BBD Model Carburetor).	(3) Adjust metering rod.
	(4) Improper PCV valve air flow.	(4) Test PCV valve and replace as necessary.
	(5) Vacuum leak.	(5) Check manifold vacuum and repair as necessary.
	(6) Clogged main jet(s).	(6) Clean main jet(s).
	(7) Undersize main jet(s).	(7) Replace main jet(s).
	(8) Blocked air bleeds.	(8) Clean air bleeds.
	(9) Clogged fuel filter screen.	(9) Replace fuel filter.
	(10) Restricted air cleaner.	(10) Clean or replace air cleaner.

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DIAGNOSIS WITH SCOPE ANALYZER

The scope analyzer is an ignition tester that provides quick and accurate diagnosis of ignition system performance. All phases of the ignition cycle are shown graphically on an oscilloscope (cathode ray tube) as they occur in engine operation.

The manufacturers of scope analyzer equipment provide descriptions of test procedures possible with their equipment. This section is not intended to cover all uses of scope equipment, but to point out differences in scope pattern between the point system used on four-cylinder engines and the SSI (Solid State Ignition) system used on six- and eight-cylinder engines (fig. 1A-1).

The upper section shows a typical scope pattern of the point system from firing line to firing line and areas of the pattern significant to diagnosis. The scope pattern shows time duration horizontally and voltage vertically.

Compare the scope pattern of the point system with the typical pattern of the SSI system.

Note the somewhat longer duration of the spark line shown on the SSI pattern. This longer spark provides superior combustion with the leaner air-fuel mixtures now used.

The SSI waveform pattern is below the zero line in the coil section but otherwise is similar to that of the point system in this area.

Other than the differences described, scope ignition diagnosis procedures for point and SSI systems are essentially the same.

COMPRESSION TEST

(1) Clean spark plug recesses with compressed air.
(2) Remove spark plugs.
(3) Block throttle in wide open position.
(4) Insert compression gauge and crank engine for three revolutions. Record reading on third revolution.

CYLINDER LEAKAGE TEST

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance or rough idle is caused by combustion chamber leakage. A compression test alone may not reveal this fault. The cylinder leakage test provides an accurate means of testing engine condition. Cylinder leakage testing will point out exhaust and intake valve leaks, leaks between cylinders or into the water jacket, or any causes of compression loss.

(1) Check coolant level and fill as required. Do not install radiator cap.

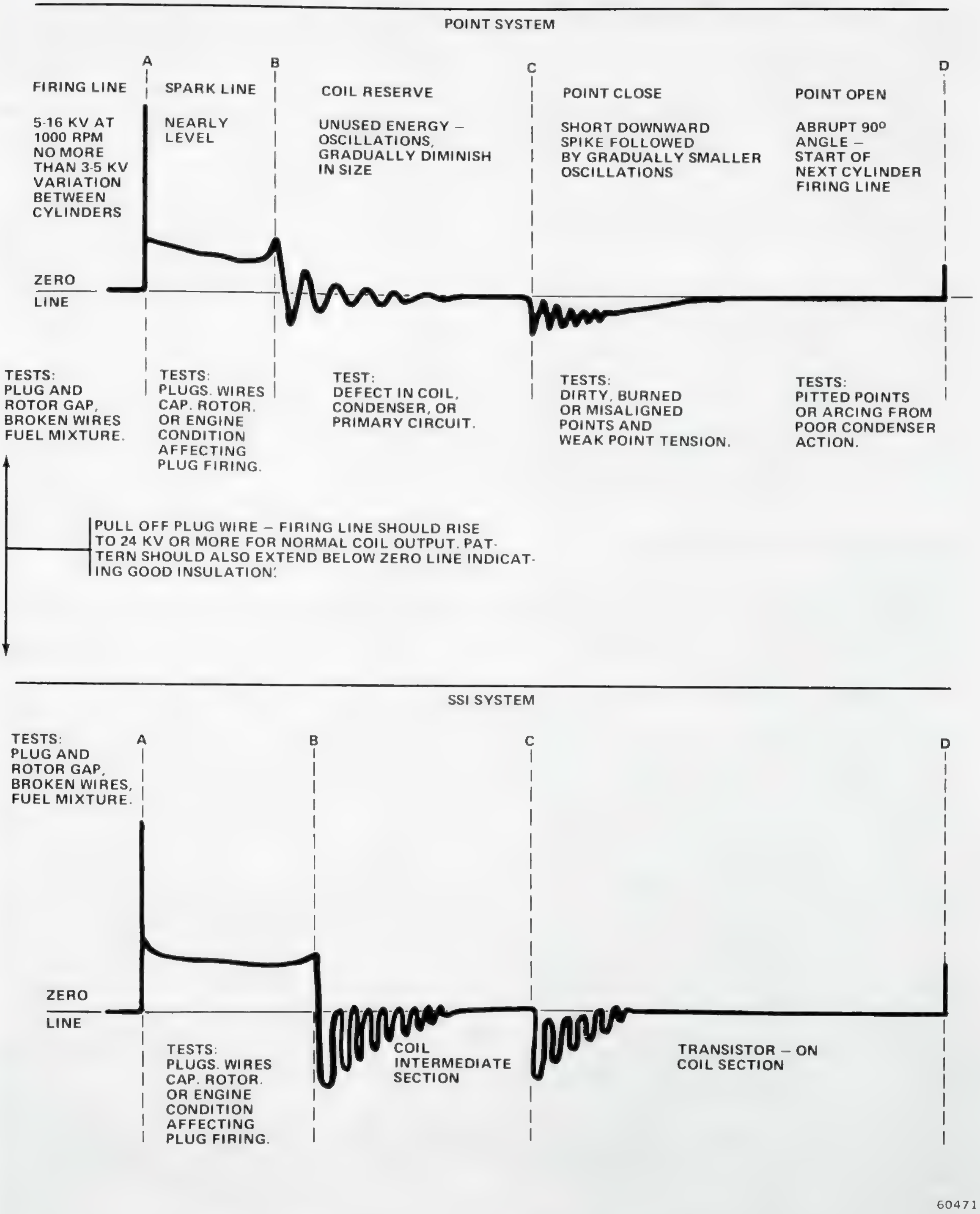

Fig. 1A-1 Scope Diagnosis Pattern—Ignition Primary

(2) Start and run engine until it reaches normal operating temperature, then turn OFF.

(3) Remove spark plugs.

(4) Remove oil filler cap.

(5) Remove air cleaner.

(6) Set carburetor fast idle speed screw on top step of fast idle cam.

(7) Calibrate tester according to manufacturer's instructions.

NOTE: *Shop air source for testing should maintain 70 psi minimum and 200 psi maximum (80 psi recommended).*

(8) Perform test procedures on each cylinder according to tester manufacturer's instructions.

NOTE: *While testing, listen for air escaping through carburetor, tailpipe or oil filler cap opening. Check for bubbles in radiator coolant.*

(9) All gauge indications should be even, with no more than 25% leakage. For example, at 80 psi input pressure, a minimum of 60 psi should be maintained in the cylinder. Refer to Cylinder Leakage Test Diagnosis.

BLOWN CYLINDER HEAD GASKET DIAGNOSIS

A blown cylinder head gasket usually results in a loss of power, loss of coolant or engine miss. A blown cylinder head gasket may develop between adjacent cylinders or between a cylinder and adjacent water jacket.

A cylinder head gasket blown between two adjacent cylinders is indicated by a loss of power or engine miss.

A cylinder head gasket blown between a cylinder and an adjacent water jacket is indicated by foaming of coolant or overheating and loss of coolant.

Replace a blown cylinder head gasket using the procedures outlined in Chapter 1B—Engines.

Cylinder-to-Cylinder Leak Test

To determine if the cylinder head gasket is blown between cylinders, follow the procedures outlined under Compression Test. A cylinder head gasket blown between two cylinders will result in approximately a 50 to 70% reduction in compression in the two affected cylinders.

Cylinder-to-Water Jacket Leak Test

(1) Remove radiator cap and start engine. Allow engine to warm up until thermostat opens.

(2) If large compression leak exists, bubbles will be visible in coolant.

(3) If bubbles are not visible, install radiator pressure tester and pressurize system. If cylinder is leaking into water jacket, needle will pulsate every time cylinder fires.

INTAKE LEAK DIAGNOSIS

An intake manifold leak is characterized by lower

Cylinder Leakage Test Diagnosis

Condition	Possible Cause	Correction
Air escapes through carburetor.	(1) Intake valve leaks.	(1) Refer to Valve Reconditioning under Cylinder Head
Air escapes through tailpipe.	(2) Exhaust valve leaks.	(2) Refer to Valve Reconditioning under Cylinder Head recondition.
Air escapes through radiator.	(3) Head gasket leaks or crack in cylinder block.	(3) Remove cylinder head and inspect.
More than 25% leakage on adjacent cylinder.	(4) Head gasket leaks or crack in cylinder block or head between adjacent cylinders.	(4) Remove cylinder head and inspect.
More than 25% leakage and air escapes through oil filler cap opening only.	(5) Stuck or broken piston ring(s); cracked piston; worn rings and/or cylinder wall.	(5) Inspect for broken ring(s) or piston. Measure ring gap and cylinder diameter, taper, and out-of-round.

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than normal manifold vacuum. One or more cylinders may be "dead."

Exterior Leak

(1) Start engine.
(2) Apply oil to gasketed areas of manifold. If oil is drawn into manifold, or if smoke is evident in exhaust, manifold is leaking.
(3) Open acetylene valve of oxyacetylene torch. **Do not ignite.** Pass torch tip over gasketed areas. If engine speed increases, manifold is leaking.

Interior Leak—Eight-Cylinder Only

(1) Start engine. Remove PCV valve from intake manifold.

(2) Plug PCV valve inlet in manifold. Leave PCV valve hanging free.

(3) Remove oil filler cap. Block filler tube with palm of hand. If vacuum is felt by hand, intake manifold or cylinder head vacuum is leaking into crankcase.

(4) Remove intake manifold. Check for casting flaws.

(5) Inspect cylinder head for casting flaws. Pay particular attention to area around intake valves and intake ports.

(6) With valve closed, fill port with gasoline and check for leaks. Alternately, wrap shop cloth around air nozzle and apply air pressure to port. Listen for leaks.

POWER PLANT TUNE-UP PROCEDURES

GENERAL

A complete precision tune-up is required every 30,000 miles, as explained in Chapter B—Maintenance. A tune-up accomplishes several things. First, it assures that the engine is performing as efficiently and as economically as it was designed to perform. Second, it assures that exhaust and fuel system emissions are within the limits defined by Federal regulations.

A complete precision tune-up includes all of the items listed in the U.S. Emission Control Service chart. Some items on the chart are highly-specialized emission control devices. These devices are discussed as systems in their respective chapters of this book. They are mentioned here for reference only.

For convenience in performing a precision tune-up, the necessary services are grouped together by systems.

ENGINE ASSEMBLY

Cylinder Head Screws

On four-cylinder engines, tighten cylinder head screws to the correct torque. Refer to Chapter 1B—Engines for procedure and sequence.

Valve Lash

On four-cylinder engines, adjust valve clearance of all eight valves. After adjusting clearance, check depth of

U.S. Emission Control Service

Complete Precision Tune-Up Every 30,000 Miles.

A precision electronic diagnosis should be purchased whenever questionable engine performance occurs between the scheduled complete precision tune-ups.

Air-Guard System Hoses - inspect and correct if required
Carburetor Air Cleaner Element - replace
Choke Linkage - inspect for free movement (correct if required)
Coil and Spark Plug Wires - inspect and replace if required
Cylinder Head Screws - retorque (4-cylinder)
Distributor Advance Mechanisms - check and correct if required
Distributor Cap and Rotor - inspect and replace if required
*Drive Belts - inspect condition and tension and correct if required
Engine Oil Filler Cap (filter type) - clean
Fuel Filter Element - replace
Fuel System, Cap, Tank, Lines and Connections - inspect for integrity and correct if required
Fuel Vapor Inlet Filter at Charcoal Canister - replace
Heat Valve (exhaust manifold) - inspect and lubricate
Idle Speed (curb and fast) and mixture - check and reset if required
Ignition Points and Condenser - replace (4-cylinder)
Ignition Timing - check and set if required
PCV Filter (4- and 6-cylinder) - clean
PCV Hoses - inspect and replace if required
PCV Valve - replace
Spark Plugs - replace
TAC System Hoses - inspect and correct if required
Transmission Controlled Spark Systems - inspect and correct if required
Vacuum Fittings, Hoses and Connections - inspect and correct if required
Valve Lash - adjust (4-cylinder)

*During extended high temperature and extensive air conditioner operation, the drive belts may require more frequent inspection and adjustment.

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adjusting screw. Refer to Chapter 1B—Engines for complete procedure.

Oil Filler Cap

On eight-cylinder engines, the oil filler cap routes air into the PCV system. The oil filler cap contains a polyurethane foam filter. To clean the filter, apply light air pressure in the direction opposite normal flow (through the filler tube opening). Do not oil the filter. If the filter is deteriorated, replace the filler cap.

Drive Belts

Inspect belts for defects such as fraying or cracking. Check belt tension. Belt adjustment, arrangement and tension specifications are covered in Chapter 1C—Cooling.

Vacuum Fittings, Hoses and Lines

Inspect vacuum fittings for looseness and corrosion. Inspect rubber hoses for brittleness and cracking. Pay particular attention to hose ends which are slipped onto nipples. Engine performance may be adversely affected by vacuum leaks in such unlikely places as heater control hoses or power brake booster hose.

IGNITION SYSTEM

Spark Plugs

Remove and examine spark plugs for burned electrodes and dirty, fouled, cracked or broken porcelains. Keep plugs arranged in the order removed from the engine. An isolated plug displaying an abnormal condition indicates that a problem exists in the cylinder from which it was removed. Replace plugs at mileage intervals recommended in the U.S. Emission Control Services chart. Plugs with lower mileage may be cleaned under some circumstances. Refer to Spark Plug Condition. After cleaning, file the center electrode flat with a point file. Set the gap 0.033- to 0.037-inch (fig. 1A-2).

Always use a torque wrench when installing spark plugs. Distortion from overtightening will change the gap clearance of the plug. On four-cylinder engines, tighten to 30 Nm (22 foot-pounds). On six-and eight-cylinder engines, tighten to 25 to 30 foot-pounds (34 to 41 Nm) torque.

Spark Plug Condition

Refer to figure 1A-3. Compare spark plugs with the illustrations and the following descriptions.

A—Gap Bridging

Gap bridging may be traced to flying deposits in the combustion chamber. Fluffy deposits may accumulate on the plugs during in-town driving. When the engine is suddenly put under heavy load, this material can melt and bridge the gap.

Fig. 1A-2 Spark Plug Gap

B—Scavenger Deposits

Fuel scavenger deposits shown may be white or yellow. They may appear to be harmful, but this is a normal appearance caused by additives in certain fuel brands. Such additives are designed to change the chemical nature of deposits to lessen misfire tendencies. Notice that accumulation on the ground electrode and shell areas may be heavy, but the material is easily removed. Such plugs can be considered normal in condition and can be cleaned using standard procedures.

C—Chipped Insulator

Chipped insulators usually result from bending the center electrode while gapping the plug. Under certain conditions, severe detonation can also split insulator firing ends.

D—Pre-ignition Damage

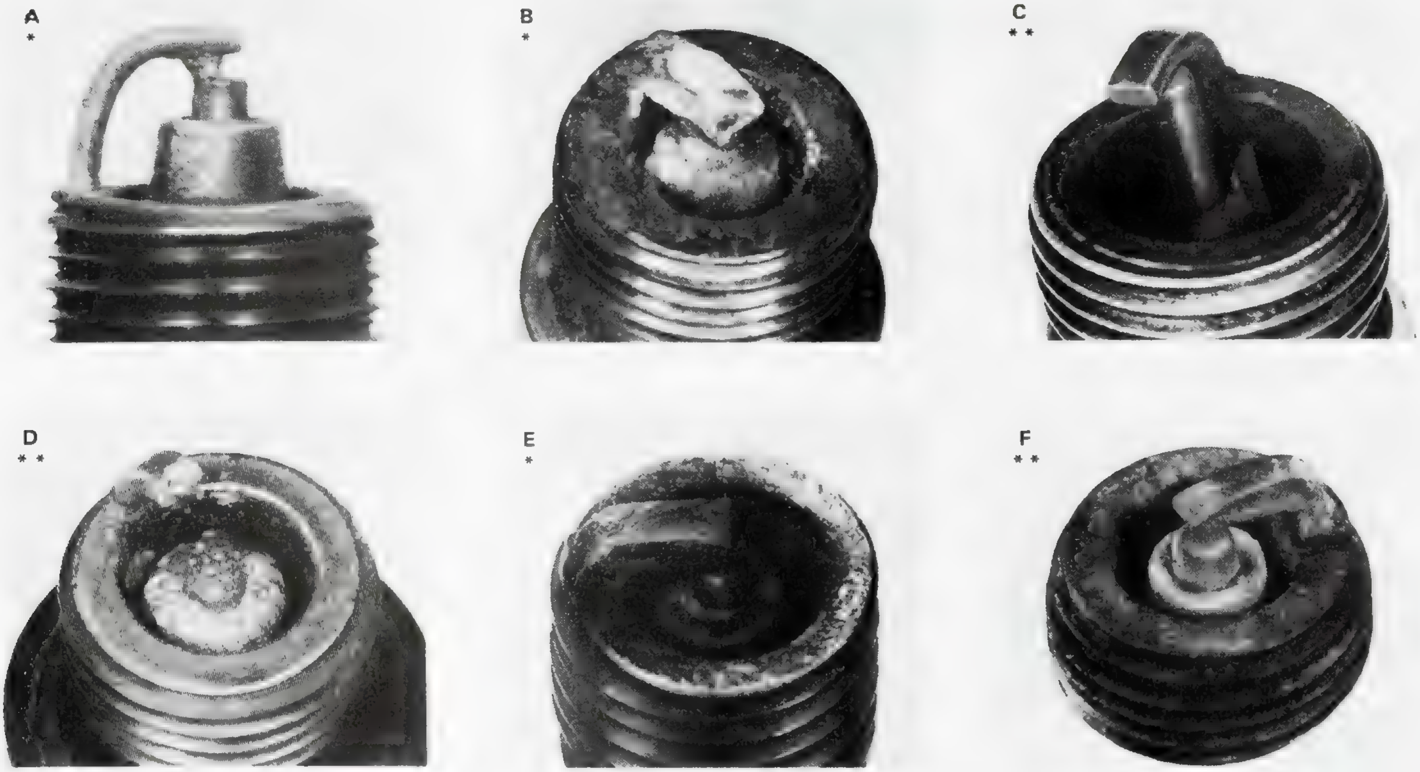
Pre-ignition damage is caused by excessive temperatures. First the center electrode melts, and somewhat later, the ground electrode. Insulators appear relatively clean of deposits. Check for correct plug heat range, overadvanced ignition timing and similar reasons for overheating.

E—Cold Fouling (or Carbon Fouling)

Cold fouling is basically a carbon deposit. Dry, black appearance of one or two plugs in a set may be caused by sticking valves or bad ignition leads. Fouling of the entire set may be caused by a clogged air cleaner, a sticking exhaust manifold heat valve or a faulty choke.

F—Overheating

Overheating is indicated by a dead white or gray insulator which appears blistered. Electrode gap wear rate will be considerably in excess of 0.001 inch per 1000



* LOW MILEAGE PLUGS WITH THIS CONDITION MAY BE CLEANED

** PLUGS WITH THIS CONDITION MUST BE REPLACED

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Fig. 1A-3 Spark Plug Conditions

miles. This may suggest that a cooler heat range should be used. Overadvanced ignition timing, detonation and cooling system problems can also cause plug overheating.

NOTE: *Fuel refiners in several parts of the United States have introduced a manganese additive (MMT) in unleaded fuel. During combustion, MMT fuel covers the entire tip of the spark plug with a rust-colored deposit. This rust color may be misdiagnosed as water in the combustion chamber. Spark plug performance is not affected by MMT deposits.*

Spark Plug Wires

To remove wires from spark plugs, twist the rubber protector boot slightly to break the seal. Grasp the boot and pull it from the plug with steady, even pressure. Do not pull on the wire itself as this will damage the wire.

To remove wires from the distributor cap or coil tower, loosen the boot first, then grasp the upper part of the boot and the wire and gently pull straight up.

Wire Test

Do not puncture the spark plug wires with a probe while performing any test. This may cause a separation in the conductor. The preferred method is to remove the suspected wire and use an ohmmeter to test for resistance according to the length of the particular wire.

Resistance Values

Inches	Ohms
0 to 15	3,000-10,000
15 to 25	4,000-15,000
25 to 35	6,000-20,000
Over 35	8,000-25,000

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When installing spark plug wires and the coil high tension wire, be certain a good tight connection is made at the spark plug, distributor cap tower and coil tower. The protector boots at the spark plugs and distributor cap must fit tightly. A partially seated wire creates an additional gap in the circuit and the resulting spark jump will cause terminal corrosion and wire damage.

Ignition Coil

Always check a suspected defective ignition coil on the car. Since a coil may break down after it has reached operating temperature, it is important that the coil be at operating temperature when tests are made. Perform the tests following the instructions of the particular test equipment manufacturer.

Distributor—Four-Cylinder

The 2-liter, four-cylinder engine uses a point-type distributor. Replace the ignition points and condenser at the intervals indicated in the Maintenance Schedule in Chapter B.

Ignition Points and Condenser Replacement

NOTE: *Replace the ignition points and set to specification before adjusting ignition timing.*

(1) Remove distributor cap, rotor and dust cover.

(2) Disconnect condenser and point assembly primary wires.

(3) Remove condenser retaining screw and remove condenser.

(4) Remove point assembly retaining screw and remove points.

(5) Wipe distributor cam clean and inspect surface. If cam is not damaged, apply small amount of distributor cam lubricant to cam lobes.

(6) Install replacement point assembly.

(7) Rotate engine until point rubbing block is on **high** point of distributor cam lobe.

WARNING: *Keep hands clear of fan and engine drive belts while rotating engine. Place manual transmission in NEUTRAL, automatic in PARK, and set parking brake fully.*

(8) Loosen point assembly retaining screw slightly and insert screwdriver in adjustment slot and between tabs on breaker plate. Turn screwdriver to adjust point gap. Measure gap (0.018 inch or 0.45 mm) with a *clean, flat feeler gauge* (fig. 1A-4). Tighten point assembly retaining screw and recheck point gap making sure rubbing block is on high point of cam.

NOTE: *If using a dwell meter, follow tool manufacturer's instructions for connections. Adjust points to the correct dwell (47°±3°) angle by turning screwdriver in adjustment slot. It is not necessary to use a feeler gauge.*

(9) Install condenser and retaining screw.

(10) Connect coil feed and point primary wires to condenser.

(11) Install dust cover, rotor and distributor cap.

(12) Check ignition timing and adjust, if required.

Distributor Rotor

Visually inspect the rotor for cracks, evidence of burning or corrosion on the metal tip, or evidence of mechanical interference with the cap (fig. 1A-5). Some burning is normal on the end of the metal tip. Inspect the spring for insufficient tension. Replace a rotor displaying any of the conditions mentioned.

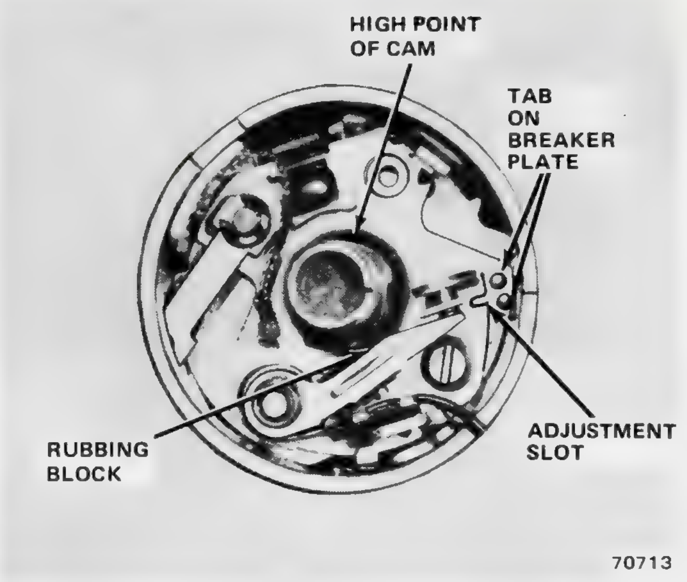

Fig 1A-4 Setting Ignition Points

Check for a shorted rotor as follows:

WARNING: *Do NOT use this procedure on SSI-equipped cars.*

(1) Remove coil wire from center terminal of distributor cap and remove distributor cap.

(2) Grip coil wire with insulated pliers and hold wire end 3/8 inch away from metal contact strip of rotor.

(3) Crank engine one or two revolutions.

(4) If coil spark jumps gap to rotor, rotor is shorted.

Distributor Cap

Remove the distributor cap and wipe clean with a dry rag. Perform a visual inspection for cracks, carbon runners, broken towers, burned or eroded terminals and damaged rotor button (fig. 1A-6). Replace cap displaying any of these conditions. When replacing the cap, move one ignition wire at a time to the replacement cap. If necessary, refer to Distributor Wiring Sequence in Specifications. Make sure each wire is installed in the tower corresponding to the tower from which it was removed. Push the wires firmly into place.

Replace the cap if the inserts inside the cap are excessively burned. The vertical face of the insert will show some evidence of burning through normal operation. Check the inserts for evidence of mechanical interference with the rotor tip.

Distributor—Six- and Eight-Cylinder

The distributor used on six- and eight-cylinder engines is the solid state ignition (SSI) type. Other than cap and rotor inspection as outlined in Chapter B, there is no scheduled maintenance for this distributor. Refer to Chapter 1G—Ignition System for distributor service procedures.

Distributor Rotor

Visually inspect the rotor for cracks, evidence of burning or corrosion on the metal tip, or evidence of mechanical interference with the cap (fig. 1A-5). A small quantity of silicone grease is applied to the distributor rotor tip during manufacture to reduce radio interference. After a few thousand miles, this grease becomes charred by the high voltage carried by the rotor. This is normal. Do not scrape the residue from the rotor blade. Inspect the spring for insufficient tension. Replace a rotor displaying any of the conditions shown. Coat the tip of the replacement rotor with AMC Silicone Dielectric Compound, or equivalent.

Distributor Cap

Remove the distributor cap and wipe clean with a dry rag. Perform a visual inspection for cracks, carbon runners, broken towers, burned or eroded terminals and damaged rotor button (fig. 1A-6). Replace cap displaying any of these conditions. When replacing the cap, move one ignition wire at a time to the replacement cap. If necessary, refer to Distributor Wiring Sequence in Specifications. Make sure each wire is installed in the tower

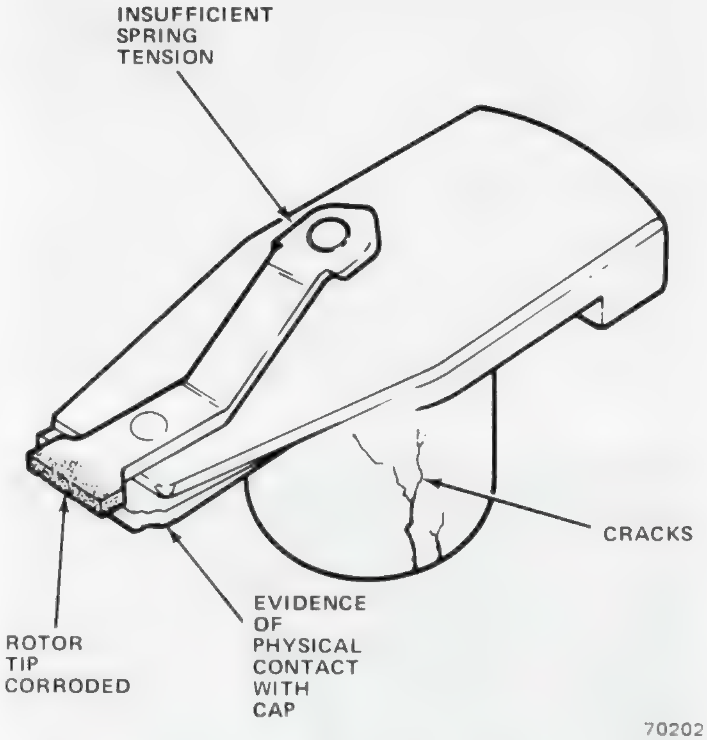

Fig. 1A-5 Rotor Inspection—Typical

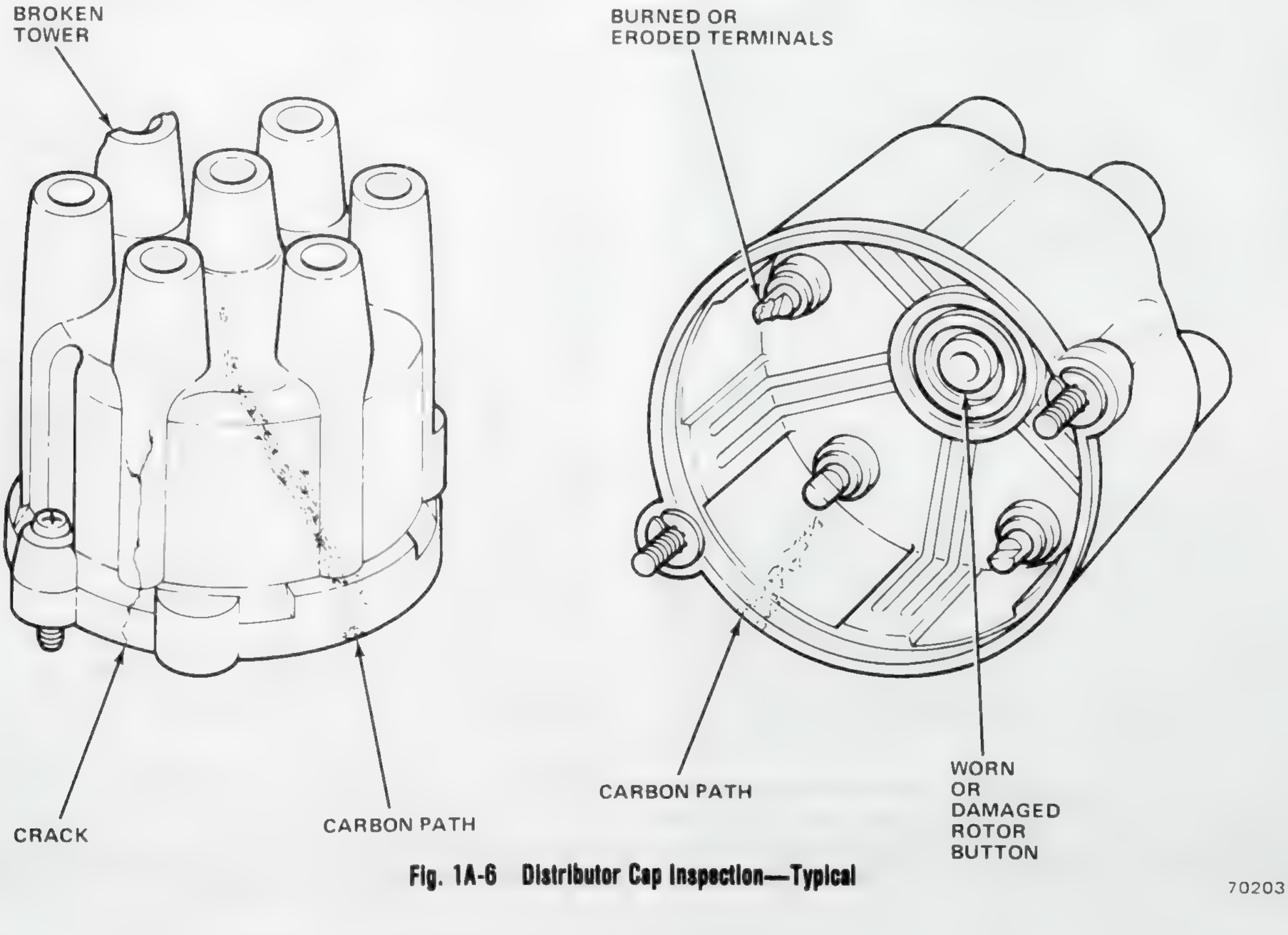

Fig. 1A-6 Distributor Cap Inspection—Typical corresponding to the tower from which it was removed. Push the wires firmly into place.

Replace the cap if the inserts inside the cap are excessively burned. The vertical face of the insert will show some evidence of burning through normal operation. Check the inserts for evidence of mechanical interference with the rotor tip.

Initial Ignition Timing

A graduated degree scale located on the timing case cover is used for timing the ignition system. A milled notch on the vibration damper is used to reference the No. 1 firing position of the crankshaft with the timing marks on the scale as shown in figures 1A-7, 1A-8 and 1A-9.

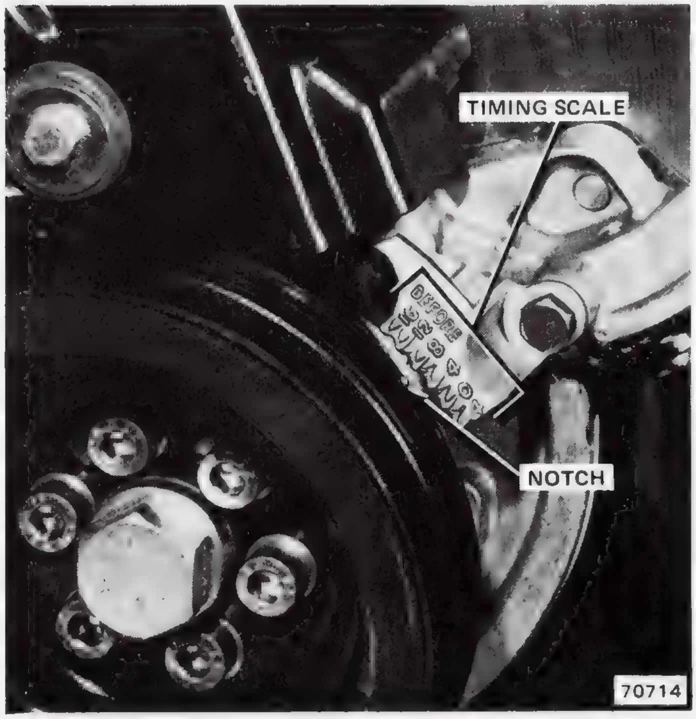

Fig. 1A-7 Timing Mark Location—Four-Cylinder Engine

Magnetic Timing Probe

On six- and eight-cylinder engines, a socket is cast into the timing case cover for use with a special magnetic timing probe. This special probe senses the milled notch on the vibration damper. The probe is inserted through the socket until it touches the vibration damper. It is automatically spaced away from the damper by damper eccentricity. Ignition timing can then be read from a meter or computer printout, depending on the manufacturer's equipment.

The socket is located at 9.5° ATDC, and the equipment is calibrated for this reading. **Do not use the probe location to check timing using a conventional timing light.**

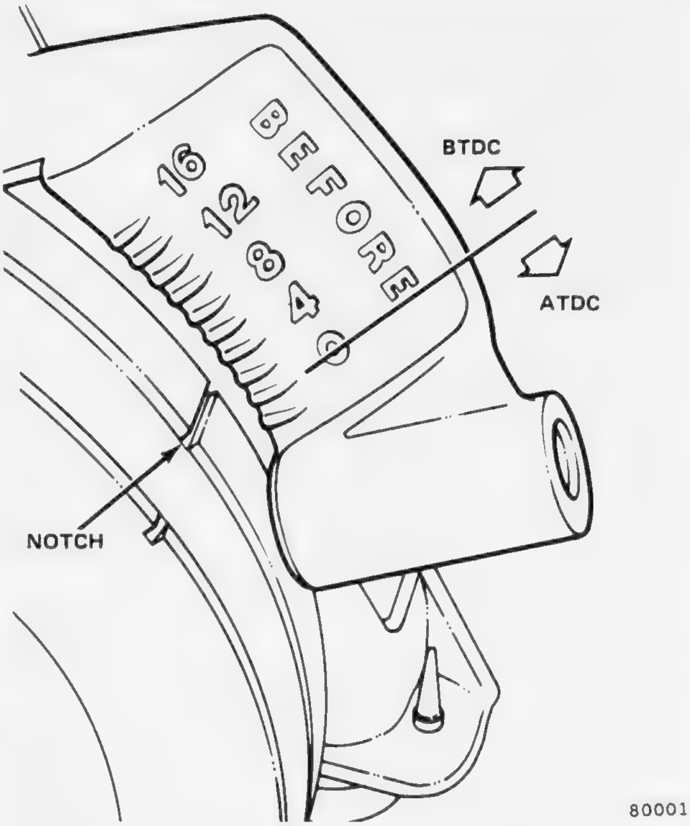

Fig. 1A-8 Timing Mark Location—Six-Cylinder Engine

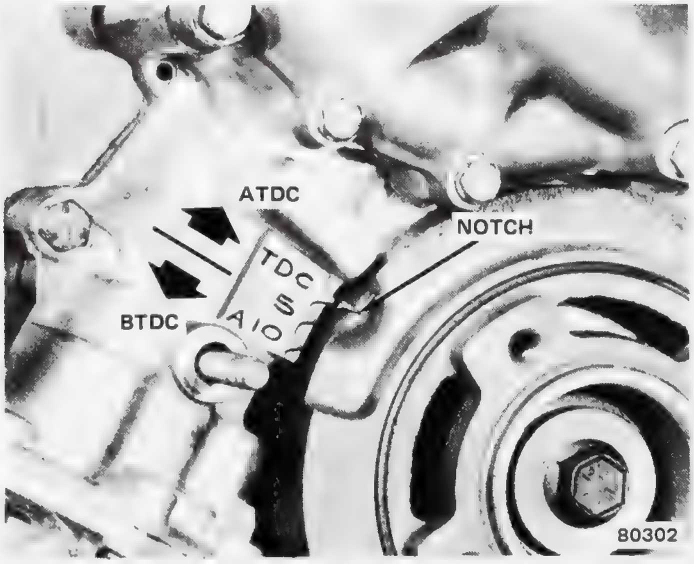

Fig. 1A-9 Timing Mark Location—Eight-Cylinder Engine

Timing Procedure

(1) Disconnect distributor vacuum hose.

(2) Connect ignition timing light and properly calibrated tachometer.

NOTE: *If a timing light incorporating an advance control feature is used, set the control to the OFF position.*

NOTE: *On SSI ignition coils, a convenient terminal is provided for tachometer correction.*

(3) Start engine.

(4) Adjust idle speed to specified curb idle at operating temperature.

(5) Adjust initial ignition timing to setting specified on Tune-Up Specifications—On-Car chart by loosening distributor holddown clamp and rotating distributor.

(6) Tighten distributor holddown clamp and verify that ignition timing did not change.

Distributor Advance Mechanism

Adjustable Advance Control Timing Light Procedure

(1) Disconnect TCS solenoid vacuum valve wires, if equipped.

(2) Increase engine speed to 2000 rpm.

(3) Turn advance control of ignition timing light until ignition timing has returned to initial setting. For example: If initial timing specification is 8° Before Top Dead Center (BTDC) at 500 rpm or less, the timing mark on the crankshaft must align with 8° BTDC on the timing scale at 2000 rpm to determine total amount of advance.

NOTE: *The degree reading on the advance meter should indicate as specified in the Tune-Up Specifications—On-Car chart in the column headed Total Degrees Advance at 2000 rpm..*

(4) If total advance at 2000 rpm is less than specified, disconnect vacuum advance hose at distributor.

(5) Check maximum centrifugal degrees advance at engine rpm specified. Refer to Distributor Curves in Specifications.

If the centrifugal advance degrees are as specified, replace the vacuum unit.

Distributor Advance—On Tester

Distributor advance also may be tested with the distributor out of the car. Follow distributor test equipment manufacturer's instructions.

Information given in the Distributor Curves is for on-car testing. If the distributor advance is checked on a distributor tester, convert the information in the Distributor Curves from engine rpm to distributor rpm and from engine degrees to distributor degrees. Divide engine rpm by 2 to obtain distributor rpm. Divide engine degrees advance by 2 to obtain distributor degrees advance. For instance, if the Distributor Curve indicates 8 to 12 degrees advance at 2000 rpm, the corresponding on-tester specifications would be 4 to 6 degrees advance at 1000 rpm.

NOTE: *The inches of vacuum reading is the same, regardless if test is on-engine or off-engine.*

FUEL SYSTEMS

General Inspection

Fuel systems depend on hoses and tubing to carry liquid fuel, fuel vapors and vacuum. Fuel vapor and vacuum leaks upset the operation of the engine and may reduce the effectiveness of emission control devices. Liquid fuel leaks not only waste fuel but also create a fire hazard. Carefully inspect hoses and tubing for cracks, dents, corrosion and unintentional bends. Inspect fittings for corrosion or looseness. Inspect fuel tank for leaks caused by loose mounting straps, broken seams, dents or corrosion. Check filler neck grommets and hoses.

Air Cleaner

Replace the dry-type air cleaner element at each precision tune-up. Under extreme conditions, more frequent replacement is recommended.

Fuel Filter

All AMC cars have two fuel filters. The in-tank filter is designed to be maintenance-free. The in-line filter between the fuel pump and carburetor requires periodic replacement. When installing the replacement filter, be careful to position the fuel return nipple at the top of the filter.

Engine Idle Speed and Mixture Setting Procedures

General

The engine and related systems must be performing properly before making idle speed and mixture adjustments.

A plastic limiter cap is installed over the mixture adjusting screw(s) on all carburetors (fig. 1A-10, 1A-11, 1A-12, and 1J-13). On four-cylinder engines, the limiter prevents any mixture adjustment. On six- and eight-cylinder engines, the limiter permits adjustment of the mixture within a narrow range, effectively controlling exhaust emissions at idle. Remove the limiter cap only when instructed in the following mixture adjustment procedures. To remove, carefully insert a No. 10 sheet metal screw into the center of the cap and turn clockwise. An alternate method is to melt the cap with a soldering iron.

Two mixture setting procedures are used. The infrared method can be used only on vehicles without catalytic converter. The idle drop (tachometer) method must be used on all vehicles with catalytic converter.

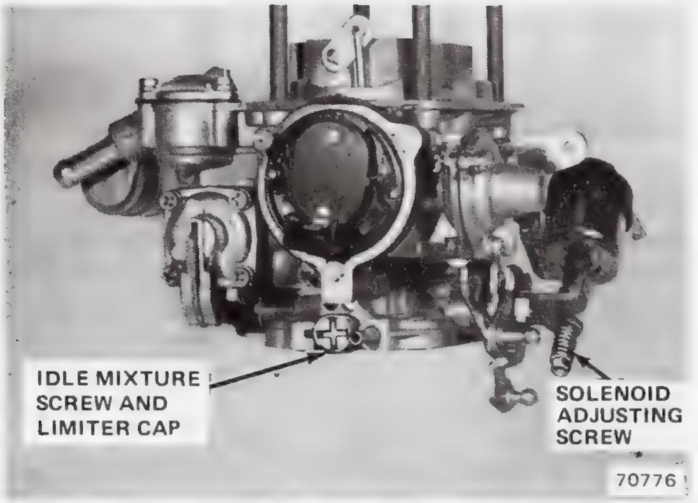

Fig. 1A-10 Holley-Weber Model 5210 Carburetor

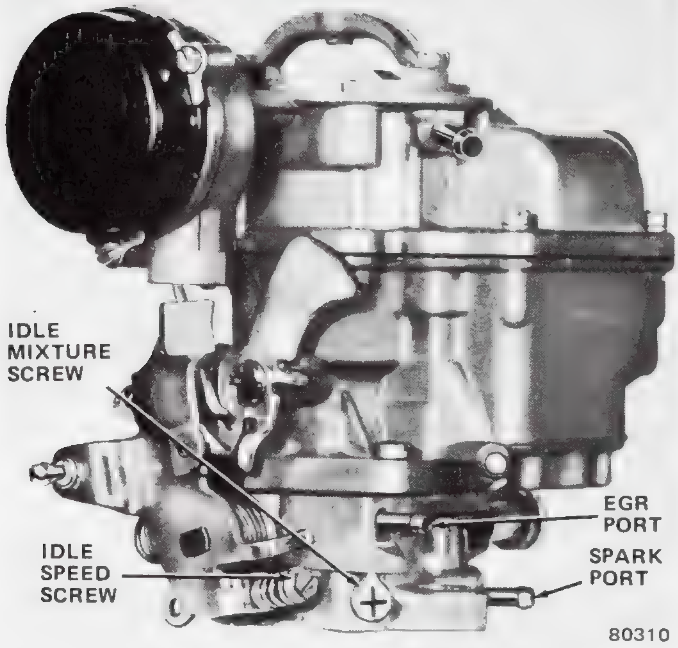

Fig. 1A-11 Carter Model YF Carburetor

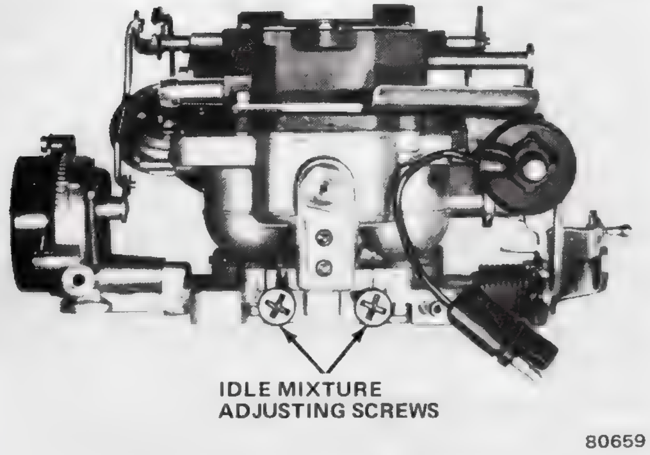

Fig. 1A-12 Carter Model BBD Carburetor

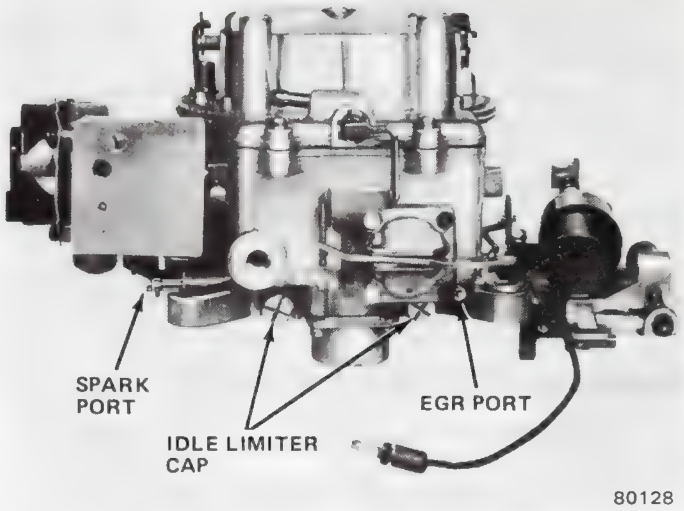

Fig. 1J-13 Motorcraft Model 2100 Carburetor

Precautions

- Because automatic transmission vehicles are adjusted in DRIVE, set the parking brake firmly and do not accelerate the engine.
- Bring the engine up to operating temperature before setting idle and mixture.
- Perform procedures with the air cleaner installed.
- Do not idle the engine more than 3 minutes at a time.
- If the mixture setting procedure takes more than 3 minutes, run the engine at 2000 rpm for 1 minute.
- Be sure the curb idle setting is correct before adjusting mixture.
- Be careful of fan, belts and other moving objects while working under the hood with the engine running. Do not stand in direct line with the fan blades.

Idle Setting Procedure

(1) Warm engine to operating temperature.

(2) Turn curb idle adjusting screw to obtain specified curb idle speed. If carburetor is equipped with solenoid:

(a) Turn solenoid adjusting screw (Model 5210), nut on solenoid plunger (Model YF or BBD), or hex screw on solenoid carriage (Model 2100 and 2150) to obtain specified idle speed.

(b) Tighten locknut, if equipped.

(c) Disconnect solenoid wire and adjust curb idle screw to obtain 500 rpm idle speed.

(d) Connect solenoid wire.

NOTE: *When setting idle speed, put manual transmission in NEUTRAL. Put automatic transmission in DRIVE.*

WARNING: *Set parking brake firmly. Do not accelerate engine.*

Mixture Setting Procedure—Infra-Red Analyzer

NOTE: *This procedure applies only to vehicles WITHOUT catalytic converter.*

(1) Observe precautions listed above.

(2) Connect IR analyzer by following manufacturer's instructions.

NOTE: *Inspect analyzer periodically and calibrate to insure accuracy.*

(3) Warm engine to operating temperature.

(4) Set curb idle speed as outlined above.

(5) Calibrate analyzer.

(6) Insert probe of analyzer at least 18 inches into tailpipe.

NOTE: *The exhaust system and test equipment must be free of leaks to prevent erroneous readings.*

(7) Observe CO level and compare to chart.

Engine Idle CO Level

	Engine	Transmission	CO Level, Maximum
No Catalytic Converter	232	Automatic	1.0%
	258	Automatic	1.0%

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(8) If less than specified, turn screw counterclockwise 1/16-turn at a time until specified CO reading is obtained.

(9) If greater than specified, turn screw clockwise until specified CO reading is obtained.

(10) Allow 10 seconds for meter to stabilize after each adjustment.

NOTE: *If the idle speed changes more than 30 rpm during the mixture adjustment, reset to the specified rpm and repeat the adjustment until the specified carbon monoxide level is obtained.*

(11) If unable to obtain specified carbon monoxide level at either stop, remove limiter cap and adjust idle speed mixture as outlined in steps (8), (9) and (10).

(12) Install replacement blue idle limiter cap over idle mixture screw with limiter cap tab positioned against full rich stop. Be careful to not disturb idle mixture setting while installing cap. Press cap firmly and squarely into place.

NOTE: *Limiter caps are easier to install if they are heated by immersing in hot water.*

Mixture Setting Procedure—Idle Drop (Tachometer)

NOTE: *This procedure applies only to vehicles WITH catalytic converter.*

(1) Observe precautions listed above.

(2) Warm engine to operating temperature.

(3) Adjust each idle mixture screw to full rich stop (counterclockwise). Note position of screw head slot(s) inside limiter cap(s).

NOTE: *On Model 5210 carburetors, the mixture limiter is installed in a slot, preventing any turning.*

(4) Remove idle limiter cap(s) by installing No. 10 sheet metal screw and turning clockwise. Discard cap(s).

(5) Set idle mixture screw(s) to position noted in step (1) if screw position changed while removing limiter cap(s).

(6) Connect tachometer and start engine.

NOTE: *Use a tachometer with an expanded scale of 400—800 or 0—1000 rpm. Inspect periodically to ensure accuracy within 2%.*

(7) Position gear selector as listed in Specifications.

(8) Adjust idle speed as listed in Specifications. Use Set-To value. If equipped with solenoid, set idle as follows:

(a) With solenoid energized, set specified curb idle speed.

(b) Disconnect solenoid wire and adjust idle using engine-off throttle stop screw to obtain 500 rpm.

(c) Connect solenoid wire.

(9) Starting from full rich position established in step (3), turn mixture screw(s) leaner (clockwise) until perceptible loss of rpm is noted.

(10) Turn mixture screw(s) richer (counterclockwise) until highest rpm reading is obtained. Do not turn screw(s) any further than point at which highest rpm is first obtained. This is referred to as lean best idle.

NOTE: *Engine speed will increase above curb idle speed an amount that corresponds approximately to the lean drop specification to be applied in step (11).*

(11) As final adjustment, turn mixture screw(s) clockwise to obtain specified drop in engine rpm. On BBD, 2100, and 2150 series carburetors, turn both idle mixture screws in small, equal amounts until drop is achieved.

NOTE: *If the final rpm differs more than ±30 rpm from the originally set curb idle speed, set curb idle to specification and perform steps (10) and (11) again.*

(12) Install replacement (blue) limiter cap(s) to mixture screw(s) with limiter tab positioned against full rich stop. On Model 5210, position tab in slot on carburetor body to prevent any adjustment. Be careful to not disturb mixture setting while installing cap.

Idle Drop

Engine	Transmission	Emission Package	Idle Drop (RPM)
2-Liter 2V	All	49 and Cal	120
	All	Alt	75
232 1V	Man	49	50
	Auto	49	25
258 1V	Man	Alt and Cal	50
	Auto	Alt and Cal	25
258 2V	Man	49	50
	Auto	49	25
304 2V	Auto	All	20
360 2V	Auto	All	20

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Choke Linkage

Check all choke linkage including the fast idle cam for free movement at the mileage intervals specified in the Mechanical Maintenance Schedule.

Free-up carburetor linkage by applying AMC Carburetor and Combustion Area Cleaner or equivalent. Never use oil to lubricate carburetor linkage.

For correct choke system adjustments, refer to Chapter 1J—Fuel Systems.

PCV Air Inlet Filter

Four- and Six-Cylinder Engines

A polyurethane foam PCV air inlet filter is located in a filter retainer in the air cleaner. Rotate the retainer to remove it from the air cleaner (fig. 1A-14). Clean the filter in kerosene at the mileage intervals recommended in the Maintenance Schedule. After cleaning, lightly oil the filter with clean engine oil.

Eight-Cylinder Engine

A polyurethane foam PCV air inlet filter is located in the sealed oil filler cap. To clean the filter, apply light air pressure in direction opposite normal flow (through the filler tube opening of the cap). Do not oil the filter. If the filter is deteriorated, replace the filler cap.

Fuel Tank Vapor Emission Control System

The fuel tank, filler cap, fuel lines and vent lines must be maintained in good condition to prevent raw fuel vapors (hydrocarbons) from entering the atmosphere.

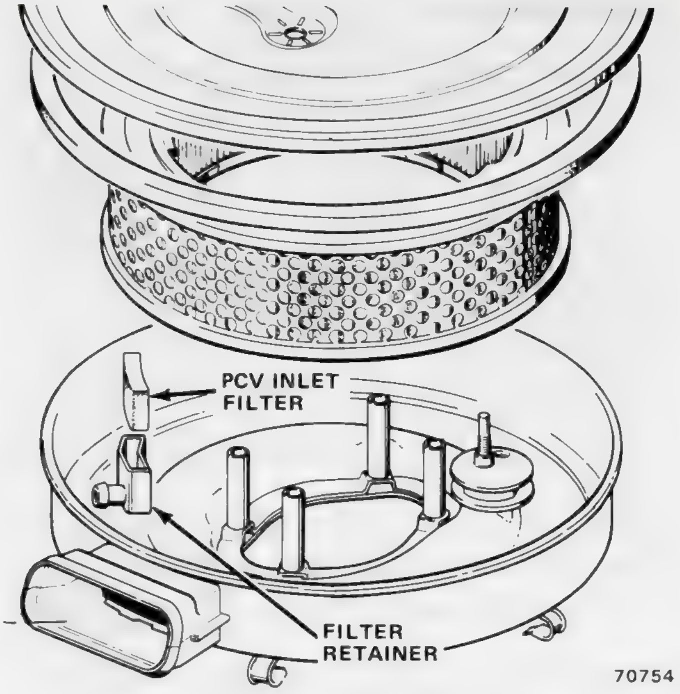

Fig. 1A-14 PCV Air Inlet Filter—Typical

Inspect the filler cap for evidence of fuel leakage stains at the filler neck opening. Remove the cap and check the condition of the sealing gasket. Replace the filler cap if the gasket is damaged or deteriorated.

Inspect the fuel tank for evidence of fuel leakage stains. Trace stain to its origin and repair or replace the tank as required.

Inspect the fuel and vent lines for leakage or damage. Repair or replace as required. Be sure all connections are tight.

If liquid fuel is present at the fuel vapor storage canister, inspect the liquid check valve and replace if necessary.

Charcoal Canister Filter

The filter pad located at the bottom of the canister is the only serviceable item of the canister assembly. Replace at intervals as prescribed in the Maintenance Schedule, located in Chapter B of this manual.

Thermostatically Controlled Air Cleaner (TAC) System

Inspect valve for proper operation. If necessary, refer to Chapter 1J—Fuel Systems for functional test.

Inspect hoses for cracks and brittleness. Replace as necessary.

EXHAUST SYSTEM

Air Guard System

Inspect hoses for defects. Replace as necessary.

Exhaust Manifold Heat Valve

The exhaust manifold heat valve is an often overlooked, but highly important emission related component. This valve can affect the gas mileage, performance, driveability and emission levels.

Inspect the exhaust manifold heat valve for correct operation and lubricate with AMC Heat Valve Lubricant, or equivalent, every 30,000 miles. Refer to Chapter 1K—Exhaust Systems for service procedures.

SPECIFICATIONS

Tune-Up Specifications—On-Car—Six- and Eight-Cylinder Engines

Displacement and Carburetion	Transmission	Initial Timing BTDC at Curb Idle Speed With Vacuum Hose Disconnected		Curb Idle Speed — RPM (Auto in Drive, Manual in Neutral)		Distributor Model Number	Vacuum Unit Number	Total Degrees Advance at 2000 RPM	Centrifugal Advance	Spark Plug Type
		Set To	OK Range	Set To	OK Range					
232 CID 1V	M	8° (49)	6° 10°	600 (49)	500 700	3231915	8128773	28.9 to 37.9	Refer to Distributor Curves	N13L Gap 0.033 to 0.037 inch (Alternate RN13L)
	A	10° (49)	8° 12°	550 (49)	450 650					
258 CID 1V	M	10° (Alt)	8° 12°	600 (Alt)	500 700	3232434	8128769	20.9 to 29.9		
		6° (Cal)	4° 8°	850 (Cal)	750 950					
	A	10° (Alt)	8° 12°	550 (Alt)	450 650					
		8° (Cal)	6° 10°	700 (Cal)	600 800					
258 CID 2V	M	6° (49)	4° 8°	600 (49)	500 700	3231915	8128773	28.9 to 37.9		
	A	8° (49)	6° 10°	600 (49)	500 700					
304 CID 2V	A	10° (49)	8° 12°	600 (49)	500 700	3233173	8128770	30.1 to 39.3		N12Y Gap 0.033 to 0.037 inch (Alternate RN12Y)
		10° (Alt)	8° 12°	700 (Alt)	600 800	3230443	8128898	22 to 31.3		
		5° (Cal)	3° 7°	700 (Cal)	600 800	3231340	8128772	25.3 to 34.5		
360 CID 2V	A	10° (49)	8° 12°	600 (49)	500 700	3233174	8128771	27.6 to 36.9		
		10° (Alt)	8° 12°	700 (Alt)	600 800	3231341	8128898	19.7 to 29		
		10° (Cal)	8° 12°	650 (Cal)	550 750	3233174	8128771	27.6 to 36.9		

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NOTE: Specifications are given for 49-State Applications (49), Altitude Compensation Applications (Alt), and California Applications (Cal).

Tune-Up Specifications—On-Car—Four-Cylinder Engine

Displacement and Carburetion	Transmission	Initial Timing @ 700 RPM or Less with Vacuum Hose Disconnected		Curb Idle Speed (RPM) (Auto. in Drive, Manual in Neutral)		Distributor Model Number	Vacuum Unit Number	Total Advance @ 2000 RPM	Centrifugal Advance	Spark Plugs	Breaker Arm Tension	Condenser Capacity	Point Gap	Cam Dwell Angle	Valve Lash	Cylinder Head Screw
		Set To	OK Range	Set To	OK Range											
2-Liter 2V	M	12° (49)	10° 14°	900 (49)	800 1000	3250163	8127930	28°-38.1°	Refer to Distributor Curves	N8L Gap 0.033–0.037 in	18 - 23 oz.	0.2μF ± 10%	0.45mm (0.018 in.)	47° ± 3°	COLD INTAKE 0.10–0.18mm (0.004–0.007 in) EXHAUST 0.36–0.43mm 0.014–0.017 in)	COLD 88 N·m (65 ft.lb.)
	A	12° (49)	10° 14°	800 (49)	700 900										WARM INTAKE 0.15–0.23mm (0.006–0.009 in) EXHAUST 0.41–0.48mm (0.016–0.019 in)	WARM 98 N·m (73 ft.lb.)
		8° (Cal)	6° 10°	800 (Cal)	700 900											

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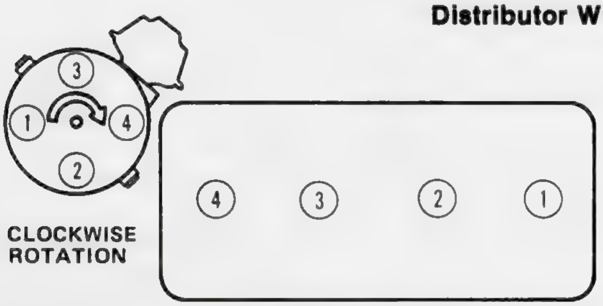
Distributor Wiring Sequence and Firing Order



CLOCKWISE ROTATION

FIRING ORDER: 1-3-4-2
FOUR CYLINDER

FRONT

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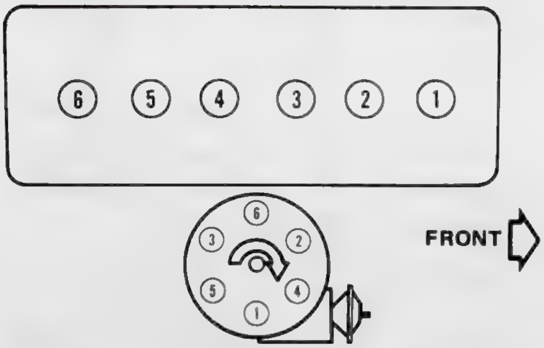
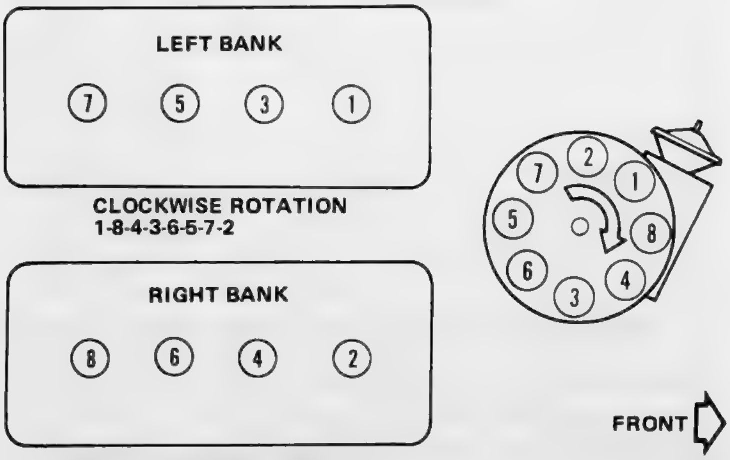


FRONT

CLOCKWISE ROTATION
1-5-3-6-2-4

SIX-CYLINDER ENGINES



CLOCKWISE ROTATION
1-8-4-3-6-5-7-2

FRONT

EIGHT CYLINDER ENGINES

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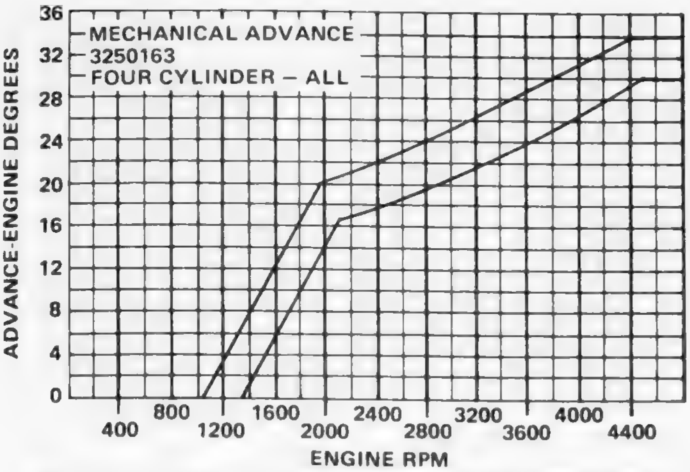
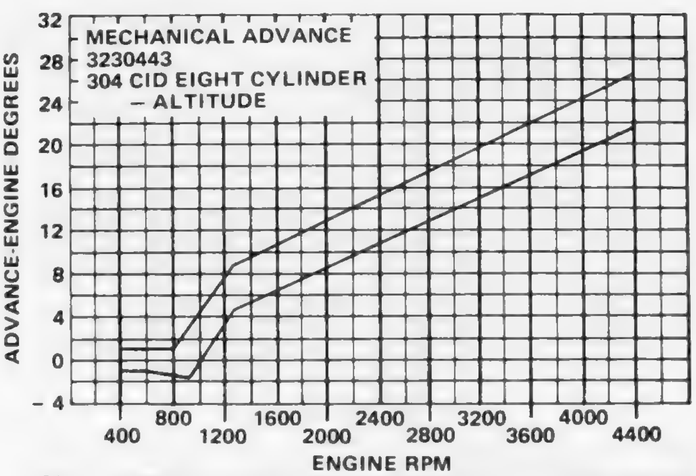
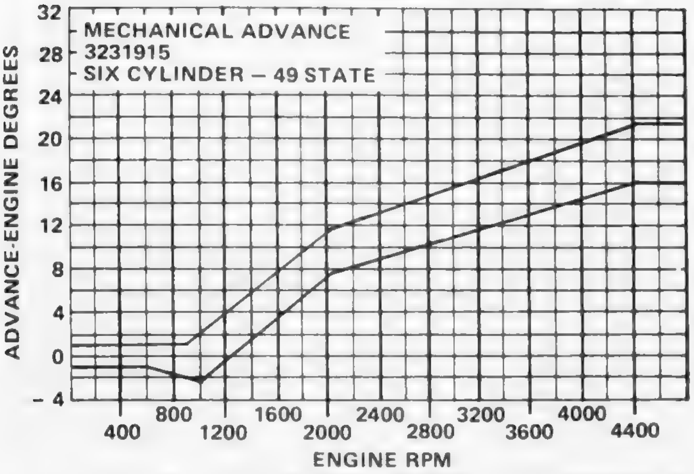
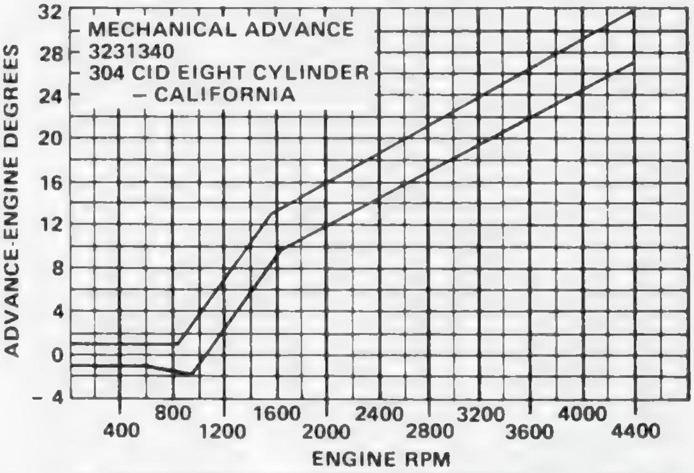
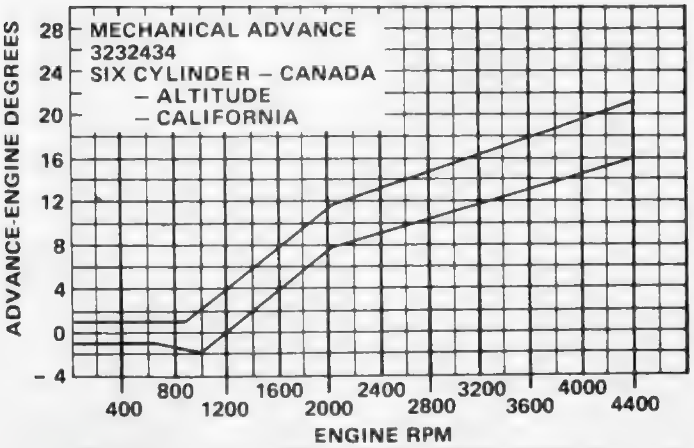
Distributor Curves—On-Car

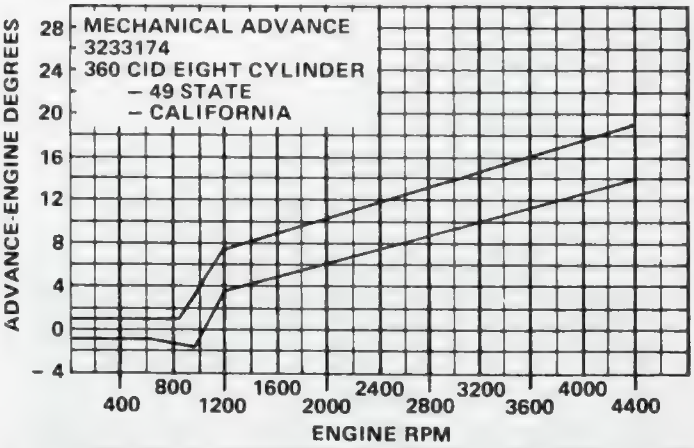


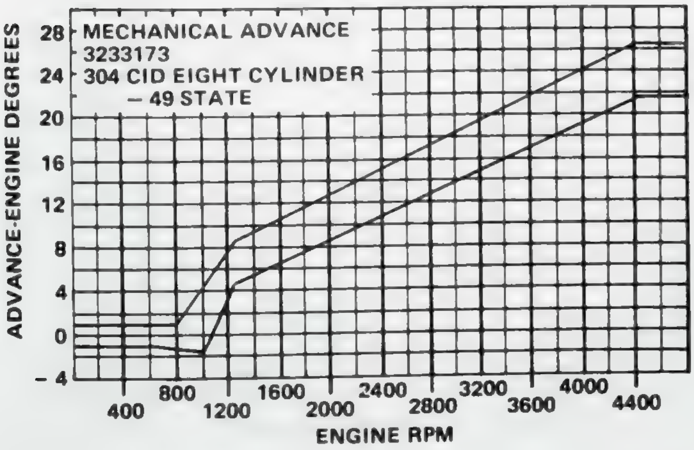


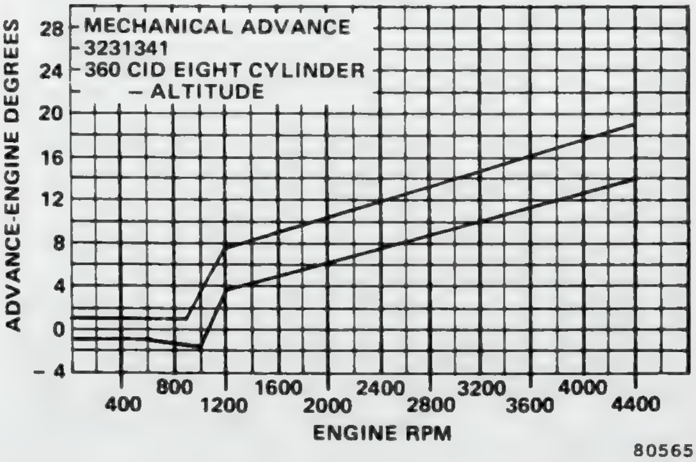












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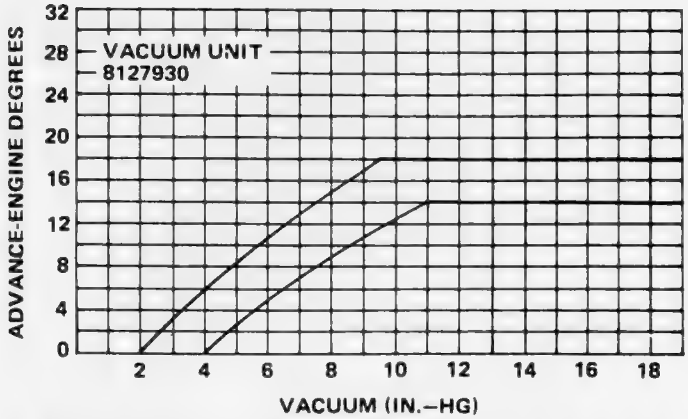
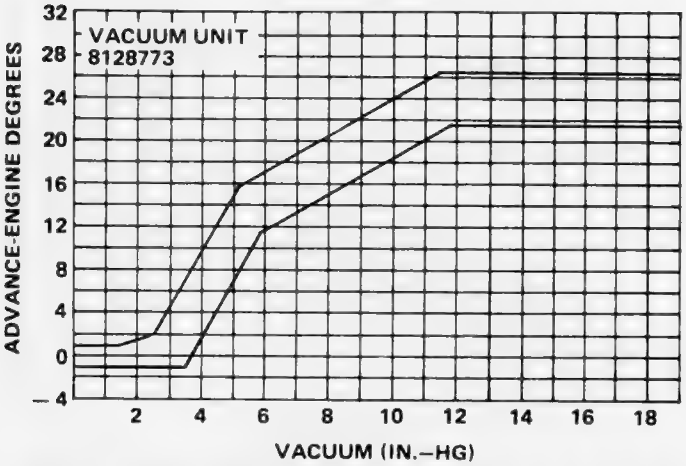
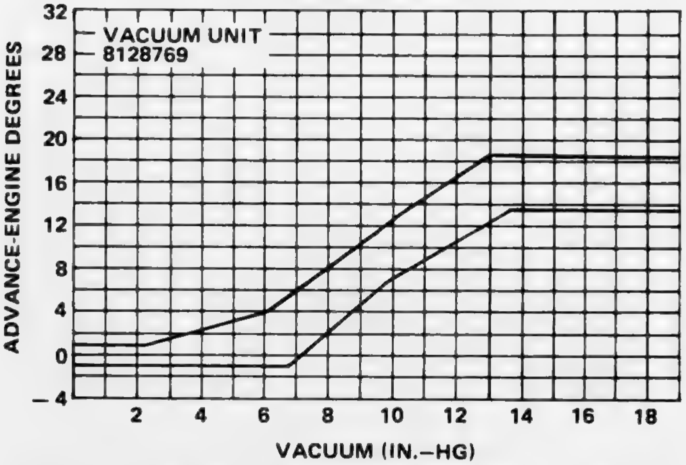
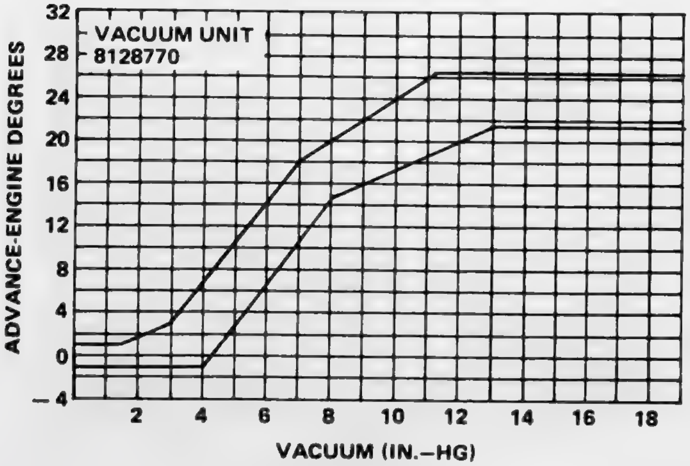
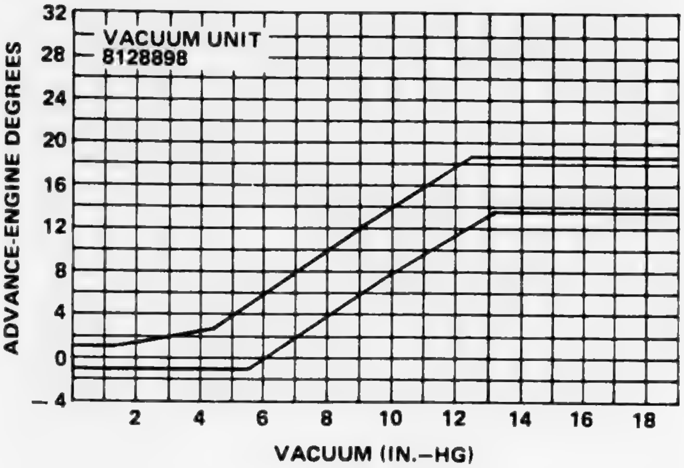
Distributor Curves—On-Car

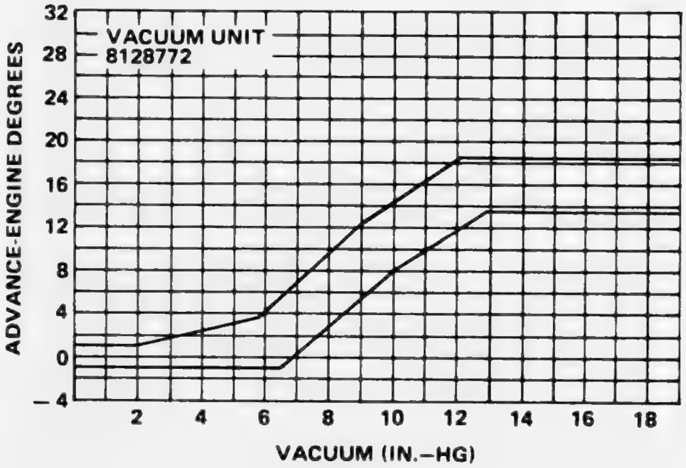


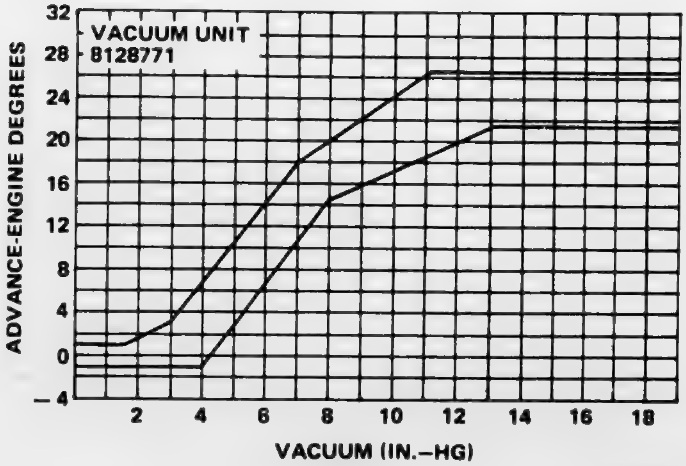












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ENGINES 1B

SECTION INDEX

FOUR-CYLINDER ENGINE

GENERAL

The four-cylinder engine utilizes an overhead, belt-driven camshaft. Many alloy castings are used for lower weight. Cylinders are numbered from the front, and the firing order is 1-3-4-2. The engine is slanted 18° to the right side of the car.

The cast aluminum alloy cylinder head has five integral camshaft bearing bosses (fig. 1B-1). The camshaft is retained by removable bearing caps and is driven by a toothed rubber drive belt. The quiet-running drive belt requires no lubrication. Tension is adjusted with an eccentric idler pulley.

The overhead camshaft operates directly on mechanical bucket-type tappets which are fitted with a tapered adjusting screw for ease of adjustment.

The light-weight aluminum intake manifold is of the individual runner type (fig. 1B-1). Each cylinder has its own runner for better fuel distribution. The manifold is water-heated to prevent fuel vapor condensation.

Intake and exhaust manifolds are on opposite sides of the head. This arrangement, known as cross-flow, provides an efficient path for fuel, air and exhaust gases.

The rugged cast-iron cylinder block carries a cast-iron crankshaft in five main bearings, doweled for precision location (fig. 1B-2). The crankshaft is cross-drilled for lubrication and has eight counterweights. Aluminum alloy pistons are carried on forged steel connecting rods. Full-floating piston pins are retained by spring clips.

The crankshaft driven oil pump runs at twice the speed of conventional distributor-driven oil pumps.

Identification

Build Date Code

The engine Build Date Code is located on a machined flange at the left rear of the block adjacent to the oil level indicator (fig. 1B-3).

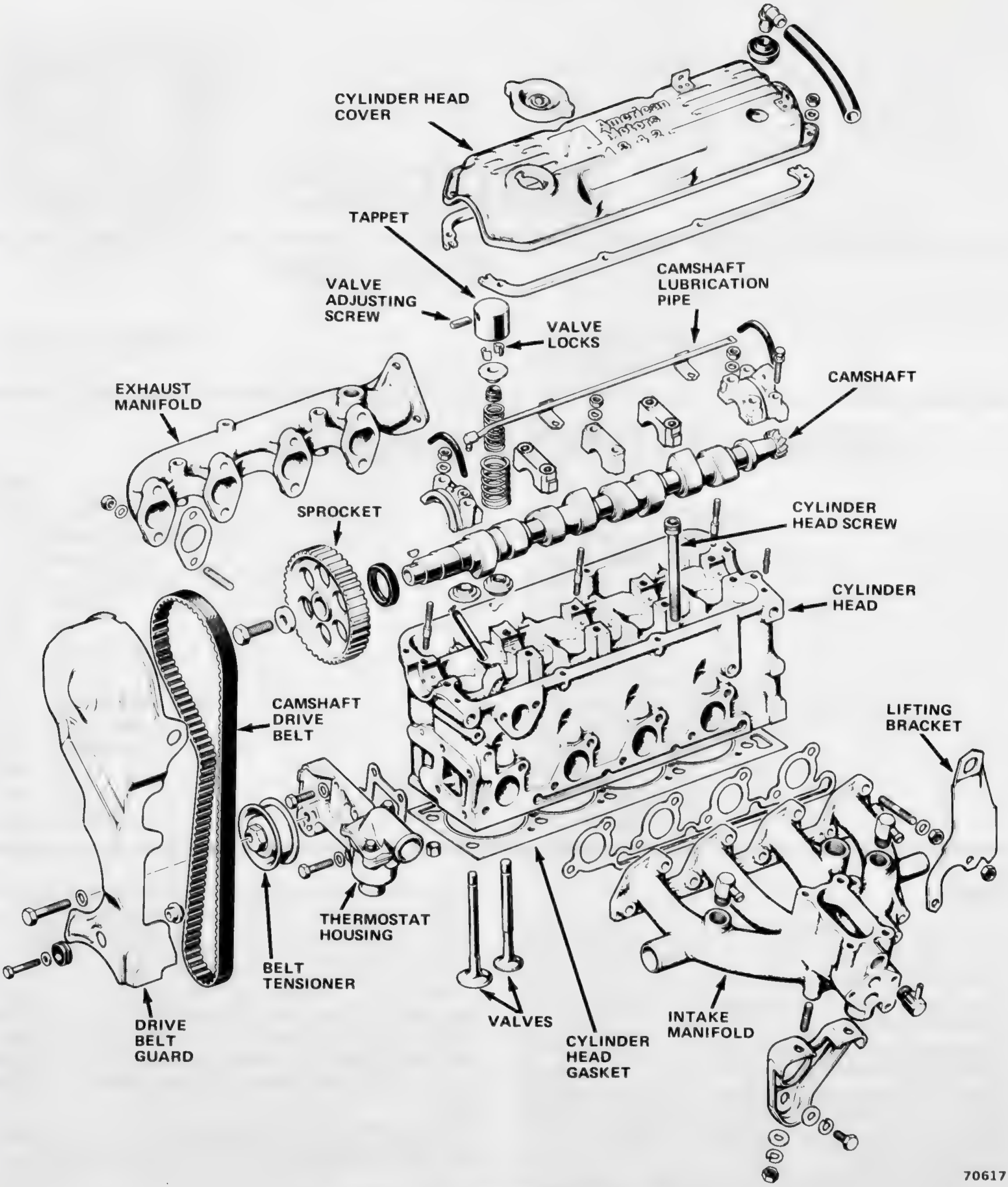

Fig. 1B-1 Four-Cylinder Engine Assembly—Head

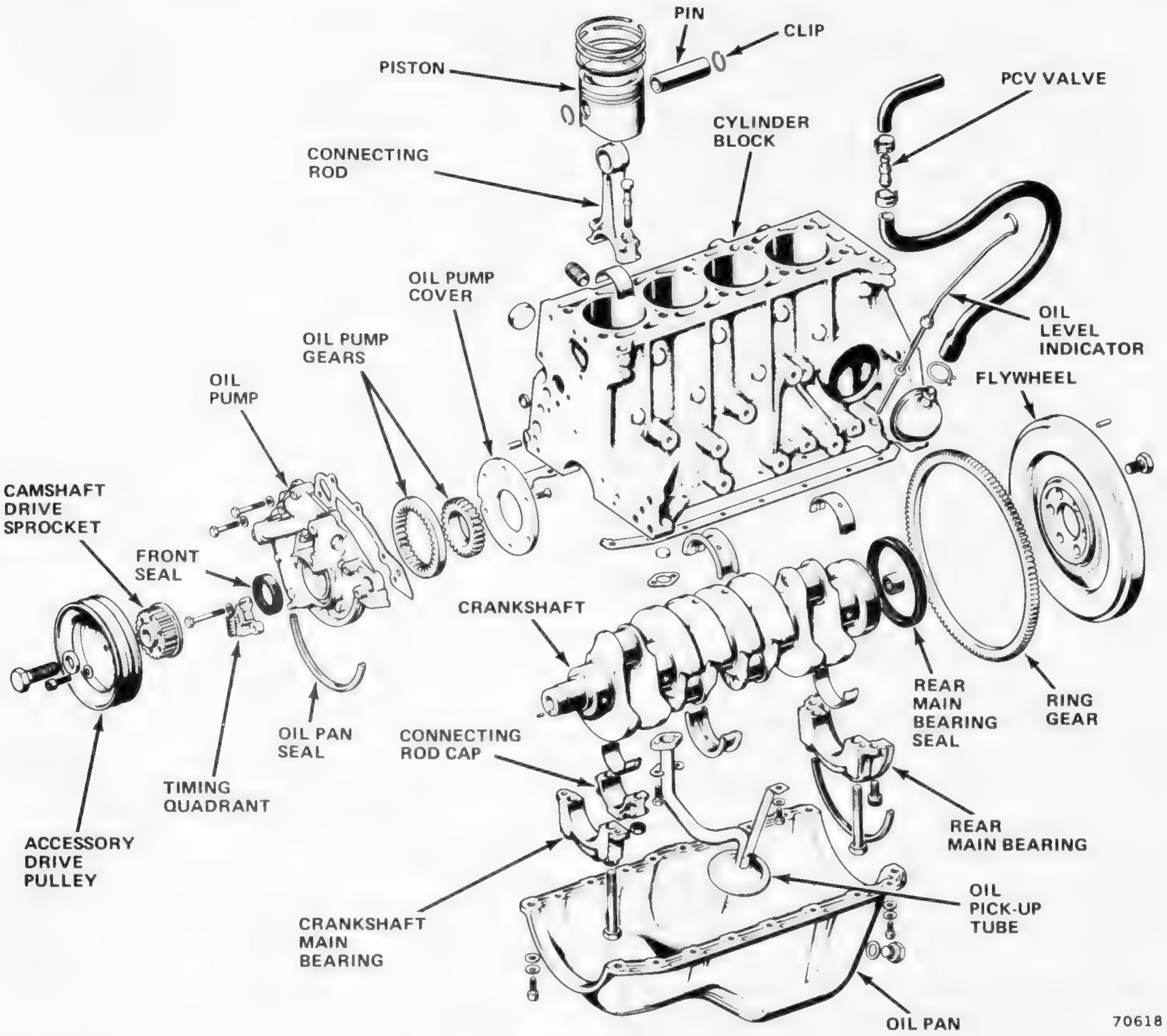

Fig. 1B-2 Four-Cylinder Engine Assembly—Block

The numbers of the code identify the year, month and day the engine was built. The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

The example code identifies a 121 CID with 2V carburetor and 8.2:1 compression ratio built March 18, 1978.

NOTE: *Engines built for sale in Georgia and Tennessee have an additional, nonrepeating number, located on the engine adjacent to the Build Date Code.*

Example:	Kenosha-Built *E-1197277* or W-1207177* Brampton (Canada)-Built C-0316477*

Oversize or Undersize Components

All four-cylinder engines are built to standard size. Oversize or undersize components are not used.

SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly (short block) may be installed whenever the original engine block is worn or damaged beyond repair. It consists of engine block, crankshaft, crankshaft bearing set, piston and rod assemblies, rear main bearing seal and clutch housing dowel pins.

NOTE: *Short engine assemblies have an S stamped on the same surface as the Build Date Code for identification.*

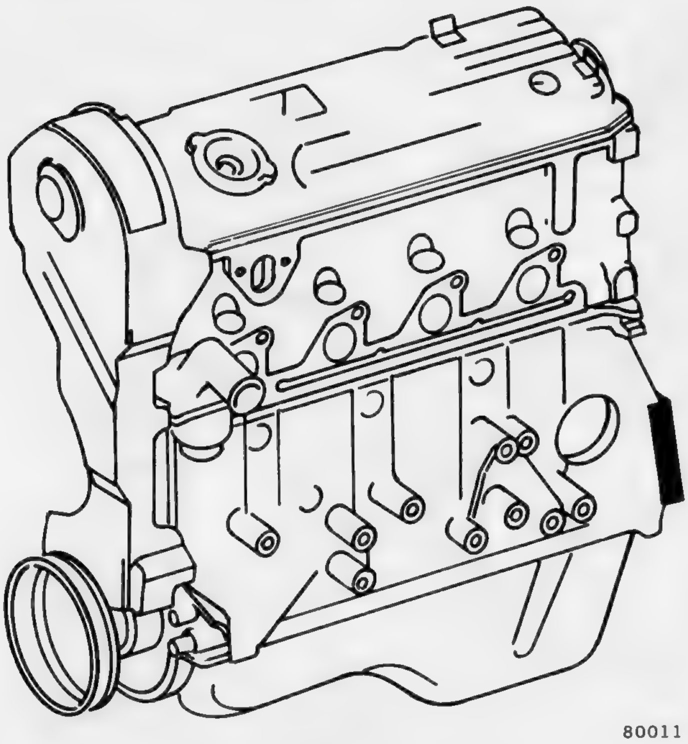

Fig. 1B-3 Build Date Location

Engine Build Date Explanation

Letter Code	CID	Carburetor	Comp. Ratio
G	121	2V	8.1:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
1 — 1977 2 — 1978	01 — 12	G	01 — 31

Example: 2 03 G 18

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Installation includes transfer of component parts from the worn or damaged original engine. Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this chapter.

ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side of the engine and at the rear between the transmission extension housing and the rear support crossmember (fig. 1B-4 and 1B-5).

Cushion Replacement

If both cushions are to be replaced, follow complete replacement procedure for one side before starting replacement procedure for the other side.

(1) Remove nut from cushion upper stud.

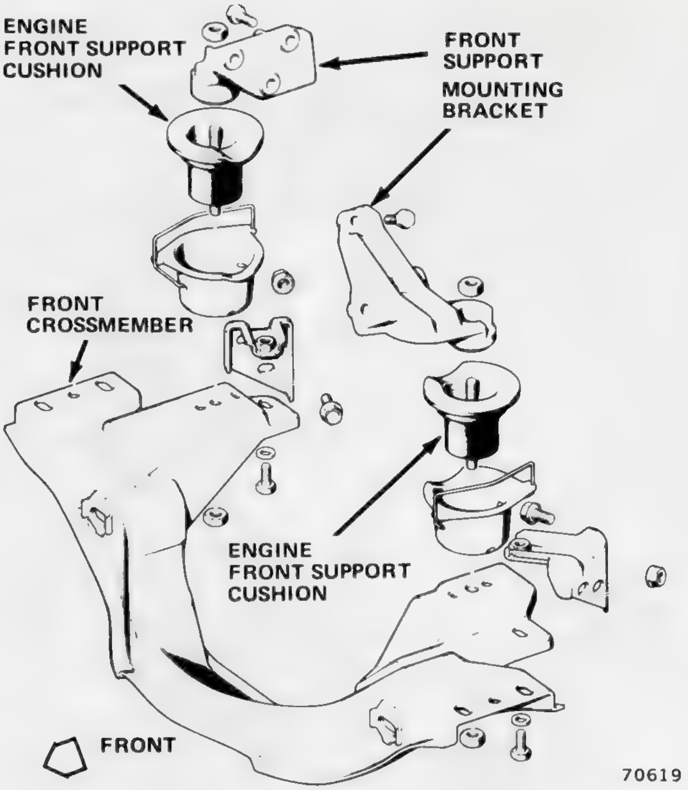


Fig. 1B-4 Engine Mounting—Front

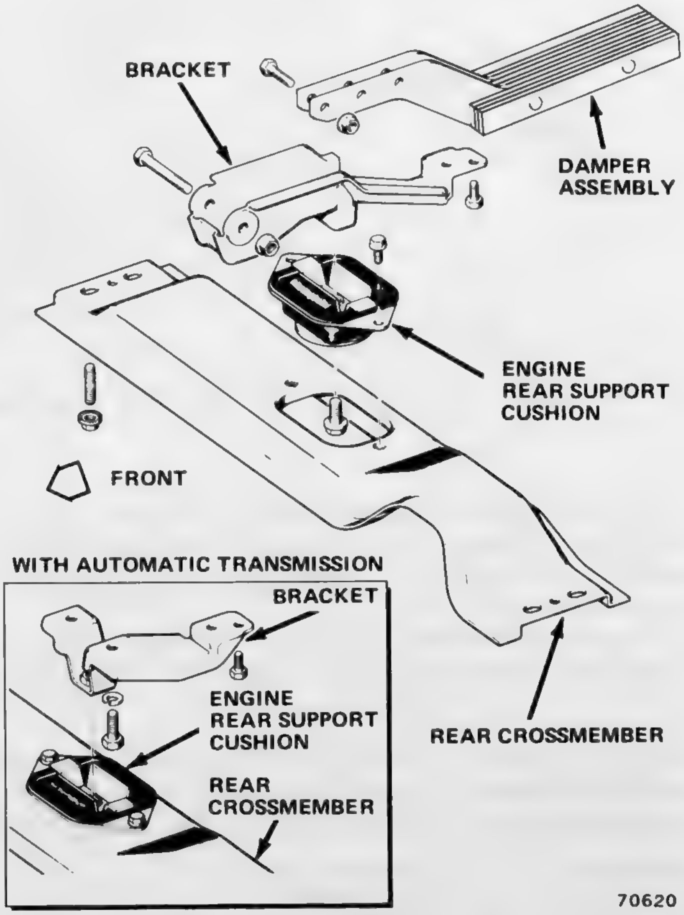


Fig. 1B-5 Engine Mounting—Rear

(2) If right side cushion is being replaced, remove TAC flexible hose.

(3) Raise engine until engine bracket clears stud on cushion. Use board on jack to protect oil pan.

(4) Remove nut from lower cushion.

(5) Remove cushion.

(6) Install cushion. Loosely install nut to lower stud. Be sure locators on cup are positioned correctly in holes in crossmember. Tighten lower nut.

(7) Lower engine onto cushion. Install upper nut and tighten.

(8) If cushion on opposite side is to be replaced, repeat entire procedure, beginning with step (1).

(9) Install TAC flexible hose, if removed.

ENGINE HOLDING FIXTURE

If it is necessary to remove the front engine mounts and front crossmember to perform service such as oil pan replacement, fabricate an engine holding fixture as shown in figure 1B-6.

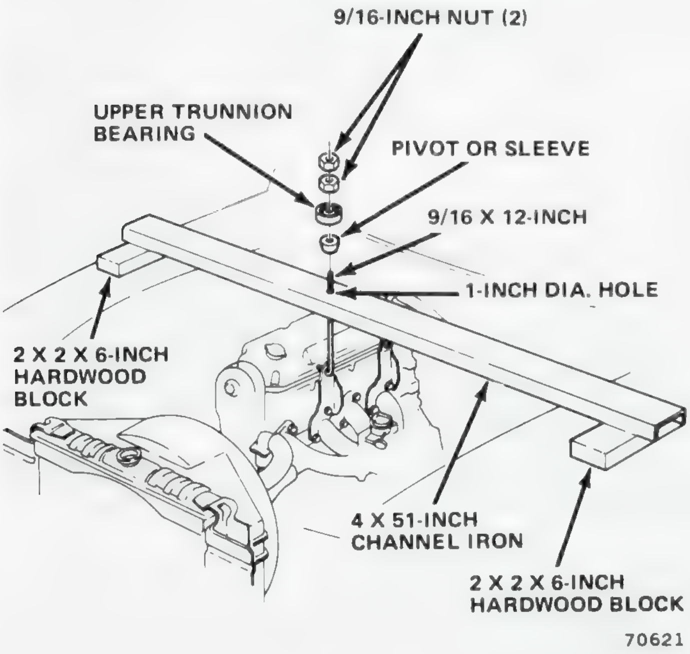


Fig. 1B-6 Engine Holding Fixture

ENGINE REMOVAL

(1) Scribe hood hinges and remove hood.

(2) Remove air cleaner and TAC flexible hose.

(3) Drain coolant.

(4) Disconnect battery negative cable from alternator bracket.

(5) Disconnect battery negative cable from battery.

(6) Remove fuel line, vapor return and canister lines. Plug main fuel line.

(7) Disconnect engine wiring at dash panel connectors.

(8) Disconnect throttle cable. On automatic transmission cars, disconnect throttle valve linkage.

(9) Disconnect upper radiator hose from radiator.

(10) If equipped with air conditioning:

(a) Remove service valve covers and front-seat valves.

(b) Loosen nuts attaching service valves to compressor head.

(c) Bleed off compressor charge.

(d) Remove service valves and cap compressor ports and service valves.

(e) Disconnect clutch feed wire.

(11) Raise car.

(12) Disconnect starter cable. Remove starter attaching screws. Remove starter motor.

(13) Remove exhaust pipe support bracket.

(14) Remove shield from bellhousing. On automatic transmission, remove torque converter nuts.

(15) Remove exhaust pipe attaching screw at manifold.

(16) Disconnect backup lamp switch wire from switch and remove from clips.

(17) Disconnect harness from alternator.

(18) Disconnect lower radiator hose and heater hose from radiator. On automatic transmission cars, disconnect oil cooler lines at flexible hose.

(19) Remove all bellhousing screws except top center.

(20) Lower car.

(21) Remove screw attaching cold air induction manifold to radiator.

(22) If equipped with air conditioning, remove condenser attaching screws and move condenser away from radiator.

(23) Remove radiator mounting screws. Move radiator 1-inch to left of car, rotate radiator and lift out with shroud attached.

(24) Remove tie from upper heater hose. Disconnect hose from heater and secure to engine.

(25) Pull backup lamp harness up and secure to engine.

(26) Disconnect hoses from power steering gear, if equipped, and secure to engine.

(27) On automatic transmission cars, remove transmission filler tube support screws.

(28) Remove engine support cushion nuts on both sides.

(29) Secure engine to lifting device.

(30) Lift engine to clear support cushion studs.

(31) Support transmission. Remove center screw from bellhousing.

(32) Remove engine from car.

ENGINE INSTALLATION

(1) Lower engine into car and move into position.

(2) Install three upper bell housing screws.

(3) Remove transmission support.

(4) Lower engine onto support cushions and install nuts.

(5) Remove lifting device.

(6) Connect wiring at dash panel connector.

(7) On automatic transmission, install filler tube support screws.

(8) Connect power steering hoses.

(9) Install upper heater hose and tie.

(10) Connect all fuel and vapor lines.

(11) Connect throttle cable. On automatic transmission, connect throttle valve linkage.

(12) Drop backup lamp switch harness down on left side of engine.

(13) Install radiator and attaching screws.

(14) If equipped with air conditioning, position condenser and install attaching screws.

(15) Install cold-air intake-to-radiator screw.

(16) Connect upper radiator hose.

(17) Lift car.

(18) Install starter motor, attaching screws and starter cable.

(19) Install remaining bellhousing screws.

(20) On automatic transmission, install torque converter nuts.

(21) Connect wire to backup lamp switch. Install harness to clips.

(22) Install exhaust pipe and gasket to manifold.

(23) Install shield to bellhousing. Install exhaust pipe support bracket.

(24) Install exhaust pipe support clamp. Tighten exhaust pipe to manifold.

(25) Install lower radiator hose and heater hose to radiator. On automatic transmission cars, connect oil cooler lines.

(26) Connect harness to alternator.

(27) Lower car.

(28) If equipped with air conditioning:

  (a) Connect clutch feed wire.

  (b) Connect service valves to proper ports, using replacement seals. Tighten nuts to 28 foot-pounds, wet.

  (c) Back-seat service valves and install covers.

  (d) Purge compressor of air.

(29) Install negative battery cable to alternator bracket and battery negative terminal post.

(30) Install air cleaner and TAC flexible hose.

(31) Fill cooling system with coolant.

(32) Check power steering fluid and add if required.

(33) On automatic transmission cars, check fluid level and add as required. Adjust throttle valve linkage.

(34) Install and align hood.

VALVE TRAIN

General

The valve train is an overhead cam configuration. The cam is driven by a toothed rubber belt. The cam lobes operate directly on bucket tappets (fig. 1B-7) which in turn operate on the valve stems.

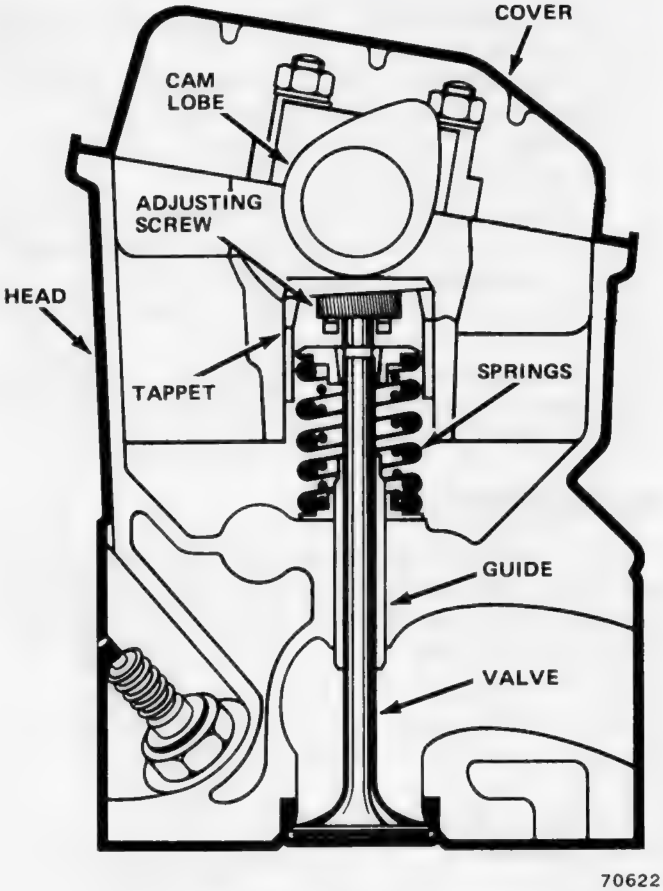


Fig. 1B-7 Valve Train

All valves are fitted with two springs, an inner spring and an outer spring to ensure positive valve control at all engine speeds. Exhaust valves are fitted with a positive rotating device to extend valve and valve seat life.

Camshaft Drive Belt

Replacement

(1) Rotate engine until camshaft timing mark is adjacent to pointer on cylinder head cover (fig. 1B-8).

(2) Crankshaft timing mark should now be pointing at zero (fig. 1B-9).

CAUTION: *Do not rotate engine by turning the camshaft. Turn the crankshaft in the direction of normal rotation.*

(3) Remove drive belts from alternator and power steering pump and air conditioning compressor.

(4) Remove cam drive belt shield.

(5) Loosen tensioner retaining screw.

(6) Remove cam drive belt.

(7) Install replacement belt as follows:

  (a) Install belt to crankshaft sprocket.

  (b) Position belt in tensioning pulley.

  (c) Install belt to cam sprocket. Use hands only. Do not pry with tool.

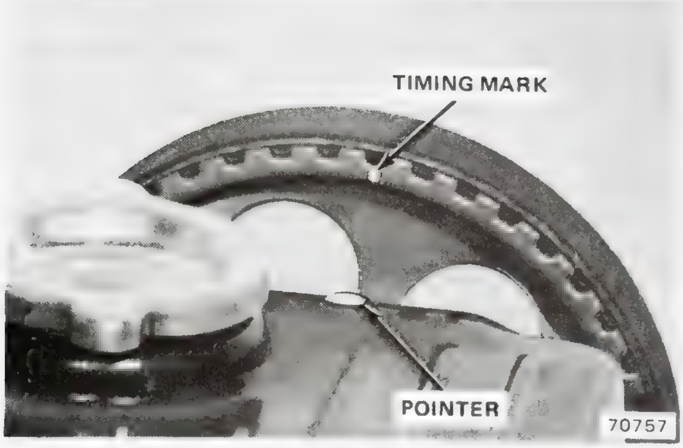


Fig. 1B-8 Camshaft Sprocket Timing Mark

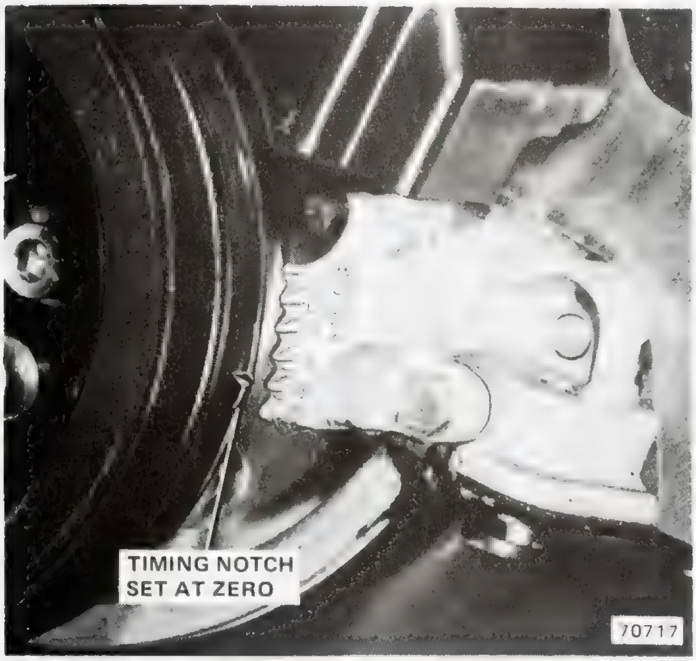


Fig. 1B-9 Crankshaft Timing Mark

(8) Turn offset adjusting nut on tensioning pulley (fig. 1B-10). Turn nut counterclockwise to increase tension. Belt is properly tensioned when drive side of belt can be twisted 90° with fingers.

NOTE: *When checking belt tension, apply tension on crankshaft with a wrench in counterclockwise direction so slackness is all on the side of the belt being checked.*

(9) While maintaining pressure on tensioning pulley nut, tighten retaining screw to 39 newton-meters (29 foot-pounds) torque. Check belt tension after tightening tensioning pulley.

CAUTION: *Excessive tension may cause the tensioning pulley to fail.*

(10) Install cam drive belt shield.
(11) Install and tighten drive belts.

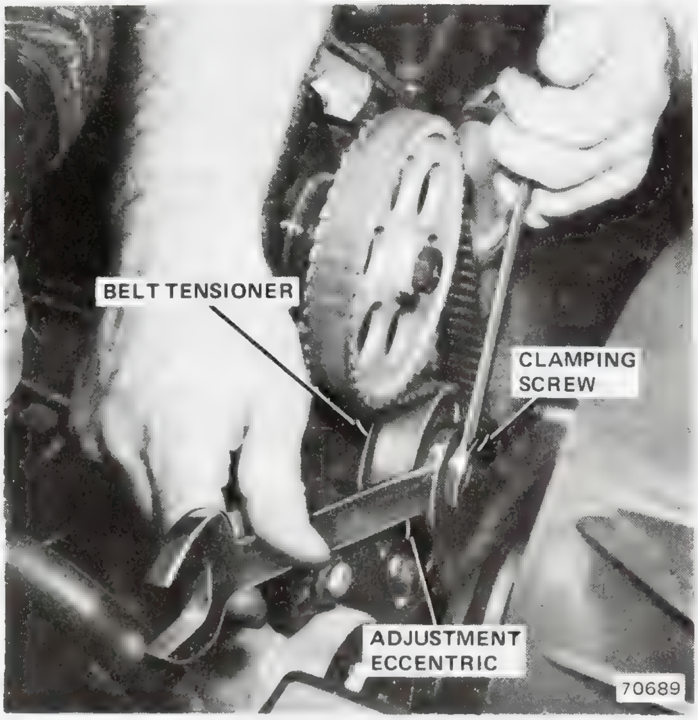


Fig. 1B-10 Tensioning Camshaft Drive Belt

Belt Tension

A special tool is not required to check belt tension. With thumb and forefinger, grasp drive belt on longest (drive side) midway between sprockets (fig. 1B-11). Belt has correct tension if it can be twisted 90° when grasped as described.

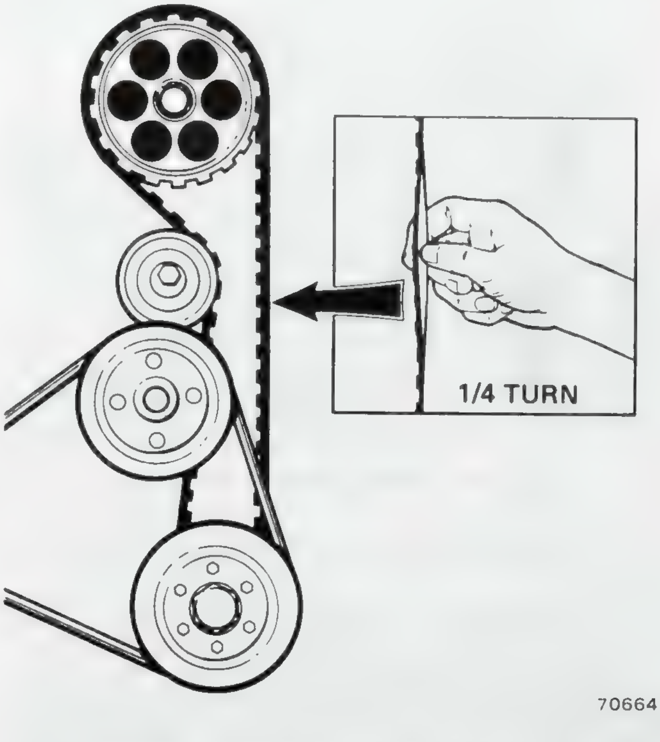


Fig. 1B-11 Checking Camshaft Drive Belt Tension

If belt tension is not correct, adjust as follows:

(1) Remove accessory drive belts.

(2) Remove cam drive belt shield.

(3) Loosen tensioning pulley retaining screw.

(4) Turn offset adjusting nut to achieve desired belt tension. Turn nut counterclockwise to increase tension. Belt has correct tension if it can be twisted 90° when grasped with thumb and forefinger.

NOTE: *When checking belt tension, apply tension on crankshaft with a wrench in counterclockwise direction so slackness is all on the side of the belt being checked.*

(5) Tighten retaining screw to 39 newton-meters (29 foot-pounds) torque. Check belt tension after tightening screw.

(6) Install drive belt shield.

(7) Install accessory drive belts.

Camshaft Drive Sprockets

Replacement—Upper Sprocket

(1) Remove cam drive belt as outlined under Drive Belt Replacement. It is not necessary to remove belt completely from crankshaft.

(2) Insert suitable tool wrapped in shop towel to prevent sprocket from turning (fig. 1B-12).

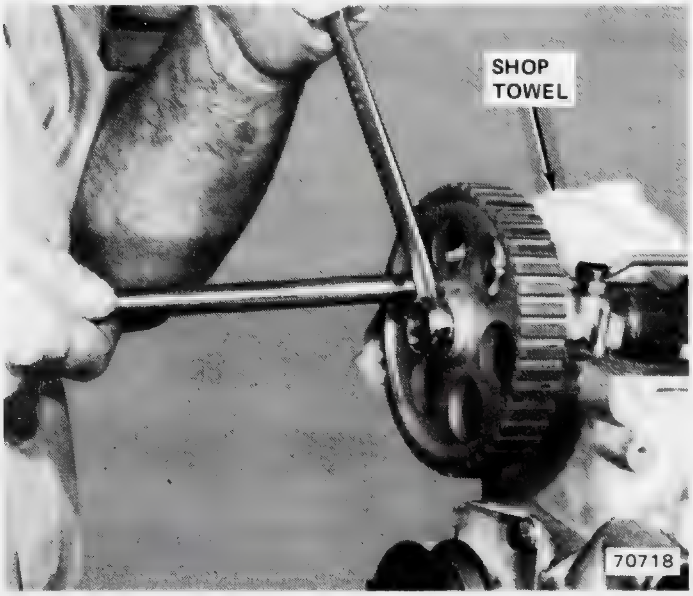


Fig. 1B-12 Removing Camshaft Sprocket

(3) Remove retaining screw. Remove sprocket, key and washer.

(4) Install sprocket and key.

(5) Install washer and retaining screw.

(6) Tighten retaining screw to 79 newton-meters (58 foot-pounds) torque. Use towel-wrapped tool to prevent sprocket from turning.

(7) Align sprocket timing marks and install drive belt as outlined under Drive Belt Replacement.

Replacement—Lower Sprocket

(1) Lift car and support with stands to provide working clearance.

(2) Loosen but do not remove pulley attaching screws. Use #40 Torx head bit.

(3) Loosen accessory drive belts.

(4) Remove accessory drive pulley screws and remove pulley from crankshaft.

(5) Remove camshaft drive belt guard.

(6) Loosen camshaft drive belt adjusting pulley. Attach Crankshaft Holding Tool J-25867 to sprocket using all six crankshaft accessory drive pulley screws.

(7) Remove sprocket-to-crankshaft attaching screw and remove crankshaft sprocket (fig. 1B-13).

(8) Remove tool from crankshaft sprocket and attach tool to replacement sprocket.

(9) Install replacement sprocket. Hole in sprocket must index with locating pin in crankshaft.

(10) Install sprocket-to-crankshaft screw and flat washer and tighten to 245 newton-meters (181 foot-pounds) torque.

(11) Remove crankshaft holding tool.

(12) Turn crankshaft until timing mark is at TDC.

(13) Turn camshaft sprocket until timing mark on sprocket is aligned with timing indicator on cylinder head cover.

(14) Install camshaft drive belt. Be sure crankshaft does not move during installation.

(15) Tension belt with adjusting pulley. Refer to Camshaft Drive Belt for proper procedure.

(16) Install camshaft drive belt guard.

(17) Install crankshaft accessory drive pulley and tighten screws to 20 newton-meters (15 foot-pounds) torque.

(18) Install and tension accessory drive belts.

(19) Remove support stands and lower car.

(20) Check ignition timing.

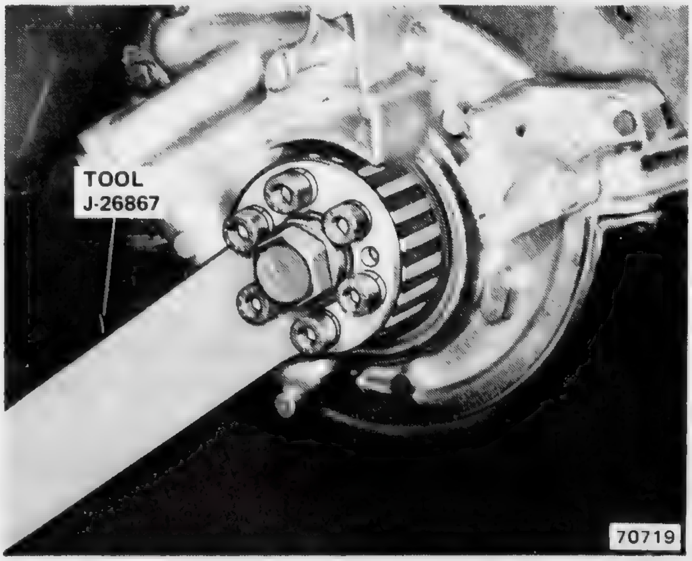


Fig. 1B-13 Removing Camshaft Drive Sprocket from Crankshaft

Camshaft and Bearings

The camshaft is supported by five split bearings. The lower half of the bearing is integral with the cylinder head. The upper half of the bearing is attached to the head by nuts and washers. No bearing inserts are used.

The front end of the camshaft extends through the front bearing and seal to accept the drive sprocket. The rear end of the camshaft extends into the cast aluminum distributor drive housing. A distributor drive gear is pressed onto the rear end of the camshaft.

Camshaft end play is maintained by the number 5 camshaft bearing.

Measuring Cam Lobe Lift

(1) Remove cylinder head cover and gaskets.

(2) Remove spark plugs.

(3) Install dial indicator and position plunger directly on cam lobe (fig. 1B-14).

(4) Rotate **crankshaft** until cam lobe depresses tappet. This positions indicator plunger on cam lobe base circle.

CAUTION: *Do not attempt to position cam lobes by turning CAMSHAFT. This could cause the drive belt to jump timing and could damage the belt teeth. Turn the CRANKSHAFT in the direction of normal rotation to position cam lobes correctly.*

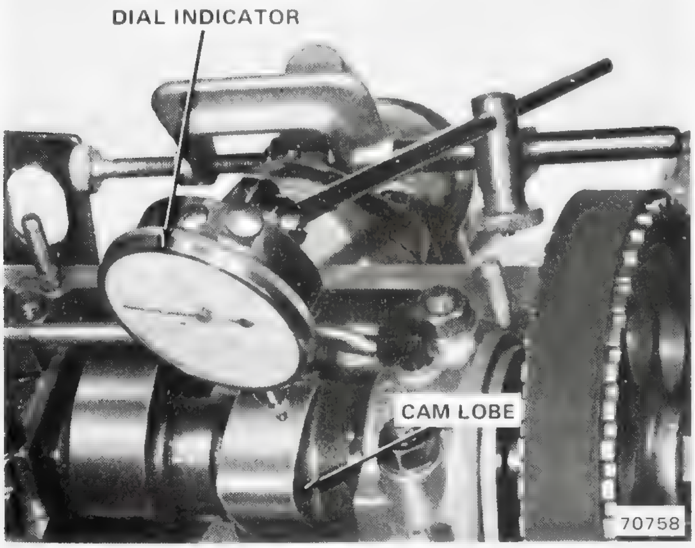


Fig. 1B-14 Measuring Cam Lobe Lift

(5) Set dial indicator to zero.

(6) Rotate **crankshaft** until cam lobe reaches its maximum upward position. Read dial indicator. Compare reading with Specifications.

Camshaft Removal

(1) Remove TAC flexible hose.

(2) Disconnect ignition wires from spark plugs. Disconnect clip from cylinder head cover. Remove distributor cap with ignition wires attached.

(3) Loosen and remove accessory drive belts.

(4) Remove camshaft drive belt guard.

(5) Loosen tensioner and remove camshaft drive belt.

(6) Remove camshaft sprocket. Use suitable tool wrapped in shop towel to prevent turning.

(7) Disconnect distributor primary wire and vacuum line. Remove distributor housing with distributor attached.

(8) Remove PCV hose. Remove cylinder head cover.

(9) Remove two 10 mm screws from number 5 bearing cap.

(10) Remove nuts from bearing caps 1, 3 and 5 (fig. 1B-15).

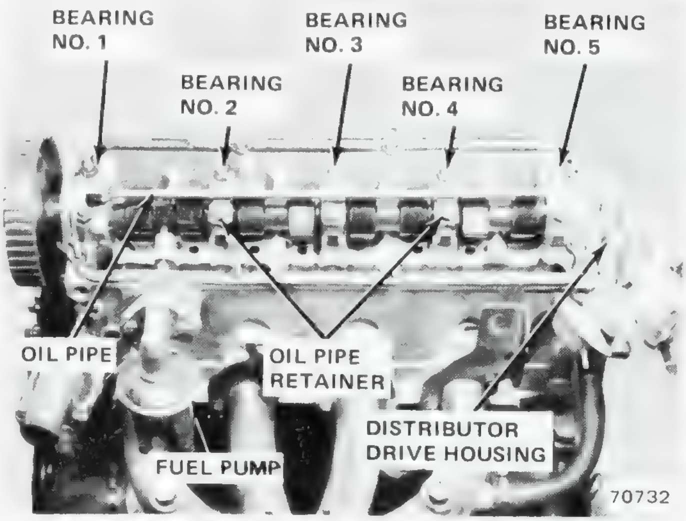


Fig. 1B-15 Camshaft and Bearings

(11) Remove nuts from caps 2 and 4 and remove oil pipe.

(12) Remove all bearing caps and keep in order.

(13) Remove camshaft.

(14) Remove distributor drive gear from camshaft and install on replacement camshaft.

(15) Remove cylinder head cover gaskets.

Camshaft Inspection

Inspect the camshaft bearing journals for an uneven wear pattern or rough finish. If either condition exists, inspect camshaft bearings. This is the most probable location of bearing damage. Replace camshaft or head as required.

Inspect the distributor drive gear for damage or excessive wear. Replace if necessary.

Inspect each cam lobe and the matching valve tappet for wear. If the face of the tappet(s) is worn concave, the matching camshaft lobe(s) will also be worn. Both the camshaft and the tappet(s) must be replaced. Refer to Tappets for additional inspection procedures.

Camshaft Installation

(1) Install camshaft into head.

(2) Oil and install bearing caps.

(3) Install oil tube. Install and tighten nuts on caps 2 and 4. Tighten nuts to 18 newton-meters (13 foot-pounds) torque.

(4) Install and tighten nuts on caps 3 and 5. Install screws to cap 5 and tighten to 9 newton-meters (7 foot-pounds) torque.

(5) Install replacement seal on camshaft.

(6) Tighten bearing cap number 1.

(7) Install camshaft sprocket and tighten capscrews. Use suitable tool wrapped in shop towel to prevent turning.

(8) Install cylinder head cover end seals to head. Install side gaskets.

(9) Temporarily install cylinder head cover and hand-tighten nuts.

(10) Position camshaft timing mark in line with indicator on cylinder head cover.

(11) Install distributor housing using replacement gasket (fig. 1B-16). Index rotor to number 1 cylinder.

(12) Install distributor cap.

(13) Connect ignition primary wire and vacuum line to distributor.

(14) Rotate crankshaft to TDC.

(15) Install camshaft drive belt and tighten.

(16) Install drive belt guard.

(17) Install pulley, spacer and fan.

(18) Install accessory drive belts and tighten.

(19) Remove cylinder head cover and set valve tappet clearance. Refer to Tappets for procedure.

(20) Apply sealer to joints in cylinder head cover gaskets. Install cylinder head cover and tighten nuts to 5.7 newton-meters (50 inch-pounds) torque.

(21) Install ignition harness clip to cylinder head cover. Connect ignition wires to spark plugs.

(22) Install TAC hose.

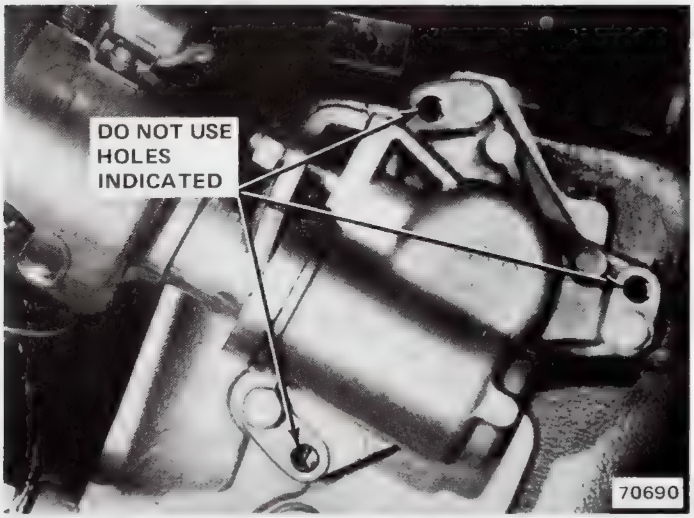


Fig. 1B-16 Distributor Drive Housing Installation

(23) Install PCV hose.

(24) Start engine and adjust ignition timing.

Distributor Drive Gear Replacement

(1) Remove camshaft.

(2) Pull distributor drive gear from camshaft using suitable 3-jaw puller (fig. 1B-17).

(3) Install gear on camshaft. Bevel on inside diameter of gear faces camshaft.

(4) Drive gear onto camshaft using block of wood and hammer.

(5) Seat gear against shoulder with 18 mm socket.

(6) Install camshaft.

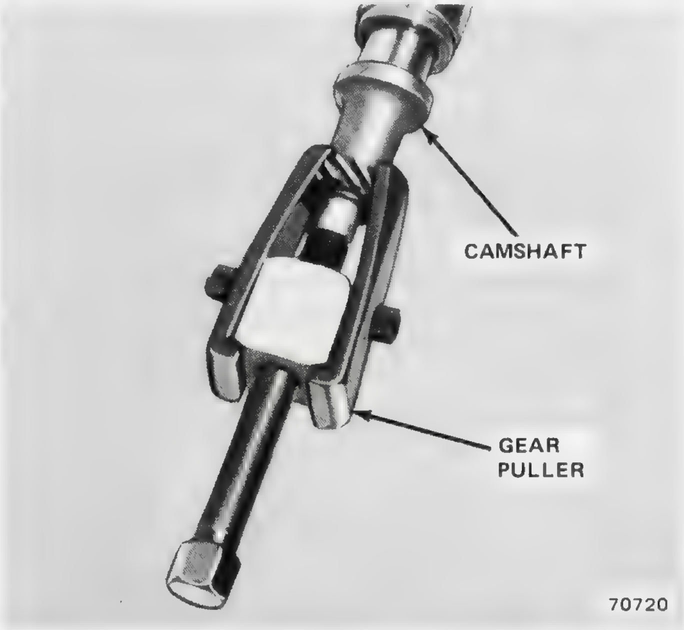


Fig. 1B-17 Distributor Drive Gear Removal

Tappets

Removal

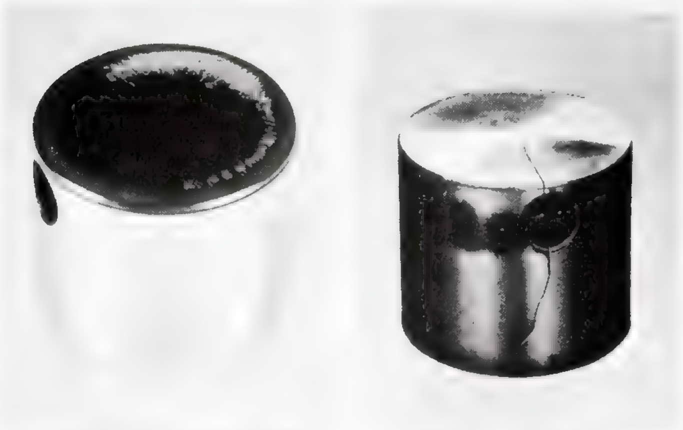
(1) Remove camshaft as outlined under Camshaft Removal.

(2) Remove tappets from respective bores by lifting upward.

Inspection

Inspect tappets for excessive wear, stress cracks and worn bearing surfaces. A spalling (metal flaking) condition may be noticed on the surface (fig. 1B-18). If this condition does not extend into the cam lobe contact area, the tappet is acceptable.

WARNING: *Operating the engine at excessive speed can cause severe damage to the tappets (fig. 1B-18). Do not operate the engine above 5500 rpm, which corresponds to 32 mph in first gear, 60 mph in second gear and 88 mph in third gear.*



TAPPET WITH ACCEPTABLE WEAR PATTERN

TAPPET DAMAGED BY EXCESSIVE RPM

Fig. 1B-18 Tappet Inspection

Installation

(1) Lubricate tappets with AMC Engine Oil Supplement, or equivalent.

(2) Install tappets in bores.

(3) Install camshaft as outlined in Camshaft Installation.

(4) Adjust tappet clearance.

(5) Pour remaining EOS over valve train.

NOTE: *The EOS must remain in the engine for at least 1,000 miles but need not be drained until the next scheduled oil change.*

Adjustment

NOTE: *Valve adjustment must be done with engine at operating temperature.*

Adjust tappets at intervals specified in the Mechanical Maintenance Schedule, or any time camshaft or tappets are removed.

Each mechanical tappet is provided with a clearance adjusting screw. The screw is threaded into a hole drilled into the tappet at an angle of approximately 86° to the valve stem. A flat is milled onto the screw perpendicular to the valve stem. Each time the screw is turned one complete turn, the flat is moved 0.05 mm relative to the valve stem.

Tappet adjustment consists of three separate operations: checking camshaft-to-tappet clearance with a feeler gauge, adjusting clearance if required, and checking the position of the adjusting screw after adjustment is completed.

(1) Remove TAC flexible hose.

(2) Disconnect harness clip from cylinder head cover. Disconnect ignition wires from spark plugs. Remove cap from distributor and lay aside.

(3) Remove cylinder head cover.

(4) Rotate **crankshaft** to bring cylinder number 1 to TDC of power stroke. This may be determined by observing position of distributor rotor. Rotor tip should point to mark stamped on edge of distributor housing.

(5) Check clearance of four tappets listed below (fig. 1B-19). Refer to Tappet Clearance chart for specifications.

(a) Check clearance of exhaust valve tappets for cylinders 1 and 3.

(b) Check clearance of intake valve tappets for cylinders 1 and 2.

NOTE: *The front valve in each pair is the intake valve. The rear valve in each pair is the exhaust valve.*

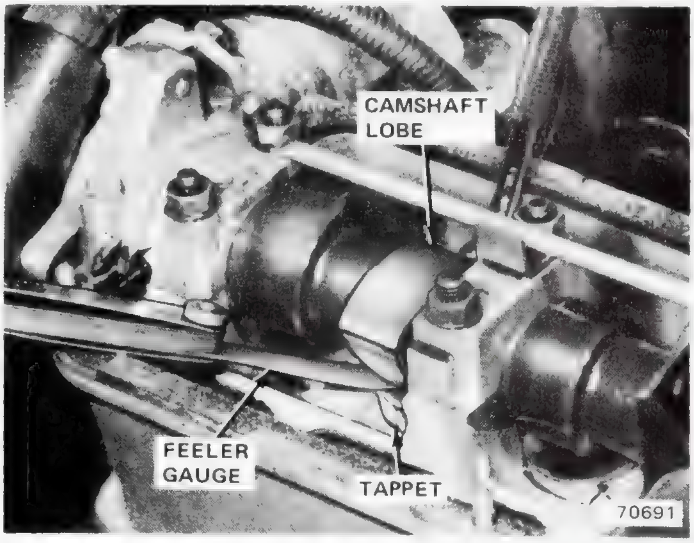


Fig. 1B-19 Checking Tappet Clearance

Tappet Clearance Specifications

	Intake	Exhaust
Hot	(0.006 – 0.009 in.)	(0.016 – 0.019 in.)

70737

(6) If clearance of any valve tappet is incorrect, perform following steps:

(a) Use Adjusting Screw Bit J-26810 and wrench to turn adjusting screw (fig. 1B-20). Turn screw one complete turn until it clicks. Each turn changes clearance by 0.05 mm (0.002 inch). Continue making complete turns until clearance is within specifications.

(b) When clearance is within specifications, use Tappet Adjusting Screw Gauge J-26860 to check position of screw in tappet (fig. 1B-21). Outside edge of tappet must fall within band marked on gauge. If gauge indicates that adjusting screw is turned too far into tappet, install next thicker screw.

(c) It is necessary to remove tappet from head to change adjusting screw. Note which tappets have to be removed, then proceed to step (7). When all eight tappets have been adjusted, remove those requiring screw replacement.

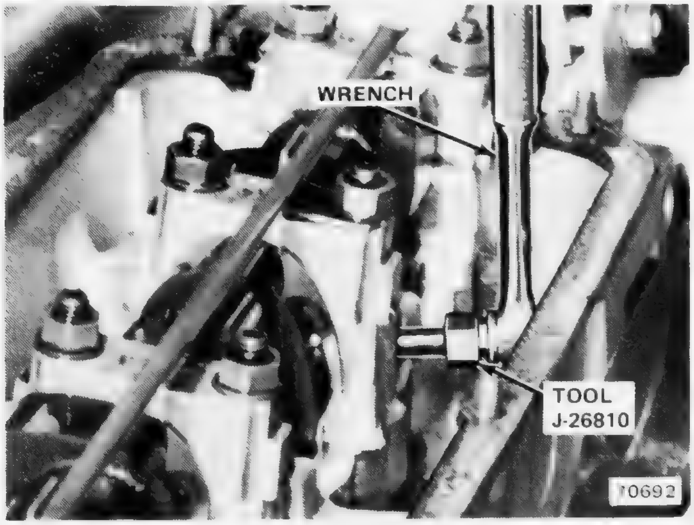


Fig. 1B-20 Adjusting Tappet Clearance

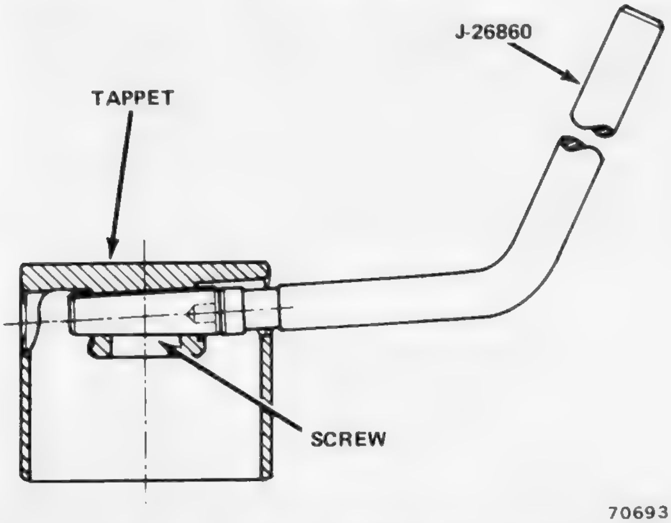


Fig. 1B-21 Checking Adjusting Screw Position

(7) Turn crankshaft 360° and stop at TDC. Distributor rotor should now be pointing 180° opposite mark stamped on edge of distributor body.

(8) Perform clearance check, clearance adjustment and screw position check on following valve tappets:

(a) Exhaust valve tappets for cylinders 2 and 4.

(b) Intake valve tappets for cylinders 3 and 4.

(9) Remove tappets requiring adjusting screw replacement. Refer to Tappet Replacement.

NOTE: *Five sizes of adjusting screws are available. They are identified by grooves on the end of the screw opposite the wrench socket.*

(10) Install cylinder head cover, using replacement gaskets.

(11) Install distributor cap, install harness clip to cylinder head cover and install ignition wires to spark plugs.

(12) Install TAC flexible hose.

Valves

NOTE: *The following procedures apply only after the cylinder head has been removed from the engine. If head has not been removed, refer to Cylinder Head Removal.*

Removal

(1) Fabricate wooden fixture as shown in figure 1B-22. Attach fixture with 3/8 x 4 3/4 inch screws and nuts to bottom of head to hold valves against seats while springs are compressed.

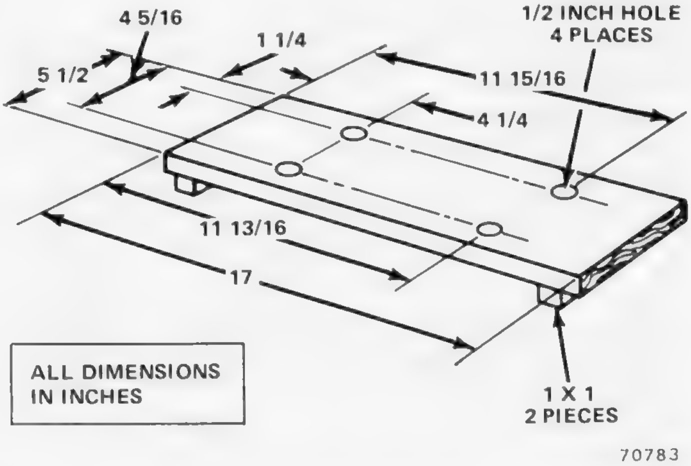


Fig. 1B-22 Cylinder Head Fixture Fabrication

(2) Compress valve spring with Spring Compressor J-26809 (fig. 1B-23). Remove valve locks, retainers, springs and oil deflector.

(3) Remove valves and place in rack in same order as removed from cylinder head.

Cleaning and Inspection

(1) Clean all carbon buildup from combustion chambers, valve ports, valve stems and head.

(2) Clean all dirt and gasket cement from cylinder head machined surface.

NOTE: *Do not use carbon brushes intended for cast iron heads. Use a softer brush specifically made for aluminum. Use a razor blade scraper to remove final traces of material.*

(3) Inspect for cracks in combustion chambers and valve ports.

(4) Inspect for cracks in gasket surface at each coolant passage.

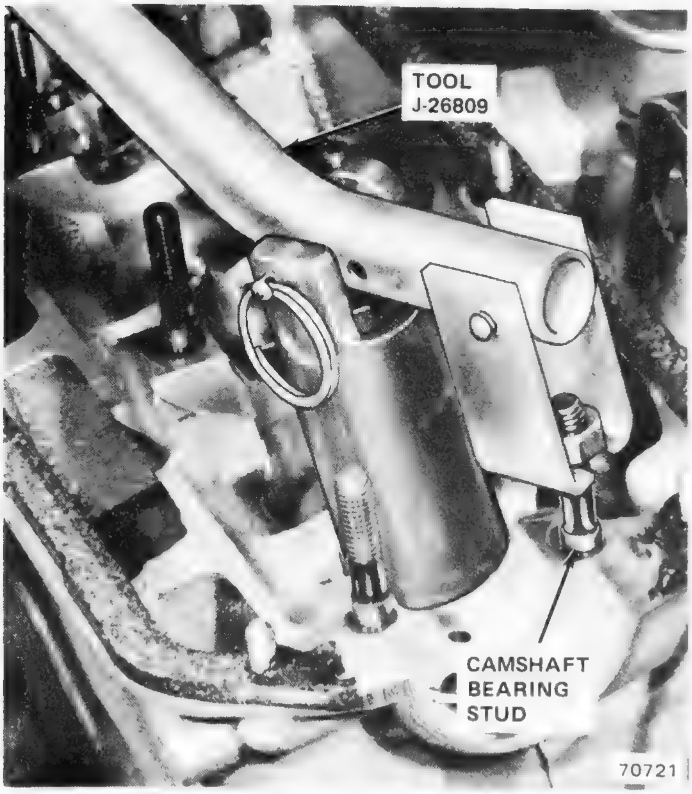


Fig. 1B-23 Compressing Valve Springs

(5) Inspect valves for burned, cracked or warped heads. Inspect for scuffed or bent valve stems. Replace valves displaying any of this damage.

Valve Refacing

NOTE: *Only INTAKE valves may be refaced. Do not reface exhaust valves. If damaged, replace them.*

Use a valve refacing machine to reface intake valves. After refacing, the face width must not exceed 3.5 mm (fig. 1B-24).

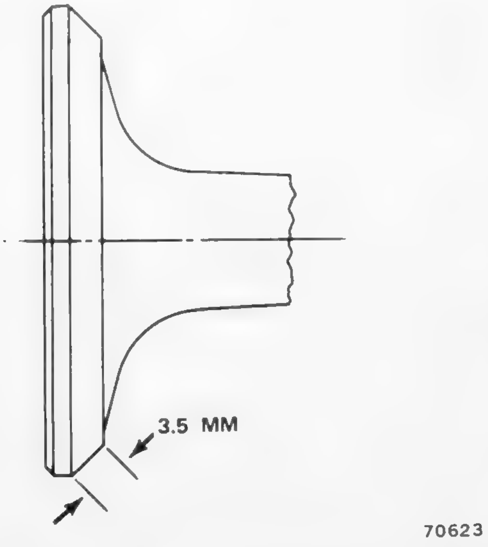


Fig. 1B-24 Valve Face Width

NOTE: *When a valve is refaced, it is necessary to replace the tappet adjusting screw to obtain correct cam lobe-to-tappet clearance.*

Valve Seat Refacing

Install a pilot of the correct size in the valve guide and reface the valve seat to the specified angle with a dressing stone. Remove only enough metal to provide a smooth finish.

Use tapered stones to obtain the specified seat widths.

Control seat runout to 0.03 mm.

Valve Stem Oil Seal Replacement

A polyacrylate rubber valve stem oil seal is installed on each valve stem to prevent valve train lubricating oil from entering the combustion chamber through the valve guides. Replace oil seals whenever valve service is performed or whenever oil seals are defective.

Valve stem oil seal replacement requires removal of valve springs. Refer to Valve Springs for procedure.

Valve Guides

Valve guides are an integral part of the cylinder head and are not replaceable.

Valve Stem-to-Guide Clearance

Valve stem-to-guide clearance may be checked by either of the following methods.

Preferred Method:

- Use a dial indicator to measure lateral movement of valve stem with valve installed in guide and even with end of guide (fig. 1B-25). Dial indicator reading should not exceed 0.8 (0.031 inch) for intake valves and 1.0 mm (0.039 inch) for exhaust valves.

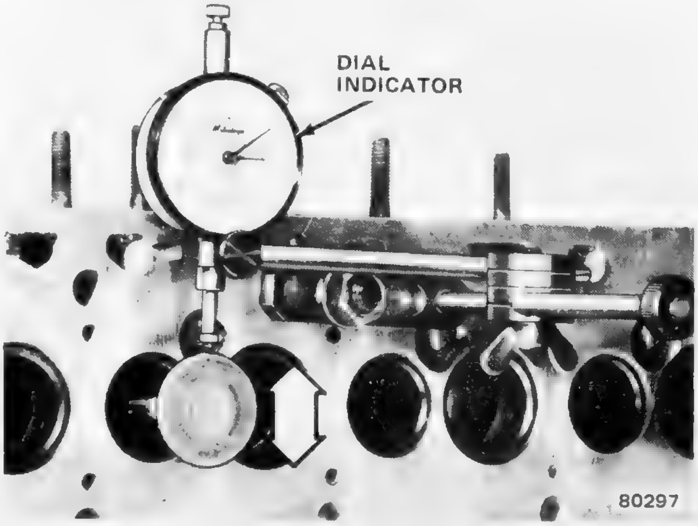


Fig. 1B-25 Checking Valve Stem Clearance with Dial Indicator

Alternate Method:

(1) Remove valve from head and clean valve guide with solvent and bristle brush.

(2) Insert telescoping gauge into valve guide approximately 3/8-inch from valve spring side of head (fig. 1B-26) with contacts crosswise to head. Measure telescoping gauge with micrometer.

(3) Repeat measurement with contacts lengthwise to cylinder head.

(4) Compare valve guide diameter with valve stem diameter listed in Specifications. Measurements must not differ by more than 0.077 mm.

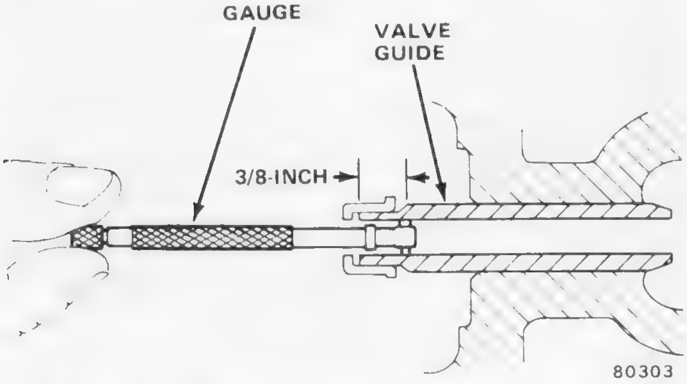


Fig. 1B-26 Measuring Valve Guide with Telescoping Gauge

Valve Installation

(1) Thoroughly clean valve stems and valve guide bores.

(2) Lightly lubricate stem and install valve in valve guide from which it was removed.

(3) Install replacement valve stem oil deflector on valve stem.

(4) Position valve springs (two per valve) and retainer on valve stem.

NOTE: *The closed coil of the small spring and the color-coded end of the large spring face the head.*

(5) Compress springs with compressor tool and install locks. Release tool.

(6) Tap valve springs from side-to-side to be certain springs are properly seated on cylinder head.

Valve Springs

Valve Spring and Oil Seal Removal

NOTE: *This procedure applies only when the head is installed on the engine. If the head is removed from the engine, refer to Valves.*

The valve springs are held in place on the valve stem by a retainer and a pair of conical locks. The locks can be removed only by compressing the springs.

(1) Remove camshaft. Refer to Camshaft Removal.

(2) Remove tappets.

(3) Loosely install nut to one stud adjacent to each bearing.

(4) Remove TAC vacuum motor and valve assembly.

(5) Remove spark plug.

(6) Install air adapter in place of spark plug.

NOTE: *An adapter can be made by welding an air hose connector to the body of a spark plug from which the porcelain has been removed.*

(7) Connect air hose to adapter and maintain at least 90 psi in cylinder to hold valves against their seats.

(8) Place 13/16-inch socket on each retainer and strike with hammer to loosen valve locks.

(9) Use Valve Spring Compressor J-26809 to compress springs (fig. 1B-23). Remove locks.

(10) Remove retainer and springs.

(11) Remove oil seal using Valve Stem Oil Seal Remover J-26854 (fig. 1B-27).

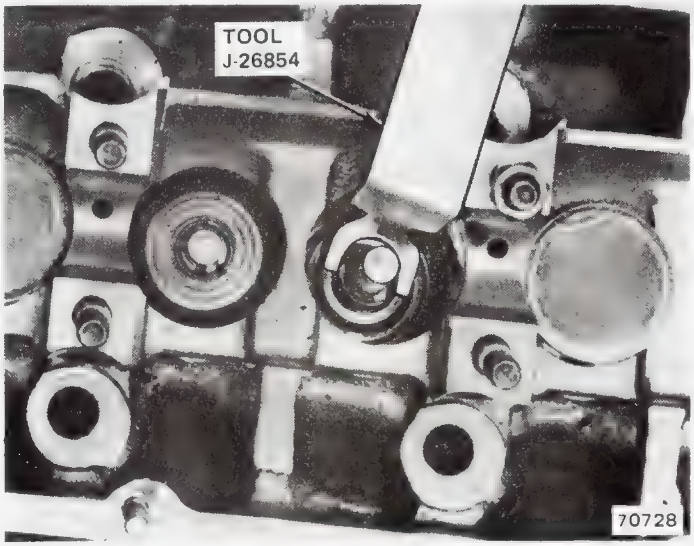


Fig. 1B-27 Removing Valve Stem Oil Seal

Valve Spring Tension Test

Use Valve Spring Tester J-8056 to test each valve spring for specified tension value (fig. 1B-28). Replace springs that are not within specifications.

Oil Seal and Valve Spring Installation

(1) Use Valve Stem Oil Seal Installer J-26811 to gently press oil seal onto valve stem (fig. 1B-29). Use small mirror to observe position of oil seal on valve stem. One-sixteenth inch of bevel should be visible when seal is properly installed (fig. 1B-30).

CAUTION: *Install deflector carefully to avoid damage from sharp edges of the valve lock grooves.*

(2) Install springs and retainer.

(3) Compress springs with Valve Spring Compressor J-26809 and insert valve locks. Release tool and remove.

Fig. 1B-28 Valve Spring Tester

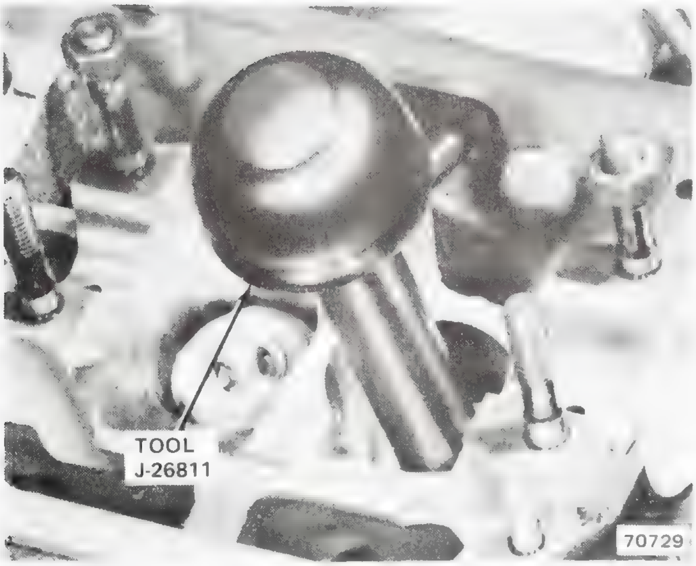


Fig. 1B-29 Installing Valve Stem Oil Seal

NOTE: *Tap springs from side-to-side to be certain springs are properly seated on cylinder head.*

(4) Disconnect air hose, remove adapter and install spark plug. Tighten spark plug to 30 newton-meters (22 foot-pounds) torque.

(5) Install tappets.

(6) Install camshaft. Refer to Camshaft Installation.

(7) Install cylinder head cover and replacement gaskets.

(8) Install TAC vacuum motor and valve assembly.

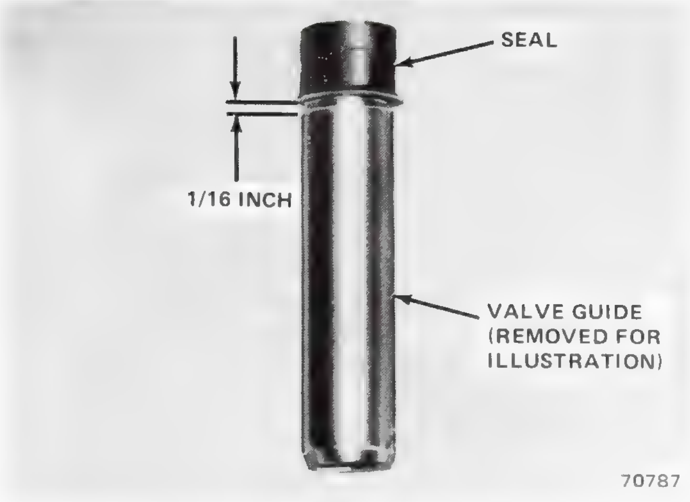


Fig. 1B-30 Oil Seal Position

INTAKE AND EXHAUST MANIFOLDS

The intake manifold is mounted on the left side of the cylinder head (fig. 1B-31). A one-piece gasket is used between the manifold and the head. The cast-aluminum manifold contains a hot-water passage which prevents condensation of fuel vapor. A fitting adjacent to cylinder number 3 carries air from the Air Guard pump into passages leading to the exhaust ports in the head. The EGR valve mounts on a boss below the carburetor mounting pad.

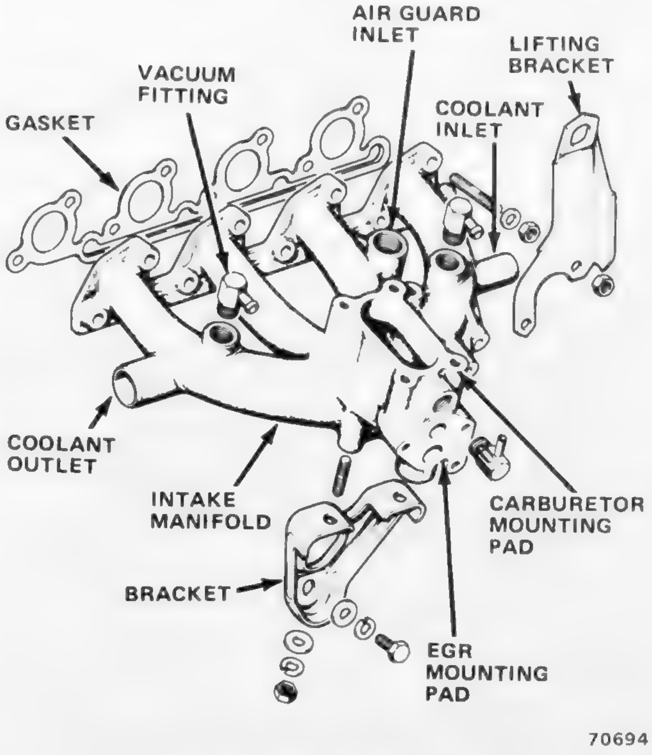


Fig. 1B-31 Intake Manifold

The cast-iron exhaust manifold is mounted on the right side of the cylinder head (fig. 1B-32). A steel tube carries exhaust gases from the exhaust manifold, behind the head to the EGR valve on the intake manifold.

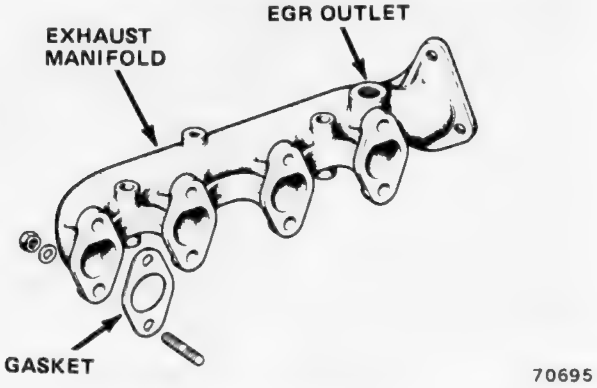


Fig. 1B-32 Exhaust Manifold

Intake Manifold

Removal

(1) Drain cooling system.

(2) Disconnect EGR tube from exhaust manifold. Remove screw from tube clamp.

(3) Remove air cleaner and disconnect TAC vacuum hose.

(4) Disconnect fuel line at carburetor.

(5) Disconnect fuel return line from filter.

(6) Disconnect and plug fuel line tube at chassis rail.

(7) Disconnect accelerator cable.

(8) Disconnect air hose from diverter valve.

(9) Disconnect vacuum hose from power brake booster, if equipped.

(10) If equipped with air conditioning, loosen compressor mounting bracket.

(11) Remove fuel pump screws and remove pump.

(12) Disconnect water inlet and outlet hoses from manifold.

(13) Disconnect all canister hoses from carburetor.

(14) Disconnect throttle solenoid, PCV solenoid and electric choke wires.

(15) Disconnect coil primary and secondary wires.

(16) Remove manifold bracket lower screw.

(17) Disconnect PCV hose at block.

(18) Remove manifold nuts. Remove lift brackets and manifold.

(19) Remove gasket.

Installation

(1) Install gasket.

(2) Install manifold, lift brackets and nuts. Do not tighten.

(3) Connect EGR tube to exhaust manifold.

(4) Tighten intake manifold nuts to 24 newton-meters (18 foot-pounds) torque.

(5) Install bracket lower screw and tighten to 41 newton-meters (30 foot-pounds) torque.

(6) Connect fuel line at sill.

(7) Install fuel pump using replacement gasket.

(8) Tighten air conditioning compressor mounting bracket, if equipped.

(9) Connect fuel line to carburetor.

(10) Connect fuel return line to filter.

(11) Connect wires to solenoids and choke.

(12) Install throttle cable.

(13) Install EGR tube clamp screw.

(14) Connect coil wires.

(15) Connect intake manifold water hoses.

(16) Connect hose to diverter valve.

(17) Connect power brake booster vacuum hose.

(18) Connect canister hoses to carburetor.

(19) Install air cleaner and TAC components.

(20) Install radiator drain plug and fill cooling system.

(21) Run engine for 3 minutes. Check coolant level. Check for leaks.

Exhaust Manifold Replacement

(1) Remove TAC cold air induction manifold, vacuum motor and valve assembly and flexible hoses. Disconnect vacuum line.

(2) Disconnect EGR tube.

(3) Disconnect exhaust pipe from manifold.

(4) Remove manifold-to-head nuts and washers.

(5) Remove manifold and gasket.

(6) Clean gasket surfaces of head and manifold.

(7) Install replacement gasket to studs on head.

(8) Transfer shroud assembly from original manifold to replacement manifold.

(9) Install manifold to head and loosely install nuts and washers.

(10) Attach EGR tube to manifold. Tighten manifold nuts to 24 newton-meters (18 foot-pounds) torque.

(11) Attach exhaust pipe to manifold and tighten.

(12) Install cold air induction manifold, vacuum motor and valve assembly and flexible hoses.

(13) Connect TAC vacuum line.

CYLINDER HEAD AND COVER

Cover Replacement

(1) Disconnect and remove flexible TAC hose.

(2) Remove PCV valve from grommet in cylinder head cover.

(3) Disconnect ignition wires from spark plugs. Disconnect harness clip from cylinder head cover.

(4) Remove cylinder head cover nuts and washers.

(5) Strike cover with rubber mallet to break loose from head.

(6) Clean gasket material from head and cover. Inspect cover for cracks.

(7) Install end pieces in grooves of bearing caps at both ends of head (fig. 1B-33). Be sure end pieces fit into slots of side pieces. Apply AMC Gasket-in-a-Tube or equivalent to all joints.

(8) Position side pieces of replacement gasket set over studs on head.

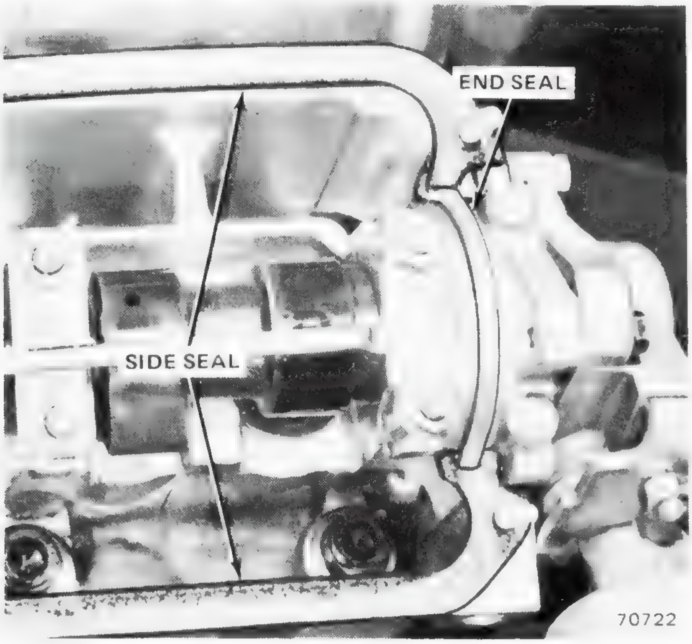


Fig. 1B-33 Cylinder Head Cover Gasket Installation

(9) Install cylinder head cover. Be careful to not disturb gaskets.

(10) Install reinforcement strips, retaining nuts and washers. Tighten nuts to 5.7 newton-meters (50 inch-pounds) torque.

(11) Install PCV valve to cover.

(12) Connect ignition wires to spark plugs. Connect clip to cylinder head cover.

(13) Install TAC hose to TAC valve assembly.

(14) Attach TAC flexible hose to air cleaner. Attach TAC vacuum hose.

Cylinder Head Removal

(1) Drain radiator.

(2) Remove air cleaner, TAC vacuum motor and valve assembly and flexible hoses.

(3) Disconnect upper radiator hose from radiator.

(4) Loosen clamp and remove bypass hose from bottom of thermostat housing.

(5) Loosen and remove accessory drive belts.

(6) If equipped with air conditioning, loosen compressor mounting bracket.

(7) Remove camshaft drive belt guard.

(8) Loosen and remove camshaft drive belt.

(9) Loosen air pump and remove belt.

(10) Remove fan, spacer and pulley.

(11) Remove air pump pivot screw and remove air pump.

(12) Remove alternator pivot screw. Do not disconnect alternator harness.

(13) Remove air pump front bracket.

(14) Disconnect exhaust pipe from manifold.

(15) Disconnect air hose from diverter valve.

(16) Disconnect heater hose from rear of head.

(17) Remove EGR tube-to-bellhousing screw.

(18) Disconnect following wires:
  (a) Temperature Sender
  (b) Oil Pressure Sender
  (c) Electric Choke
  (d) Throttle Solenoid
  (e) PCV Valve Solenoid
  (f) Distributor Primary
  (g) Ignition Secondary to Coil

(19) Disconnect fuel line at bottom of intake manifold bracket.

(20) Remove screw at bottom of intake manifold bracket.

(21) Disconnect accelerator cable.

(22) Disconnect vacuum hose from power brake booster, if equipped.

(23) Disconnect fuel return line from filter.

(24) Disconnect intake manifold water inlet and outlet hoses.

(25) Disconnect canister-to-carburetor hoses from carburetor.

(26) Disconnect PCV hose at block.

(27) Remove cylinder head cover.

(28) Loosen and remove cylinder head screws. Follow reverse order of head tightening sequence shown in figure 1B-34.

(29) Break head loose from block.

(30) Remove head with manifolds and carburetor attached.

(31) Clean fluid from cylinders.

Head Cleaning and Inspection.

(1) Thoroughly clean machined surfaces of cylinder head and block. Remove all dirt and gasket cement. A scraper and acetone are recommended.

(2) Vacuum gasket material from cylinder bores.

(3) Remove carbon deposits from combustion chambers and tops of pistons.

(4) Use straightedge and feeler gauge to check flatness of cylinder head and block mating surfaces. Refer to Specifications.

NOTE: *The head may not be milled or ground.*

Head Installation

(1) Install locating dowels in head.

(2) Install head to block using replacement gasket. Follow screw torque sequence shown in figure 1B-34.

Tighten screws to 88 newton-meters (65 foot-pounds) torque. After engine is assembled, refer to Head Retorque.

(3) Connect exhaust pipe to manifold.

(4) Install intake manifold bracket-to-block screw.

(5) Connect fuel line at bracket.

(6) Connect fuel return line to filter.

(7) Connect PCV hose to block.

(8) Connect water inlet and outlet hoses to intake manifold.

(9) Connect carburetor-to-canister hoses to carburetor.

(10) Connect vacuum hose to power brake booster, if equipped.

(11) Install air hose to diverter valve.

(12) Install heater hose to rear of head.

(13) Install EGR tube clamp screw.

(14) Install harness in clip at rear of head and connect following wires:

- (a) Temperature Sender
- (b) Oil Pressure Sender
- (c) Electric Choke
- (d) Throttle Solenoid
- (e) PCV Valve Solenoid
- (f) Distributor Primary
- (g) Ignition Secondary to Coil

(15) Connect accelerator cable. On automatic transmission, adjust throttle valve linkage.

(16) Install alternator and air pump front bracket.

(17) Position alternator and install pivot screw. Do not tighten.

(18) Install air pump. Do not tighten.

(19) Install camshaft drive belt. Refer to Camshaft Drive Belt for procedure.

(20) Install belt guard.

(21) Drape alternator and air pump belts over pulley. Install fan, spacer and pulley.

(22) Tighten air pump belt.

(23) Tighten alternator belt.

(24) Install and tighten accessory drive belts.

(25) Tighten air conditioning compressor mounting bracket, if equipped.

(26) Install radiator drain plug.

(27) Install coolant.

(28) Temporarily install cylinder head cover and retain with 2 nuts on each side.

(29) Plug TAC vacuum hose.

(30) Start engine and warm up for 5 minutes.

(31) Retorque head. Refer to Head Retorque for procedure.

(32) Install air cleaner, TAC vacuum motor and valve assembly and flexible hoses.

Head Retorque

Perform this procedure at intervals outlined in the Mechanical Maintenance Schedule and after head installation.

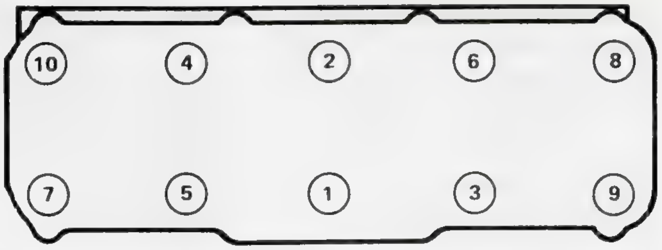


Fig. 1B-34 Head Torque Sequence

NOTE: *Engine must be at operating temperature.*

(1) Remove TAC flexible hose.

(2) Disconnect ignition wire clip and PCV hose from cylinder head cover.

(3) Disconnect ignition wires from spark plugs.

(4) Remove cylinder head cover.

(5) Remove gaskets and seals from head. Clean gasket from cover.

(6) Follow head torque sequence shown in figure 1B-34. Loosen screw number 1 1/8 turn. Tighten to 108 newton-meters (80 foot-pounds) torque. Proceed to screw number 2 and repeat procedure for each screw.

(7) Install replacement side gaskets and end seals.

(8) Apply AMC Gasket-in-a-Tube, or equivalent, to all joints.

(9) Install cylinder head cover and tighten.

(10) Install PCV hose.

(11) Install TAC hose.

(12) Connect ignition wires to spark plugs and install clip.

LUBRICATION SYSTEM

General

An internal-external tooth positive displacement oil pump is mounted on the front end of the crankshaft (fig. 1B-35). The pump draws oil through the screen and inlet tube in the sump. Oil is forced between the driven and idler gears of the oil pump and through the outlet into a gallery on the left side of the block. Oil is routed to the inlet side of the full-flow oil filter. Filtered oil passes out of the center of the oil filter into a main gallery running the entire length of the block.

Galleries extend from the main gallery to each of the five crankshaft main bearings. The crankshaft is drilled internally to deliver oil from the main bearings to the connecting rod bearings. The center main bearing (No. 3) is not drilled. Connecting rod bearing throwoff lubricates the cylinder bores and pistons.

A gallery extends up the middle of the engine block into the head. An oversize head screw bore is used as a channel. A gallery running the length of the head carries oil to the five camshaft bearings. The front camshaft bearing journal supplies oil to the oil pipe running above

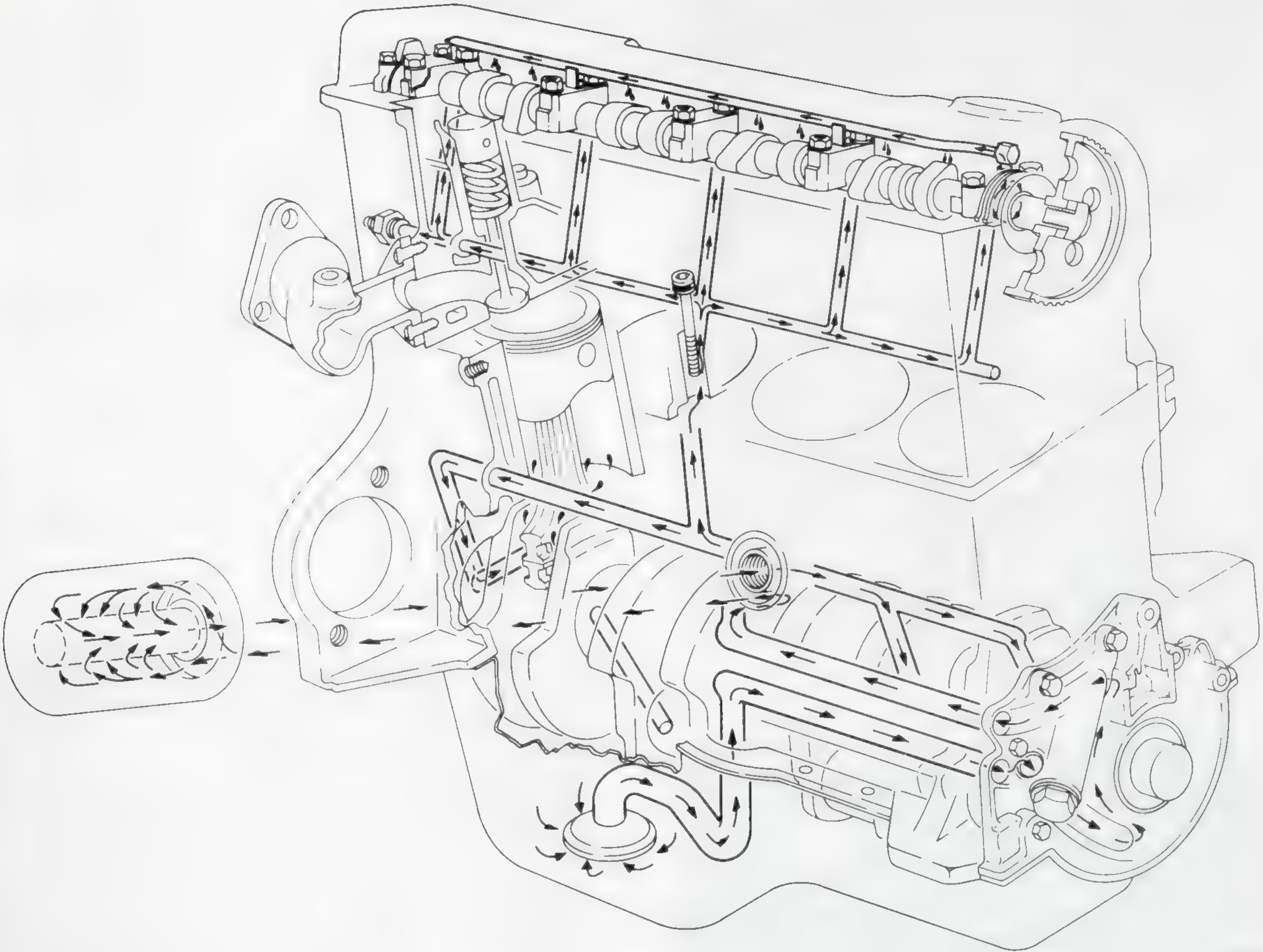


Fig. 1B-35 Lubrication System

the camshaft. Holes in the oil pipe spray oil to lubricate the camshaft lobes, tappets, fuel pump eccentric and distributor drive gear. Drains in the head direct oil back to the oil pan.

Oil Filter

A full-flow oil filter, mounted on the right side of the engine, is accessible through the hood opening. A safety valve in the filter permits oil to bypass the filtering element in the event that the filter becomes clogged with dirt or sludge (fig.1B-36).

CAUTION: *It is important that the correct type filter is installed. Use only replacement filters that have a built-in bypass valve.*

Use Tool J-22700 to remove the oil filter. Before installing replacement filter, clean mounting surface on engine block. Apply a thin film of oil to the filter gasket. Install the filter until gasket contacts seat. Tighten an additional 3/4 turn, by hand only. Operate engine at a fast idle and check for leaks.

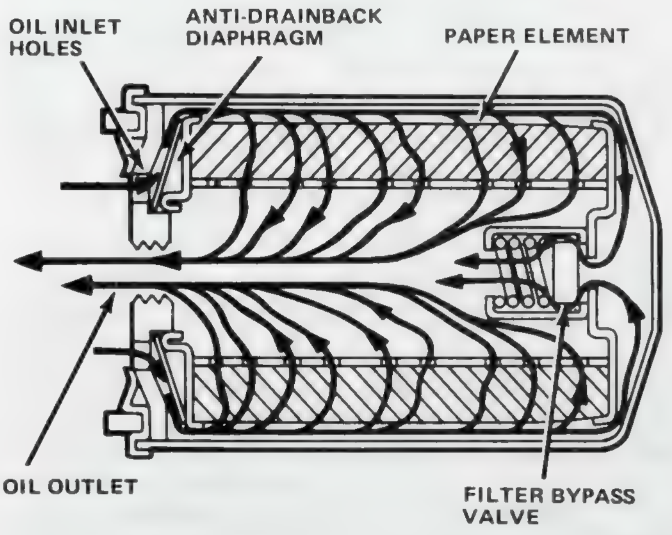


Fig. 1B-36 Oil Filter

Oil Pump

The oil pump on the AMC four-cylinder engine is different from other AMC oil pumps in several ways. It is driven directly by the crankshaft which means that it turns twice as fast as distributor-driven oil pumps. The oil pump consists of two gears, one with internal teeth and one with external teeth (fig. 1B-37).

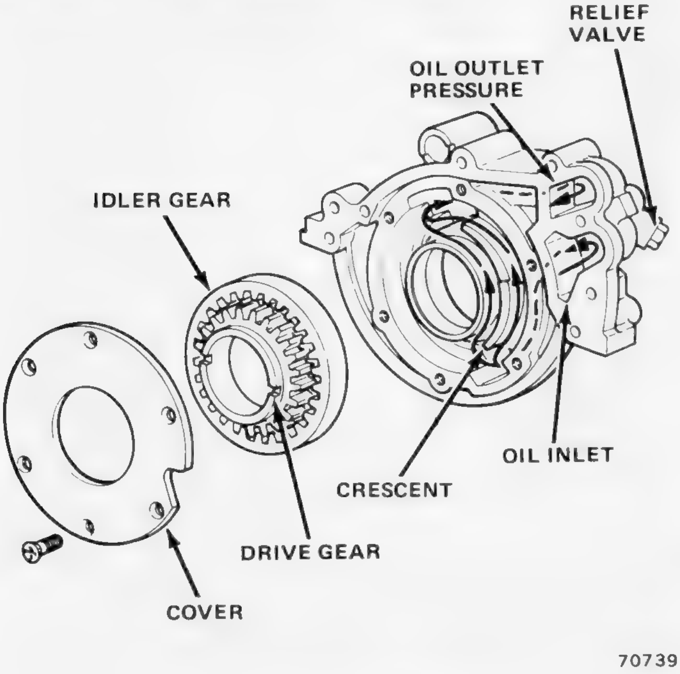


Fig. 1B-37 Oil Pump Gears

The center gear is driven by the crankshaft. The outer gear is driven by the inner gear. Oil is pulled into the pump from the oil pickup tube, forced past the crescent-shaped area and out the outlet port. A pressure relief valve bleeds excess pressure back to the inlet side of the pump (fig. 1B-38).

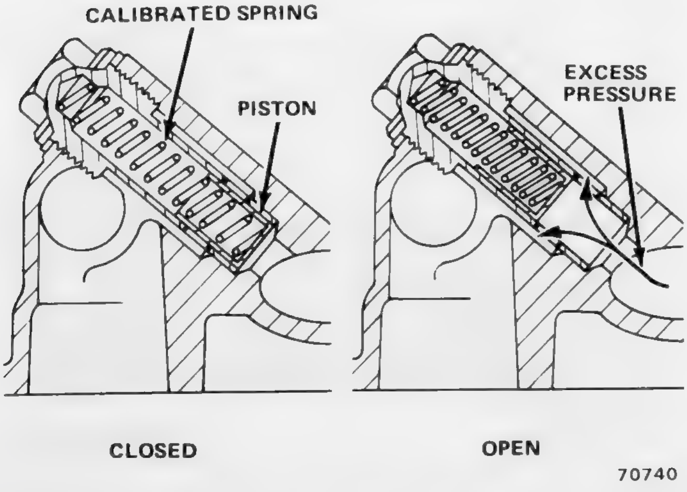


Fig. 1B-38 Relief Valve Operation

Oil Pump Removal

(1) Remove fan shroud.

(2) Raise car and support on support stands.

(3) Loosen crankshaft pulley screws but do not remove.

(4) Loosen power steering pump and remove belt.

(5) Loosen air conditioning compressor drive belt, if equipped.

(6) Loosen alternator and remove belt.

(7) Remove pulley screws and remove pulley.

(8) Attach Crankshaft Sprocket Holding Wrench J-26867 using all pulley screws.

(9) Remove crankshaft screw.

(10) Remove camshaft drive sprocket from crankshaft.

(11) Remove oil pump screws and front oil pan screws.

(12) Remove oil pump. Pry in slots provided with large screwdriver (fig. 1B-39).

(13) Remove gasket.

(14) Remove crankshaft seal.

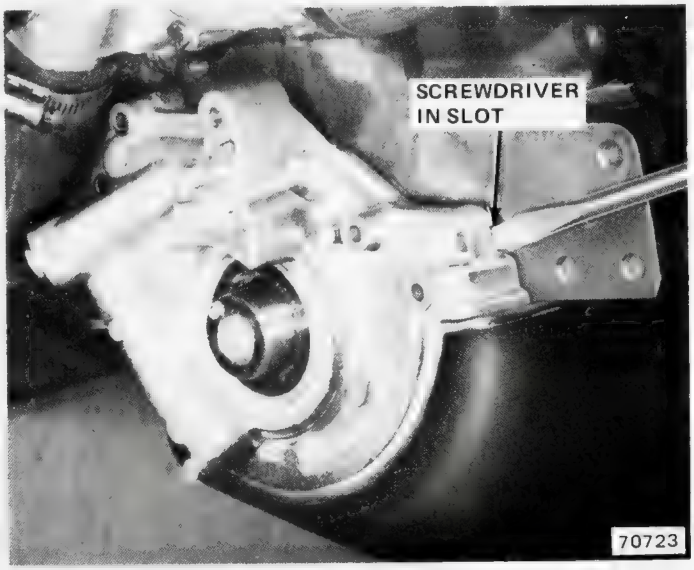


Fig. 1B-39 Oil Pump Removal

Oil Pump Installation

(1) Install gasket and trim edges.

(2) Turn crankshaft to position oil pump lugs either vertically or horizontally for ease of aligning with pump.

(3) Cut off oil pan gasket flush with front of block and discard.

(4) Apply marking material to lugs on crankshaft.

(5) Carefully tap oil pump into position as far as possible.

(6) Remove pump and observe markings. Orient pump gears accordingly.

(7) Apply silicone material to pump sealing surface.

(8) Apply silicone material to edges of pump and oil pan.

(9) Install pump. Tighten screws to 9.8 newton-meters (87 inch-pounds) torque.

(10) Install replacement crankshaft seal using Tool J-26877.

(11) Install camshaft drive sprocket. Be sure pin aligns with hole.

(12) Install crankshaft screw.

(13) Remove holding tool.

(14) Hang camshaft drive belt from sprocket. Install crankshaft accessory drive pulley. Be sure pin aligns with hole.

(15) Install camshaft drive belt. Refer to Camshaft Drive Belt for installation and timing procedure.

(16) Install belt guard.

(17) Install accessory drive belts and tighten.

(18) Install shroud.

(19) Remove support stands and lower car.

Relief Valve Replacement

Removal

(1) Remove relief valve body from oil pump.

(2) Remove spring and piston from oil pump if they did not come out with valve body.

Installation

(1) Install spring and piston into valve body.

(2) Install valve body to oil pump using replacement gasket. Tighten to 47 newton-meters (35 foot-pounds) torque.

Front Oil Seal

The front oil seal prevents oil leakage between the crankshaft nose and the oil pump housing.

Removal

(1) Remove accessory drive belts.

(2) Remove camshaft drive belt guard.

(3) Remove accessory drive pulley.

(4) Loosen camshaft belt tensioner and remove drive belt.

(5) Remove camshaft drive sprocket from crankshaft using Crank Pulley Holding Wrench J-26867. Leave sprocket attached to wrench for assembly.

(6) Pry front oil seal from oil pump recess using Front and Rear Seal Remover J-26868 (fig. 1B-40).

Installation

(1) Lubricate inner lip of seal with clean engine oil. Do not apply sealant to outer edge of seal.

(2) Drive seal into pump recess using Front Oil Seal Installer J-26877. Drive seal completely into recess (fig. 1B-41).

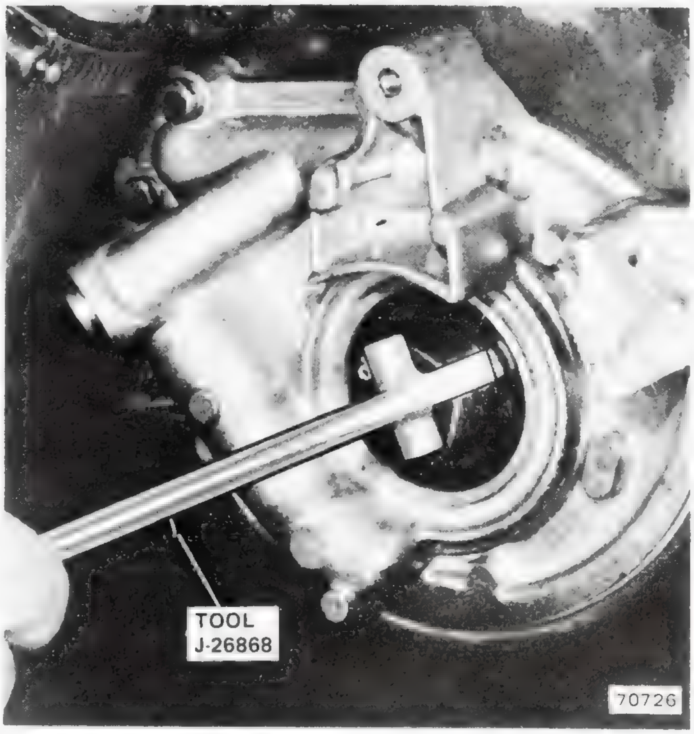


Fig. 1B-40 Removing Front Oil Seal

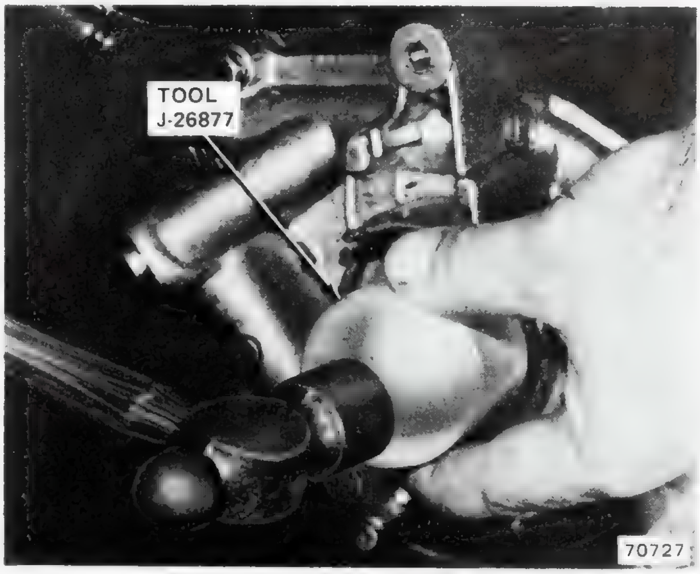


Fig. 1B-41 Installing Front Oil Seal

(3) Install camshaft belt drive sprocket. Roll pin in crankshaft must align with hole in pulley. Torque crankshaft to specification. Remove Holding Wrench.

(4) Install accessory drive pulley. Roll pin in drive belt sprocket must align with hole in accessory pulley.

(5) Install camshaft drive belt. Refer to Camshaft Drive Belt for procedure.

(6) Install belt guard.

(7) Install acccessory drive belts and tighten to specification.

Oil Pan

Removal

(1) Raise car and support with support stands.

(2) Drain oil. When oil is drained completely, install drain plug.

(3) Install lifting device to engine.

(4) Remove engine bracket-to-cushion nuts.

(5) Loosen strut and bracket screws.

(6) Raise engine approximately 2 inches.

(7) Remove crossmember-to-sill attaching parts.

(8) Remove steering gear idler bracket.

(9) Pry crossmember loose and insert wooden blocks between crossmember and sill on both sides.

(10) Remove oil pan.

(11) Scrape gasket from block.

Installation

(1) Cement replacement oil pan gaskets side to block.

(2) Install replacement front and rear seals. Apply AMC Gasket-in-a-Tube, or equivalent, to joints between side gaskets and end seals.

(3) Install oil pan. Tighten side screws to 7.9 newton-meters (70 inch-pounds) torque. Tighten end screws to 10.2 newton-meters (90 inch-pounds) torque.

(4) Install crossmember to sills.

(5) Tighten strut rod bracket screws.

(6) Lower engine onto support cushions.

(7) Install and tighten engine cushion nuts.

(8) Remove support stands and lower car.

(9) Fill oil pan with clean oil to mark on indicator.

(10) Start engine and check for leaks.

CONNECTING ROD AND PISTON ASSEMBLY

Replacement

NOTE: *The following procedure is used to service connecting rod and piston assemblies with engine in the car.*

Removal

(1) Remove head. Refer to Cylinder Head for procedures.

(2) Position pistons two at a time near bottom of stroke and remove ridge from top of cylinder walls with ridge reamer.

(3) Remove oil pan. Refer to Oil Pan for procedures.

(4) Mark connecting rods and bearing caps with cylinder number.

(5) Remove bearing caps and inserts.

(6) Remove connecting rod and piston assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod studs do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over the studs will provide protection during removal.*

Installation

(1) Clean cylinder bores thoroughly. Apply light film of clean engine oil to bores with clean, lint-free cloth.

(2) Position piston rings on pistons. Refer to Piston Rings for installation procedure.

(3) Lubricate piston and rings with clean engine oil.

(4) Use Piston Installer J-26836 to install connecting rod and piston assemblies through top of cylinder bores (fig. 1B-42). Arrow on piston top faces foward.

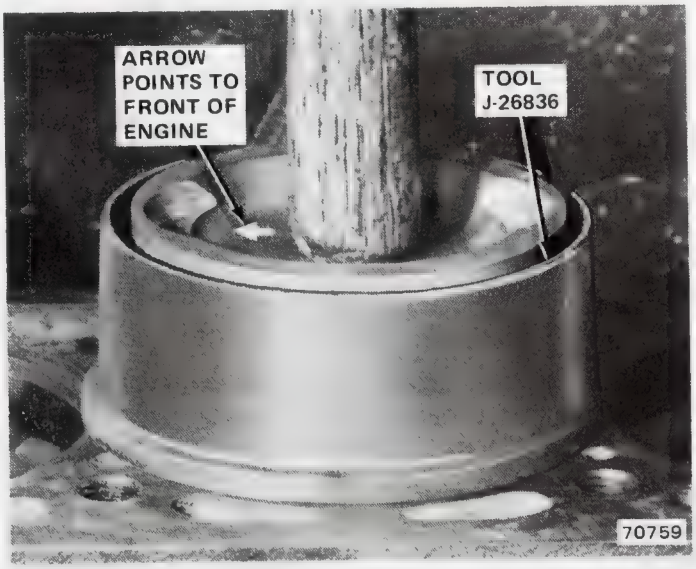


Fig. 1B-42 Piston Installation

NOTE: *Be careful that connecting rod studs do not scratch the connecting rod journals or cylinder walls. Short lengths of rubber hose slipped over the studs will provide protection during installation.*

(5) Install connecting rod bearing caps and inserts. Observe cylinder number markings made earlier. Also observe projections on connecting rod and cap. These projections must face front of engine (fig. 1B-43).

(6) Install oil pan. Refer to Oil Pan for procedures.

(7) Install cylinder head. Refer to Cylinder Head for procedures.

NOTE: *Retorque cylinder head screws retorque after engine warm-up.*

CONNECTING RODS

The connecting rods are forged steel and have bearing inserts at the crankshaft journal end. Bearing inserts are steel-backed lead alloy. Piston pins are free-floating and are retained in the pistons by clips.

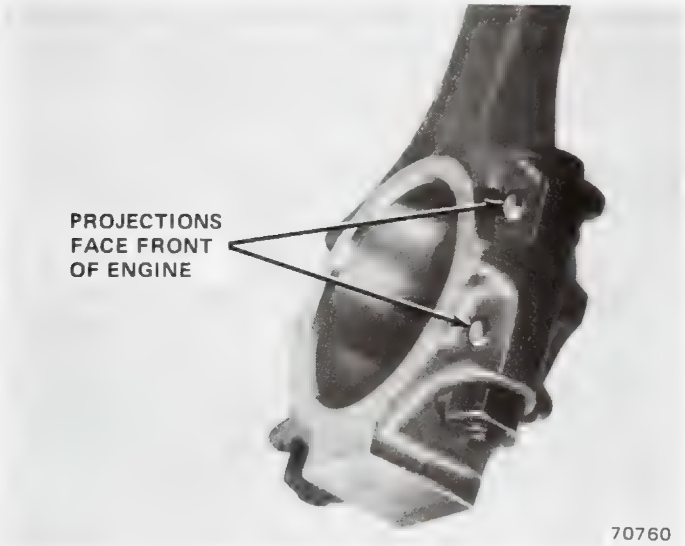


Fig. 1B-43 Connecting Rod and Cap

Misaligned or bent connecting rods cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, check rod alignment. Replace misaligned or bent rods.

NOTE: *Connecting rods are serviced in balanced sets of four only. If one rod is replaced, all must be replaced.*

Side Clearance Measurement

Slide snug-fitting feeler gauge between connecting rod and crankshaft rod journal flange. Replace connecting rod if side clearance is outside specification.

Connecting Rod Bearings

The connecting rod bearings are steel-backed lead alloy.

Connecting rod bearings are serviced only in the sizes listed in the Connecting Rod Bearing sizes chart. Selective fitting is not possible. Bearings are identified by the step number stamped on the back.

Connecting Rod Bearing Sizes

Identification	Size
Step 01	Standard
Step 02	0.25 mm Undersize
Step 03	0.50 mm Undersize
Step 04	0.75 mm Undersize

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Removal

(1) Drain engine oil.

(2) Remove oil pan and gaskets.

(3) Mark connecting rod bearing caps with cylinder number for identification at installation.

(4) Rotate crankshaft as required to position two connecting rods at a time at bottom of stroke.

(5) Remove connecting rod bearing cap. Remove lower bearing insert.

(6) Remove upper bearing insert by rotating it out of connecting rod.

Inspection

(1) Clean inserts.

(2) Inspect linings and backs of inserts for irregular wear pattern. Note any scraping, stress cracks or discoloration (fig. 1B-44). If bearing has spun in rod, replace bearing and connecting rod and inspect crankshaft journal for scoring.

(3) Inspect for material imbedded in linings which may indicate piston, distributor gear or oil pump gear problems. Figures 1B-45 and 1B-46 show common score patterns.

(4) Inspect fit of bearing locking tab in rod cap. If inspection indicates that insert may have been caught between rod and rod cap, replace upper and lower bearing inserts.

(5) Inspect insert in area of locking tab. Abnormal wear indicates bent tabs or improper installation of inserts (fig. 1B-47).

(6) Replace bearing inserts that are damaged or worn.

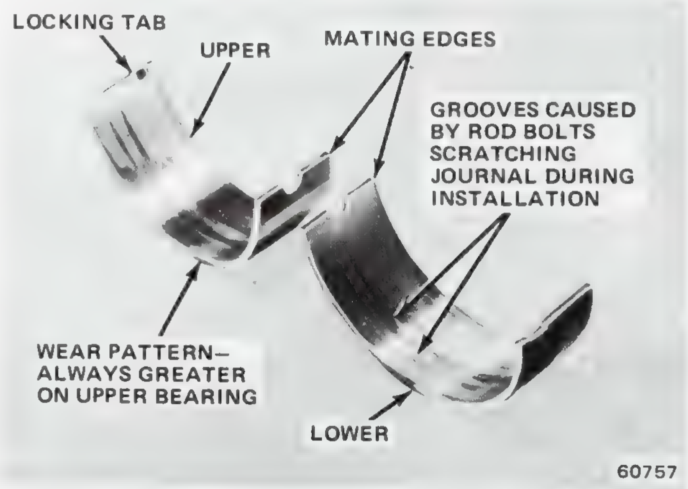


Fig. 1B-44 Connecting Rod Bearing

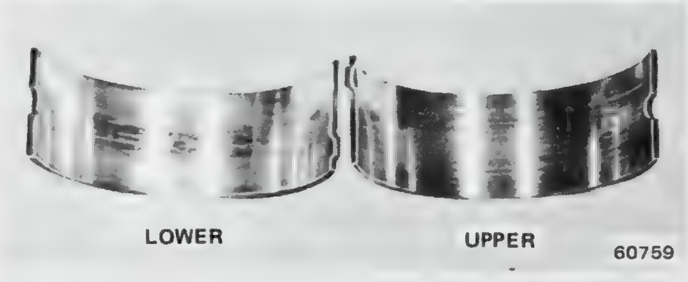


Fig. 1B-45 Scoring Caused by Insufficient Lubrication

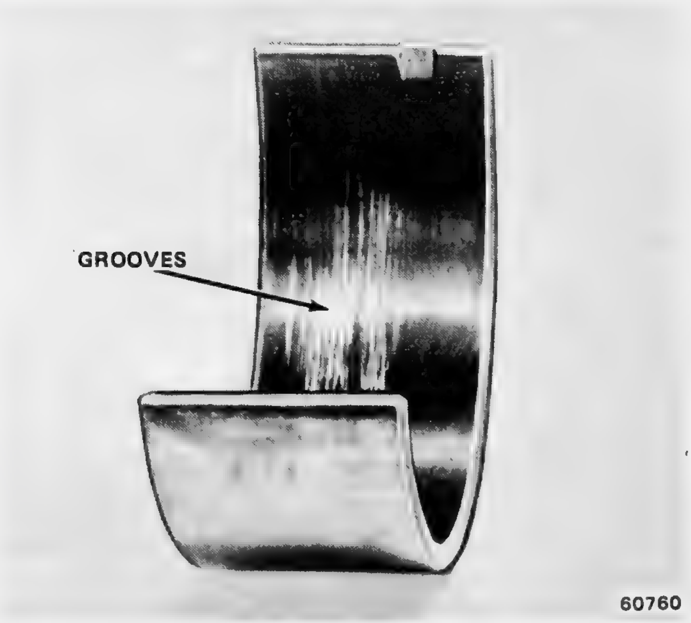


Fig. 1B-46 Scoring Caused by Dirt

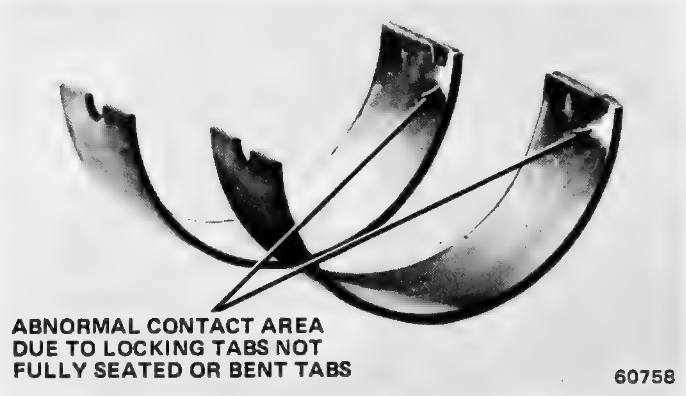


Fig. 1B-47 Locking Tab Inspection

Measuring Bearing Clearance with Plastigage

(1) Wipe journal clean.

(2) Lubricate upper insert and install in rod.

(3) Install lower insert in bearing cap. Lower insert must be dry. Place a strip of Plastigage across full width of lower insert at the center of bearing cap.

(4) Install bearing cap to connecting rod and tighten nuts to 55 newton-meters (41 foot-pounds) torque.

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading.*

NOTE: *Plastigage must not crumble in use. If brittle, obtain fresh stock.*

(5) Remove bearing cap and determine amount of clearance by measuring the width of the compressed Plastigage with the scale on Plastigage envelope (fig. 1B-48).

NOTE: *Plastigage should maintain the same size across the entire width of the insert. If size varies, it may indicate a tapered journal, bent connecting rod or dirt trapped between the insert and rod.*

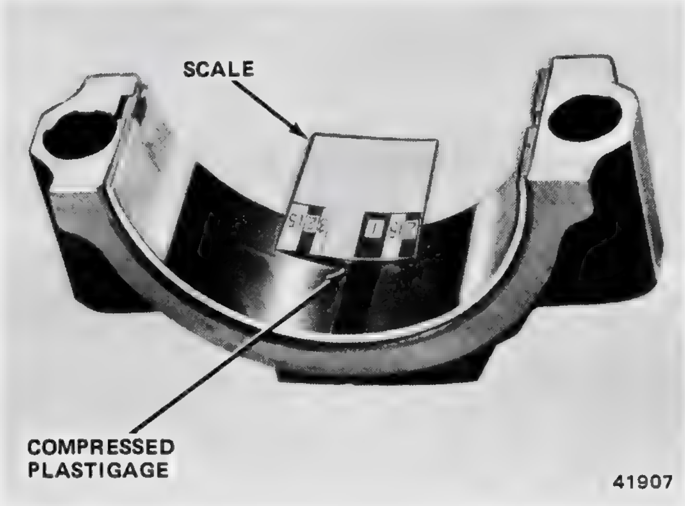


Fig. 1B-48 Bearing Clearance Measurement with Plastigage

(6) If correct clearance is indicated, proceed to Installation.

(7) If oil clearance exceeds specification, grind crankshaft to accept undersize bearings.

Measuring Bearing Clearance with Micrometer

(1) Wipe connecting rod journal clean.

(2) Use micrometer to measure maximum diameter of rod journal at four points. Take two readings 90° apart at each end of journal.

(3) Check for taper and out-of-round condition. Refer to Specifications. If any rod journal is not within specifications, the crankshaft must be replaced.

(4) If journal diameter is outside specification, grind to accept undersize bearing.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Install bearing inserts, cap and retaining nuts. Tighten nuts to 55 newton-meters (41 foot-pounds) torque.

CAUTION: *Be careful when rotating the crankshaft with bearing caps removed. Be sure the connecting rod screws do not accidentally come in contact with the rod journals and scratch the finish. Bearing failure would result. Short pieces of rubber hose slipped over the connecting rod screws will provide protection during installation.*

(3) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(4) Fill crankcase with clean oil to specified level.

PISTONS

Aluminum alloy pistons are used. The pistons are grooved to accept three piston rings: two compression rings and one three-piece oil control ring.

The piston pin bore is offset to the centerline of the piston to place it nearer the thrust side, minimizing piston slap.

An arrow on the top surface of the piston ensures correct installation in the bore. The arrow must point toward the front of the engine (fig. 1B-49).

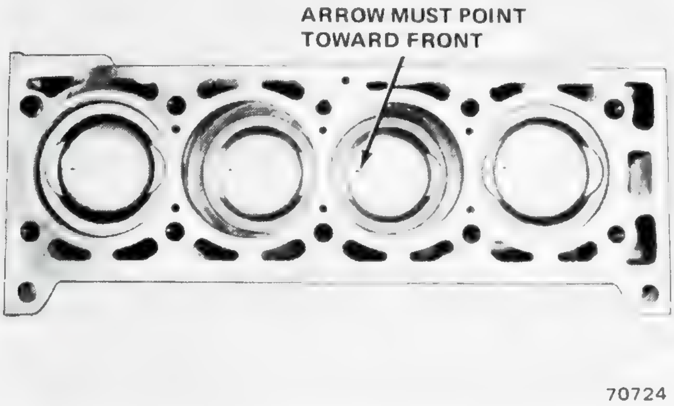


Fig. 1B-49 Pistons Correctly Positioned in Bores

Piston Fitting

Micrometer Method

(1) Measure inside diameter of cylinder bore at a point 68.1 mm below top of bore.

(2) Measure outside diameter of piston at a point 9.9 mm from bottom of piston, 90° to pin bore.

(3) The difference between cylinder bore diameter and piston diameter is piston-to-bore clearance.

Piston Rings

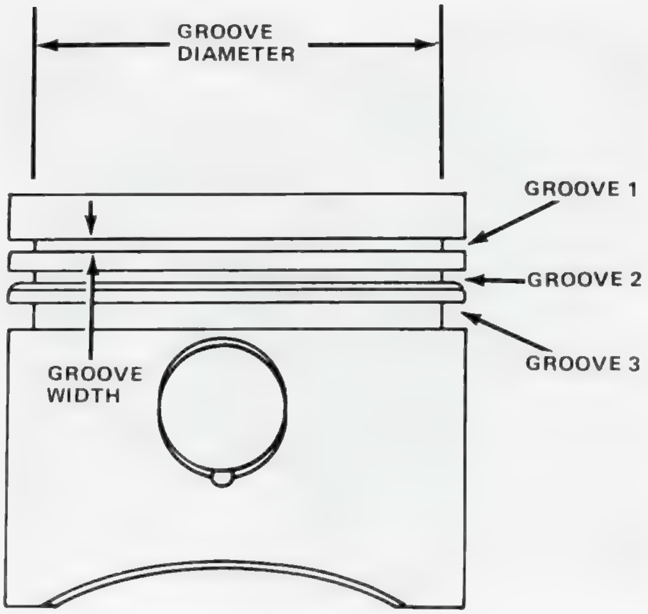
The top compression ring is nodular iron. The second compression ring is cast iron. The oil control ring is a one-piece cast iron design with a spring expander.

Ring Fitting

Piston ring groove dimensions are shown in figure 1B-50.

(1) Clean carbon from all ring grooves. Oil drain openings in oil ring grooves and pin boss must be open. Do not remove metal from grooves or lands. This will change ring groove clearances and will damage ring-to-land seating.

(2) Check ring side clearance with feeler gauge fitted snugly between ring land and ring. Rotate ring in groove. It must move freely at all points (fig. 1B-51). Refer to Specifications for correct ring side clearance.



	GROOVE DIAMETER	GROOVE WIDTH
GROOVE 1	7.830 to 7.810 cm	2.02 to 2.04 mm
GROOVE 2	7.770 to 7.750 cm	2.52 to 2.54 mm
GROOVE 3	7.770 to 7.680 cm	5.02 to 5.04 mm

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Fig. 1B-50 Piston Ring Groove Dimensions

Fig. 1B-51 Ring Side Clearance

(3) Place ring in bore and push down with inverted piston to position near lower end of ring travel. Measure ring gap (joint clearance) with feeler gauge fitting snugly in ring opening (fig. 1B-52).

Installation

(1) Install oil control ring expander (fig. 1B-53). Install one-piece oil control ring. Special tool is not required.

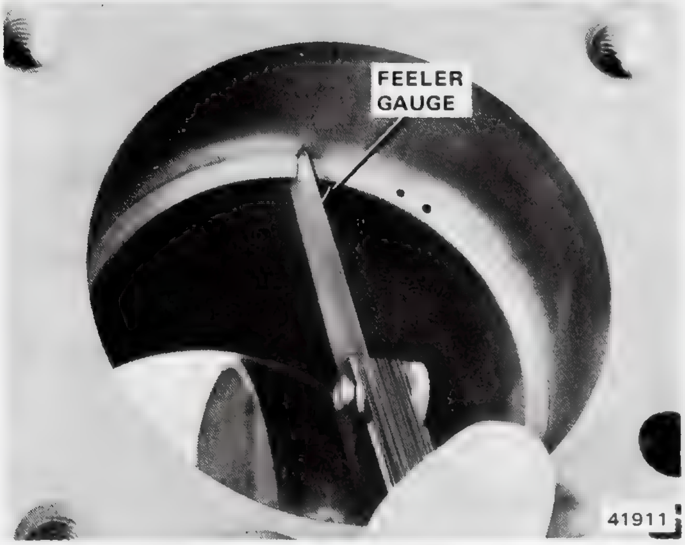

Fig. 1B-52 Ring Gap Clearance

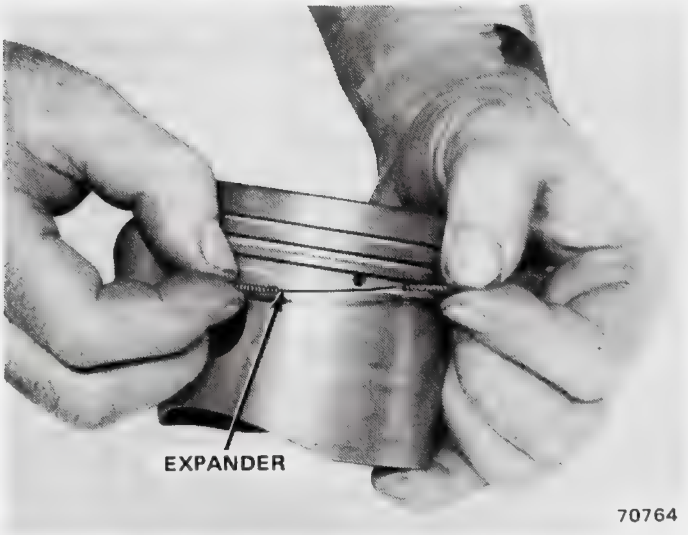

Fig. 1B-53 Oil Control Ring Expander Installation

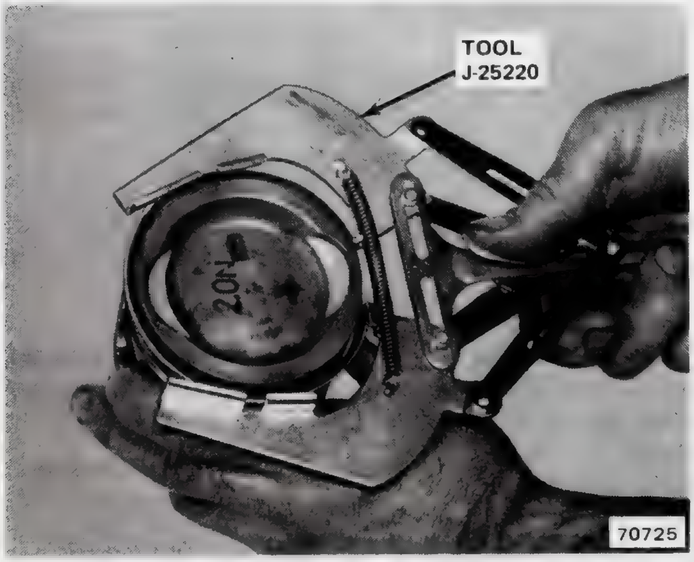

Fig. 1B-54 Compression Ring Installation

(2) Install lower compression ring using ring installer to expand ring around piston (fig. 1B-54).

(3) Install upper compression ring using ring installer to expand ring around piston (fig. 1B-54). Ring gap should be 180° from lower compression ring.

NOTE: *Make certain upper and lower compression rings are installed properly. Ring gap should not be above piston pin. Figure 1B-55 shows typical ring markings indicating the top side of the ring.*

Fig. 1B-55 Typical Ring Markings

Piston Pins

Piston pins are free-floating in piston and connecting rod. A spring clip is snapped into a groove at each end of the pin bore in the piston to retain the pin.

Removal

Using suitable punch, pry clip out of piston. A depression is provided for this purpose (fig. 1B-56). Be careful to not make burrs around the depression.

Fig. 1B-56 Prying Pin Clip from Piston

Pin Fitting

(1) Inspect pin and pin bore for nicks and burrs. Remove as necessary.

(2) With pin removed from piston, clean and dry piston pin bore and replacement piston pin.

(3) Position pin so that pin bore is in vertical position. Insert pin in bore. At room temperature, pin should slide completely through pin bore with very little pressure.

(4) Replace piston and pin if pin jams in pin bore.

Installation

(1) Install piston pin through piston and connecting rod.

(2) Install spring clip in groove at each end of pin bore.

CRANKSHAFT

The crankshaft is cast iron and is counterweighted and balanced. The crankshaft has eight counterweights, 5 main bearing journals and 4 connecting rod journals. End thrust is controlled by the No. 3 main bearing. Bearing inserts are steel-backed lead alloy. The component parts and crankshaft are individually balanced.

NOTE: *On engines equipped with automatic transmissions, mark the torque converter and converter flexplate prior to removal and install in the same position.*

Service replacement crankshafts, flywheels, torque converters and clutch components are balanced individually and may be replaced as required without balancing the complete assembly.

Replacement

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible.

(1) Remove engine from car.

(2) Remove rear crankshaft seal.

(3) Install engine to engine stand.

(4) Remove belt cover.

(5) Remove accessory drive pulley.

(6) Loosen camshaft drive belt tensioner and remove belt.

(7) Remove belt drive pulley from crankshaft using Crank Pulley Holding Wrench J-26867. Leave pulley attached to tool for assembly.

(8) Remove oil pump.

(9) Remove oil pan.

(10) Scrape oil pan gasket from block. Acetone may be used to aid in removing gasket.

(11) Remove oil pickup tube.

(12) Mark all connecting rod bearing caps with cylinder numbers.

(13) Remove caps from two connecting rods.

(14) Rotate crankshaft and remove remaining connecting rod caps.

(15) Remove all main bearing caps.

(16) Remove crankshaft.

(17) Remove and inspect crankshaft upper bearings.

(18) Remove and inspect connecting rod upper bearings.

(19) Wash replacement crankshaft in clean solvent.

(20) Install replacement bearings in connecting rods. Oil each insert.

(21) Install replacement crankshaft upper bearings. Oil each insert.

(22) Install crankshaft.

(23) Install replacement bearings in main bearing caps. Do not oil.

(24) Install all main bearing caps except number 1. Tighten caps 2, 3, and 4 to 79 newton-meters (58 foot-pounds) torque. Tighten cap 5 to 64 newton-meters (47 foot-pounds) torque.

NOTE: *Locating dowels in block ensure correct installation position of bearing caps.*

(25) Apply Plastigage to number 1 main bearing journal. Install cap and tighten to 79 newton-meters (58 foot-pounds) torque. Do not rotate crankshaft. Remove cap and check bearing clearance.

(26) Oil insert and install number 1 bearing cap. Tighten to 79 newton-meters (58 foot-pounds) torque.

(27) Plastigage remaining bearings, one at a time. Loosen only bearing cap being checked. Oil insert before final torquing.

(28) Push all connecting rods up into cylinders to clear crankshaft rod journals. Rotate crankshaft. It must not bind.

(29) Pull two connecting rods down against journals.

(30) Apply Plastigage to journals.

(31) Install replacement bearings in rod caps. Do not oil. Install caps and torque to specification. Remove caps and check clearance.

(32) Oil inserts and install. Tighten nuts to 55 newton-meters (41 foot-pounds) torque.

(33) Rotate crankshaft and pull remaining connecting rods down into position.

(34) Perform Plastigage check on remaining bearing journals.

(35) Apply oil to inserts prior to final torquing.

(36) Install replacement oil pan side gaskets. Install replacement front and rear seals. Apply AMC Gasket-in-a-Tube or equivalent to junction of side gaskets and end seals.

(37) Thoroughly clean oil pickup tube.

(38) Install pickup tube. Apply Loctite or equivalent to screw in main bearing cap. Crimp lockplate around heads of flange screws (fig. 1B-57).

(39) Remove gasket and seal from oil pump.

(40) Install replacement gasket and seal to oil pump. Lubricate lip of seal.

(41) Install oil pump. Slots in oil pump must engage tabs on crankshaft.

(42) Install oil pan.

(43) Install camshaft belt drive sprocket. Roll pin in crankshaft must align with hole in pulley. Torque crankshaft screw to specification. Remove Holding Wrench.

(44) Install accessory drive pulley. Roll pin in camshaft belt drive sprocket must align with hole in accessory pulley.

(45) Turn crankshaft until timing mark is on TDC.

(46) Turn camshaft to align timing mark on sprocket with timing pointer on cylinder head cover.

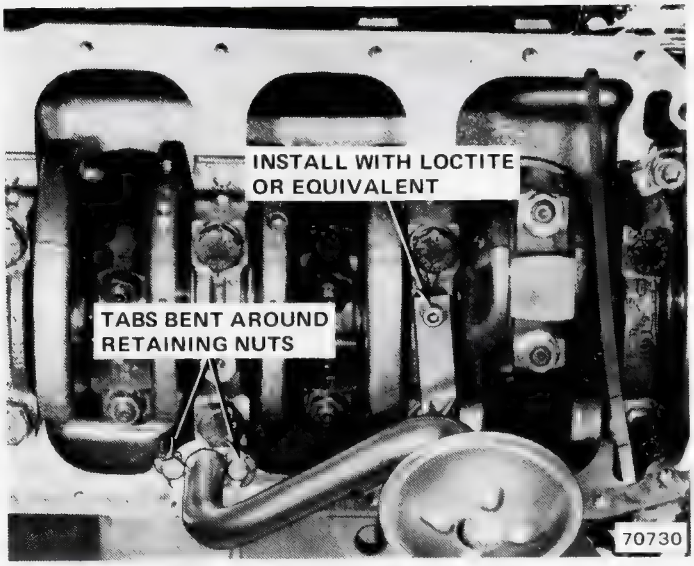

Fig. 1B-57 Installing Oil Pickup Tube

(47) Install camshaft drive belt. Adjust tension.
(48) Install belt guard.
(49) Remove engine from stand.
(50) Install replacement rear crankshaft seal. Lubricate lip of seal. Outside diameter requires no sealant.
(51) Install engine in car.

Crankshaft End Play Measurement

The crankshaft end play is controlled at the No. 3 main bearing insert which is flanged for this purpose.

(1) Attach dial indicator to cylinder block adjacent to No. 3 main bearing (fig. 1B-58).

(2) Pry shaft forward with flat-bladed screwdriver, set dial indicator push rod on face of crankshaft counterweight and set to zero.

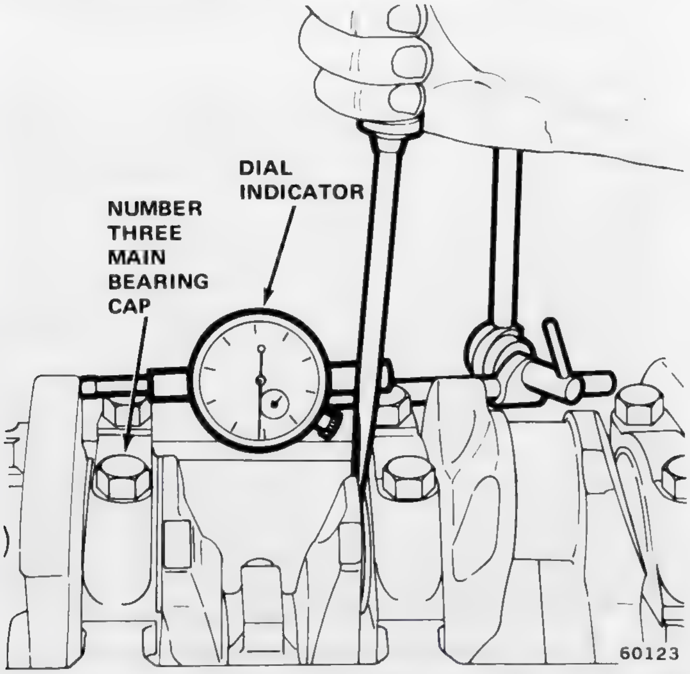

Fig. 1B-58 Measuring Crankshaft End Play

(3) Pry shaft fore and aft. Read dial indicator. End play is difference between high and low readings.

(4) If end play is out of specifications, inspect crankshaft thrust faces for wear. If no wear is apparent, replace thrust bearing and check end play. If end play is still out of specifications, replace crankshaft.

NOTE: *When replacing the thrust bearings, pry the crankshaft fore and aft to align the faces of the thrust bearings before final torque tightening.*

Crankshaft Main Bearings

Crankshaft main bearings are serviced only in the sizes listed in the Main Bearing Sizes chart. Selective fitting is not possible. Bearings are identified by the step number stamped on the back.

Main Bearing Sizes

Identification	Size
Step 01	Standard
Step 02	0.25 mm Undersize
Step 03	0.50 mm Undersize
Step 04	0.75 mm Undersize

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Removal

(1) Drain engine oil.
(2) Remove oil pan.
(3) Remove oil pickup tube.
(4) Remove main bearing cap and insert.
(5) Remove lower insert from bearing cap.
(6) Remove upper insert by loosening all of other bearing caps and inserting small cotter pin in crankshaft oil hole. Bend cotter pin as shown in figure 1B-59.
(7) With pin place, rotate crankshaft so that upper bearing insert will rotate in direction of its locking tab.

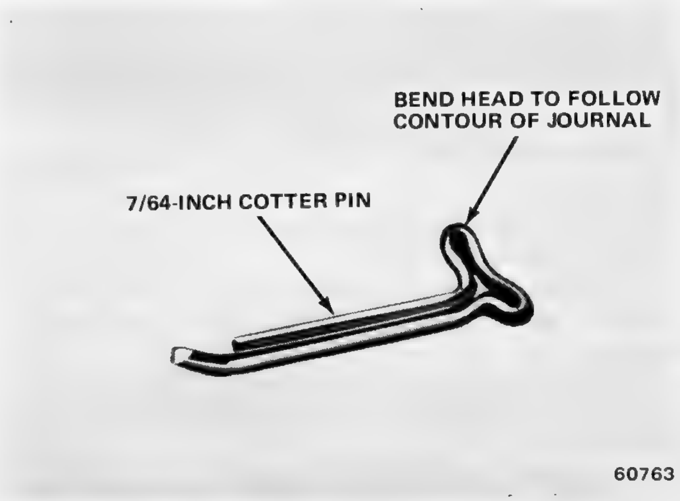

Fig. 1B-59 Upper Main Bearing Removal Tool

NOTE: *Since there is no hole in the No. 3 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing (fig. 1B-60). After moving the insert approximately one inch, remove the insert by applying pressure under the tab.*

(8) In the same manner, remove remaining bearings one at a time for inspection.

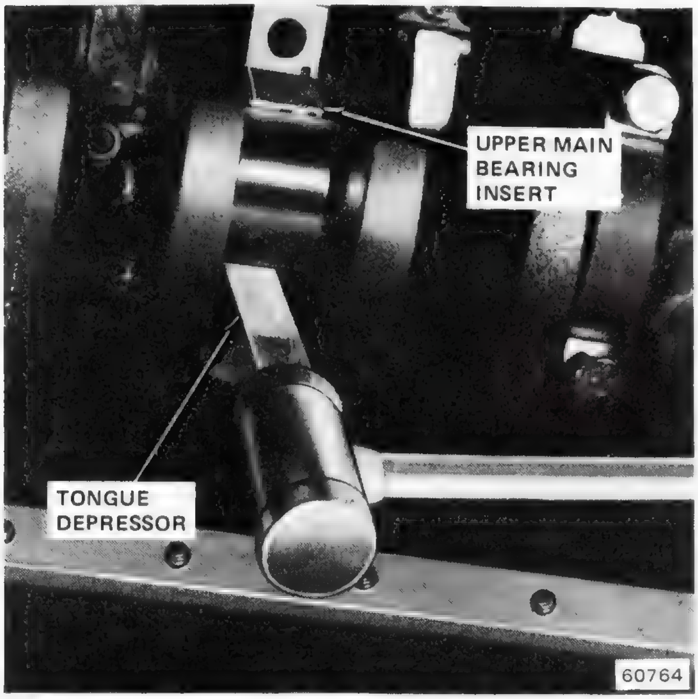

Fig. 1B-60 Removing No. 3 Main Bearing Insert

Inspection

(1) Wipe lower insert clean and inspect for abnormal wear pattern and for dirt or metal imbedded in lining. A normal main bearing wear pattern is shown in figure 1B-61.

NOTE: *If the crankshaft journal is scored, remove the engine for crankshaft repair.*

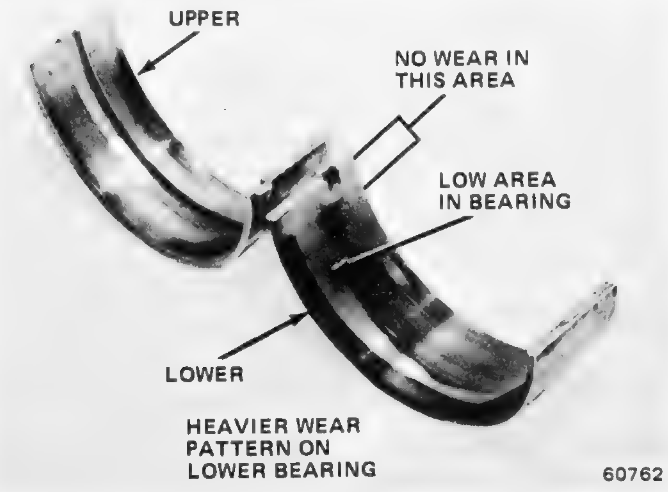

Fig. 1B-61 Normal Main Bearing Wear Pattern

(2) Inspect back of insert for fractures, scrapings or irregular wear pattern.

(3) Inspect locking tabs for damage.

(4) Replace bearing inserts that are damaged or worn.

Measuring Bearing Clearance with Plastigage (Crankshaft Installed)

NOTE: *Check clearance of one bearing at a time. All other bearings must remain tightened.*

(1) Remove main beaing cap and insert.

(2) Clean insert and exposed portion of crankshaft journal.

(3) Place strip of Plastigage across full width of bearing insert.

(4) Install bearing cap and tighten screws to 79 newton-meters (58 foot-pounds) torque.

(5) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope (fig. 1B-62). The Plastigage should maintain the same size across the entire width of the insert. If size varies, it may indicate a tapered journal or dirt trapped behind the insert.

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading. Plastigage must not crumble. If brittle, obtain fresh stock.*

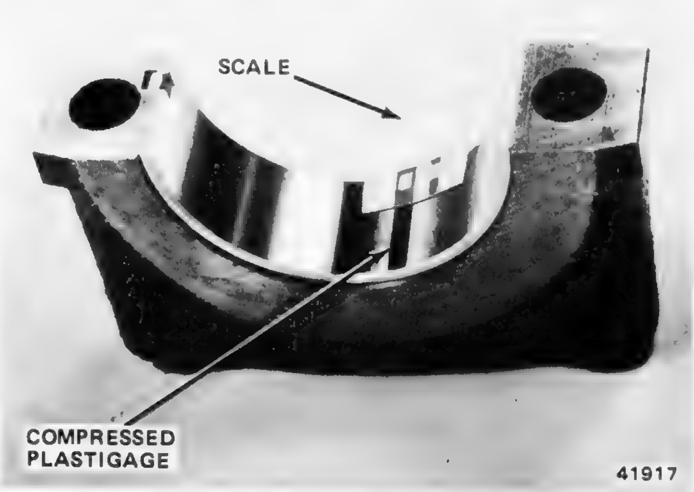

Fig. 1B-62 Checking Main Bearing Clearance with Plastigage

(6) If correct clearance is indicated, proceed to Installation.

(7) If oil clearance exceeds specification, measure crankshaft journal with micrometer. If journal size is correct, crankshaft bore of cylinder block may be misaligned which requires cylinder block replacement or machining to true bore. If journal size is incorrect, replace crankshaft or grind to accept suitable undersize bearing.

Measuring Main Bearing Journal with a Micrometer (Crankshaft Removed)

(1) Clean main bearing journal.

(2) Measure maximum diameter of journal with micrometer. Take two readings 90° apart at each end of journal.

(3) If journal diameter is outside specification, grind to accept undersize bearing.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Loosen all main bearing caps and install main bearing upper insert(s).

(3) Install main bearing cap(s) and lower insert(s). Tighten screws alternately to final torque. Tighten hex head screws to 79 newton-meters (58 foot-pounds) torque. Tighten socket head screws to 64 newton-meters (47 foot-pounds) torque. Rotate crank after tightening each main cap to make sure crankshaft rotates freely.

NOTE: *When installing a crankshaft kit (crankshaft plus bearing inserts), check each bearing for fit with Plastigage.*

(4) Install oil pickup tube. Apply Loctite or equivalent to screw in bearing cap. Bend locking tab around screw heads on flange.

(5) Install oil pan, using replacement gaskets and seals. Apply AMC Gasket-in-a-Tube, or equivalent, to joints between seals and gaskets.
Tighten drain plug securely.

(6) Fill crankcase with clean oil to specified level.

Crankshaft Rear Oil Seal

The rear main bearing crankshaft oil seal consists of a single piece of neoprene with a single lip that effectively seals the rear of the crankshaft.

Replacement

(1) Remove transmission.

(2) If equipped with manual transmission, remove pressure plate and flywheel.

(3) Remove seal with Seal Remover J-26868.

(4) Wipe lips of replacement seal with clean engine oil.

(5) Drive seal into position with Installer J-26834 (fig. 1B-63).

NOTE: *Drive seal into recess until it bottoms. When installed correctly, the seal is about 1/32 inch below the surface of the block.*

(6) Install flywheel, pressure plate and transmission.

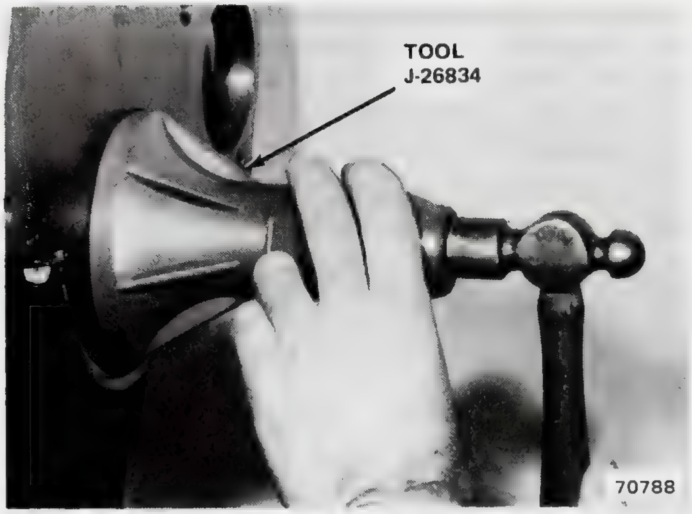

Fig. 1B-63 Crankshaft Rear Oil Seal

CYLINDER BLOCK

Disassembly

(1) Remove engine as outlined under Engine Removal.

(2) Remove crankshaft rear oil seal.

(3) Place engine assembly on engine stand.

(4) Remove cam drive belt guard.

(5) Remove accessory drive pulley.

(6) Remove cam drive belt.

(7) Remove cylinder head and manifolds as an assembly.

(8) Remove water pump.

(9) Position pistons, two at a time, near bottom of stroke and remove ridge at top of cylinder wall with ridge reamer.

(10) Drain oil and remove oil pan and gaskets.

(11) Remove oil pump.

(12) Remove oil pickup tube.

(13) Mark connecting rods and bearing caps. Remove bearing caps and inserts.

(14) Remove piston and connecting rod assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod studs do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over the rod studs will prevent damage to the cylinder bores or crankshaft.*

(15) Remove main bearing caps and inserts.

(16) Remove crankshaft.

Cylinder Bore Reconditioning

Resurfacing Cylinder Bore

CAUTION: *Do not use rigid type hones to remove cylinder glaze. A slight amount of taper always exists in cylinder walls after engine has been in service.*

(1) Use expanding hone to true cylinder bore and to remove glaze for faster ring seating. Move hone up and down at sufficient speed to produce a uniform 60° angle crosshatch pattern on cylinder walls. Do not use more than ten strokes per cylinder (a stroke is one down-and-up movement).

CAUTION: *Protect engine bearings and lubrication system from abrasives.*

(2) Scrub cylinder bores clean with solution of hot water and detergent.

(3) Immediately apply light engine oil to cylinder walls. Wipe with clean, lint-free cloth.

Assembly

(1) Install upper main beaing inserts in cylinder block.

(2) Install crankshaft.

(3) Install main bearing caps and inserts. Apply oil to insert before installing. Plastigage all bearings if replacement bearings or crankshaft have been installed.

(4) Clean cylinder bores thoroughly. Apply light film of clean engine oil to bores with clean, lint-free cloth.

(5) Position piston rings on piston as outlined under Piston Rings.

(6) Lubricate piston and rings with clean engine oil.

(7) Use Piston Installer J-26836 to install connecting rod and piston assemblies through top of cylinder bores (fig. 1B-42).

NOTE: *Be careful that connecting rod studs do not scratch the connecting rod journals or cylinder walls. Short lengths of rubber hose slipped over the connecting rod studs will provide protection during installation.*

(8) Install connecting rod bearing caps and inserts. Observe markings made earlier. Apply oil to inserts before installing.

(9) Install oil pick-up tube and replacement gasket. Apply Loctite or equivalent to capscrew holding bracket to bearing cap. Install lock plate and screws to pickup tube. After tightening screws, bend ears on lock plate to retain screws (fig. 1B-57).

(10) Install oil pan using replacement gaskets.

(11) Install oil pump and replacement oil seal.

(12) Install head and replacement gasket.

(13) Install water pump.

(14) Install cam drive belt and adjust.

(15) Install cam drive belt shield.

(16) Install cylinder head cover and replacement gaskets.

(17) Install intake and exhaust manifolds. Use replacement gaskets.

(18) Install engine as outlined under Engine Installation.

SPECIFICATIONS

Four-Cylinder Engine Specifications

Type	In Line, OHC, Four Cylinder
Bore	8.65 cm (3.41 in)
Stroke	8.44 cm (3.32 in)
Displacement	1984 cm^3 (121 in^3)
Compression Ratio	8.2:1
Compression Pressure, Desired	800-1100 kPa (116-160 lb/in^2)
Compression Pressure, Minimum	600 kPa (87 lb/in^2)
Maximum Variation Between Cylinders	300 kPa (44 lb/in^2)
Firing Order	1-3-4-2
Taxable Horsepower	18.5
Fuel	Unleaded
Camshaft	
Fuel Pump Eccentric Diameter	3.17-3.23 cm (1.25-1.27 in)
Tappet Clearance	
Intake — Hot	0.15-0.22 mm (0.006-0.009 in)
Exhaust — Hot	0.40-0.48 mm (0.016-0.019 in)
End Play	0.05-0.16 mm
Bearing Clearance	
No. 1	0.100-0.050 mm (0.004-0.002 in)
No. 2, 3, 4 & 5	0.082-0.040 mm (0.003-0.002 in)
Bearing Journal Diameter	
No. 1	3.1950-3.1925 cm (1.2579-1.2569 in)
No. 2, 3, 4 & 5	2.5960-2.5939 cm (1.0220-1.0212 in)
Base Circle Runout	0.04 mm (0.0016 in)

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Four-Cylinder Engine Specifications (Continued)

Cam Lobe Lift	
Intake	10.2 mm (0.40 in)
Exhaust	9.7 mm (0.38 in)
Intake Valve Timing (at 0.152 mm [0.006 in] lift)	
Opens	41.8° BTDC
Closes	77.8° ABDC
Exhaust Valve Timing	
Opens	75.3° BBDC
Closes	63.3° ATDC
Valve Overlap	105°
Intake Duration	299.5°
Exhaust Duration	318.6°

Connecting Rods

Total Weight (less bearings)	815-927 grams (28.7-32.7 ounces)
Maximum Variation Between Rods	8 grams (0.28 ounces)
Total Length (center to center)	14.395-14.405 cm (5.667-5.671 in)
Piston Pin Bore Diameter (with bushing)	2.4018-2.4012 cm (0.9456-0.9454 in)
Connecting Rod Bore (less bearings)	5.1619-5.1600 cm (2.0322-2.0315 in)
Bearing Clearance (diametral)	0.019 to 0.037 mm (0.0007 to 0.0029 in)
Maximum Twist between Bores	0.15 mm measured at 100 mm (0.0059 in measured at 3.9 in)
Side Clearance	0.05-0.31 mm (0.002 to 0.12 in)

Crankshaft

End play (at No. 3)	0.10 to 0.19 mm (0.0039 to 0.0075 in)
Main Bearing Journal Diameter	6.3960 to 6.3975 cm (2.1581 to 2.1587 in)
Main Bearing Journal Width	
No. 1	2.683 to 2.617 cm (1.056 to 1.030 in)
No. 2	2.821 to 2.800 cm (1.111 to 1.102 in)
No. 3	2.804 to 2.800 cm (1.104 to 1.102 in)
No. 4	2.821 to 2.800 cm (1.111 to 1.102 in)
No. 5	2.821 to 2.800 cm (1.111 to 1.102 in)
Main Bearing Clearance (diametral)	0.025 to 0.079 mm (0.00098 to 0.00311 in)
Connecting Rod Journal Diameter	4.7960 to 4.7975 mm (1.8882 to 1.8888 in)
Connecting Rod Journal Width	2.821 to 2.800 cm (1.111 to 1.102 in)
Connecting Rod Bearing Clearance (diametral)	0.019 to 0.073 mm (0.0007 to 0.0024 in)
Maximum Out-of-Round (main journals)	0.006 mm (0.0002 in)
Maximum Out-of-Round (rod journals)	0.008 mm (0.0003 in)
Maximum Taper (all journals)	0.01 mm max (0.0004 in max)

Cylinder Block

Deck Height	23.11 to 23.125 cm (9.098 to 9.104 in)
Deck Clearance	
Min. below block	3.96 mm (0.156 in)
Cylinder Bore	8.6505-8.635 cm (3.4057-3.3996 in)
Cylinder Block Flatness	0.05 mm maximum (0.002 in maximum)

Cylinder Head

Combustion Chamber Volume	4.4 to 4.6 cm^3 (0.27 to 0.28 in^3)
Valve Arrangement	IE-IE-IE-IE
Valve Guide Inside Diameter	0.9000-0.9022 cm (0.3543-0.3552 in)
Valve Stem to Guide Clearance (diametral)	
Intake	0.067 to 0.030 mm (0.0026 to 0.0012 in)
Exhaust	0.077 to 0.040 mm (0.0030 to 0.0016 in)
Intake Valve Seat Angle	45°
Exhaust Valve Seat Angle	45°
Valve Seat Width	
Intake	2.0 mm (0.079 in)
Exhaust	2.4 mm (0.094 in)
Valve Seat Runout	0.03 mm (0.001 in)
Tappet Bore Diameter	3.8500 to 3.8525 cm (1.5157 to 1.5167 in)

Four-Cylinder Engine Specifications (Continued)

Lubrication System

Oil Capacity	
Without Filter	3.312 litres (3.500 quarts)
With Filter	4.258 litres (4.499 quarts)
Normal Operating Pressure	193 kPa min. (28.5 psi) at sending unit @ 2000 rpm @ 80°C (176°F)
Oil Pressure Relief	780 kPa maximum (113 lb/in^2 maximum)
Gear Clearance	
Axial	0.02 to 0.07 mm (0.0008 to 0.0028 in)
Backlash	0.00-0.13 mm (0.000-0.005 in)

Pistons

Weight (less pin)	443-474 grams
Maximum Variation Between Pistons	8 grams
Piston Pin Bore-to-Piston Top	4.06 to 4.08 cm (1.598 to 1.606)
Piston to Bore Clearance (diametral) (Measured 68.1 mm [2.68 in] below top of block and 9.9 mm [0.39 in] from bottom of piston)	0.018 to 0.042 mm (0.0007 to 0.0017 in)
Piston Ring Gap Clearance	
Top Compression	0.25 to 0.45 mm (0.010 to 0.018 in)
Bottom Compression	0.25 to 0.45 mm (0.010 to 0.018 in)
Oil Control Rails	0.25 to 0.40 mm (0.010 to 0.016 in)
Piston Ring Side Clearance	
Top Compression	0.030 to 0.062 mm (0.0012 to 0.0024 in)
Bottom Compression	0.030 to 0.062 mm (0.0012 to 0.0024 in)
Oil Control	0.030 to 0.062 mm (0.0012 to 0.0024 in)
Piston Ring Groove Height	
Compression No. 1	2.02 to 2.04 mm (0.0795-0.0803 in)
Compression No. 2	2.52 to 2.54 mm (0.0992-0.1000 in)
Oil Control	5.02 to 5.04 mm (0.1976-0.1984 in)
Piston Ring Groove Diameter	
Compression No. 1	7.81 to 7.83 cm (3.075 to 3.083 in)
Compression No. 2	7.770 to 7.750 cm (3.059 to 3.051 in)
Oil Control	7.68 to 7.77 cm (3.024 to 3.059 in)
Piston Pin Bore Diameter	2.4002-2.4006 cm (0.9450-0.9451 in)
Piston Pin Diameter	2.3996 to 2.4000 cm (0.9447 to 0.9449 in)
Piston-to-Pin Clearance	0.004 to 0.008 mm (0.00016 to 0.00031 in)
Pin-to-Connecting Rod Clearance	0.012 to 0.022 mm (0.00047 to 0.00087 in)

Tappets

Tappet Diameter	3.845-3.847 cm (1.5138-1.5146 in)
Tappet Bore Diameter	3.850-3.8525 cm (1.5157-1.5167 in)
Tappet-to-Bore Clearance	0.030-0.075 mm (0.0012-0.0030 in)

Valves

Valve Length	
Intake	13.74-13.69 cm (5.409-5.390 in)
Exhaust	13.715-13.765 cm (5.400-5.419 in)
Valve Stem Diameter	
Intake	0.8970-0.8955 cm (0.3531-0.3526 in)
Exhaust	0.8960-0.8945 cm (0.3528-0.3522 in)
Stem-to-Guide Clearance (Dial Indicator Method)	
Intake	0.8 mm (0.031 in)
Exhaust	1.0 mm (0.039 in)
Intake Valve Head Diameter	3.80-3.77 cm (1.496-1.484 in)
Intake Valve Face Angle	45° 20′
Exhaust Valve Head Diameter	3.30 to 3.27 cm (1.299 to 1.287 in)
Exhaust Valve Face Angle	45° 20′

70782C

Four-Cylinder Engine Specifications (Continued)

Valve Springs	
Intake — Outer	
Free Length	4.918 cm (1.936 in)
Tension — Valve Open	75.5 Kg @ 3.3 cm (166.46 lb @ 1.30 in)
Tension — Valve Closed	24.2 Kg @ 4.32 cm (53.35 lb @ 1.70 in)
Inside Diameter	2.445-2.475 cm (0.963-0.974 in)
Intake — Inner	
Free Length	5.075 cm (1.998 in)
Tension — Valve Open	17.7 Kg @ 2.76 cm (39.02 lb @ 1.09 in)
Tension — Valve Closed	7.95 Kg @ 3.78 cm (17.52 lb @ 1.49 in)
Inside Diameter	1.685-1.715 cm (0.663-0.675 in)
Exhaust — Outer	
Free Length	4.918 cm (1.936 in)
Tension — Valve Open	72.7 Kg @ 3.35 cm (160.28 lb @ 1.32 in)
Tension — Valve Closed	24.2 Kg @ 4.32 cm (53.35 lb @ 1.70 in)
Inside Diameter	2.445-2.475 cm (0.963-0.974 in)
Exhaust — Inner	
Free Length	5.075 cm (1.998 in)
Tension — Valve Open	16.85 Kg @ 2.81 cm (37.15 lb @ 1.11 in)
Tension — Valve Closed	7.95 Kg @ 3.78 cm (17.52 lb @ 1.49 in)
Inside Diameter	1.685-1.715 cm (0.663-0.675 in)

70782D

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (foot-pounds)	
	Service Set-To Torques	Service In-Use Recheck Torques	Service Set-To Torques	Service In-Use Recheck Torques
Alternator and Air Pump Rear Bracket Screw	22	19-25	16	14-16
Alternator Front Bracket to Head Nut	19	16-22	14	12-16
Camshaft Bearing Cap Nuts	18	16-19	13	12-14
Camshaft Belt Tensioning Idler Screw	39	33-45	29	25-33
Camshaft Drive Belt Cover Screw	9	8-11	7	6-8
Camshaft Drive Sprocket to Crankshaft Screw	245	208-282	181	154-208
Camshaft Rear Bearing Cap Screw	9	8-11	7	6-8
Camshaft Sprocket to Camshaft	79	67-91	58	49-67
Clutch or Converter Housing to Block Screw	73	62-84	54	46-52
Connecting Rod Cap to Rod	55	51-60	41	38-44
Crankshaft Bearing Cap - Hex Head	79	67-91	58	49-67
Crankshaft Rear Bearing Cap Screw - Socket Head	64	54-74	47	40-54
Crank Pulley to Crank Sprocket	20	17-23	15	13-17
Cylinder Head to Block Screw - cold	88	75-101	65	55-75
Cylinder Head to Block Screw - warm	108	92-124	80	68-92
Cylinder Head Cover Nut	5.7	4.8-6.6	50 in-lb	42-58 in-lb
Distributor Clamp Nut	20	19-22	15	14-16
Distributor Drive Housing Screw	9	8-11	7	6-8
Drive Plate to Converter Screw	35	30-40	26	22-30
Drive Plate to Crankshaft	88	75-101	65	55-75
Exhaust Manifold to Head Locknut	24	20-28	18	15-21
Fan Pulley Screw	19	16-22	14	12-16
Flywheel to Crankshaft	88	75-101	65	55-75
Fuel Pump to Head Screw	19	16-22	14	12-16
Heat Shroud to Exhaust Manifold Nut and Screw	24	20-28	18	15-21
Intake Manifold to Head Nut	24	20-28	18	15-21
Intake Manifold Support Screw and Nut	41	35-47	30	25-35

70743A

Torque Specifications (Continued)

Oil Filter to Stud - Lubricated	21	17-25	15	12-18
Oil Inlet Tube Flange to Block Screw	9	8-11	7	6-8
Oil Pan Drain Plug	39	33-45	29	25-33
Oil Pan Screw - Side	7.9	6.7-9.1	70 in-lb	60-80 in-lb
Oil Pan Screw - Front and Rear	10.2	8.7-11.7	90 in-lb	76-104 in-lb
Oil Pressure Sending Unit	12	10-14	9	8-10
Oil Pump to Block Screw	9.8	8.4-11.3	87 in-lb	74-100 in-lb
Oil Pump Cover to Housing - Phillips	7.8	6.7-8.9	69 in-lb	59-79 in-lb
Oil Pump Pressure Relief Cap	47	40-54	35	30-40
Power Steering Pump Bracket to Block Front and Rear	45	38-52	33	28-38
Power Steering Pump Bracket to Block Front	22	19-25	16	14-18
Power Steering Pump Bracket to Block Rear	45	38-52	33	28-38
Power Steering Pump Pivot Nut	38	32-44	28	24-32
Spark Plug	30	25-35	22	19-25
Starting Motor - Nut	45	38-52	33	28-38
Starting Motor - Screw	73	62-84	54	46-62
Thermostat Housing to Head Screw	19	16-22	14	12-16
Thermostat Housing Screw	9	8-11	7	6-8
Water Outlet Adapter to Head Screw	9	8-11	7	6-8
Water Pump and Alternator Bracket Screw	22	19-25	16	14-18
Water Pump Screw - Small	9	8-11	7	6-8
Water Pump Screw - Large	22	19-25	16	14-18
Water Temperature Sending Unit	9.5	8.0-10.0	84 in-lb	71-97 in-lb

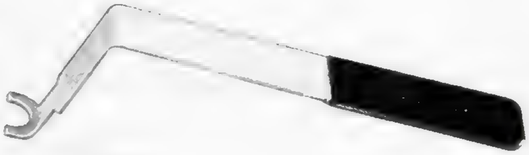
All torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

70743B

Special Tools


J-26810
TAPPET ADJUSTING
SCREW BIT


J-26811
VALVE STEM SEAL
INSTALLER


J-26854
VALVE STEM SEAL REMOVER


J-26860
TAPPET ADJUSTING
SCREW GAUGE


J-26809
VALVE SPRING COMPRESSOR

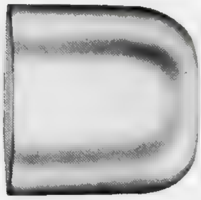

J-24239-01
HEAD BOLT WRENCH


J-26836
PISTON INSTALLER

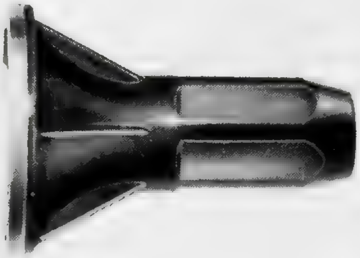

J-26867
CRANKSHAFT PULLEY
HOLDING WRENCH

Special Tools (Continued)

J-25220
PISTON RING
INSTALLER



J-26877
CRANKSHAFT FRONT
SEAL INSTALLER



J-26834
CRANKSHAFT REAR
SEAL INSTALLER

J-26868
CRANKSHAFT FRONT AND
REAR SEAL REMOVER

SIX-CYLINDER ENGINE

GENERAL

The 232 and 258 CID are six-cylinder, in-line, overhead valve engines (fig. 1B-65 and 1B-66). Both engines operate only on no-lead gasoline. Cylinders are numbered from front to rear. Firing order is 1-5-3-6-2-4. Crankshaft rotation is clockwise, viewed from the front. The crankshaft is supported by seven two-piece bearings. The camshaft is supported by four one-piece, line bored bearings.

The six-cylinder engine features a quench-head design. The combustion chamber shape, both in the head and in the piston crown compresses the combustion mixture closer to the spark plug. In most applications, this permits the use of more ignition timing advance for better fuel economy.

Because of the similarity of the 232 and 258 CID engines, service procedures have been consolidated and typical illustrations are used.

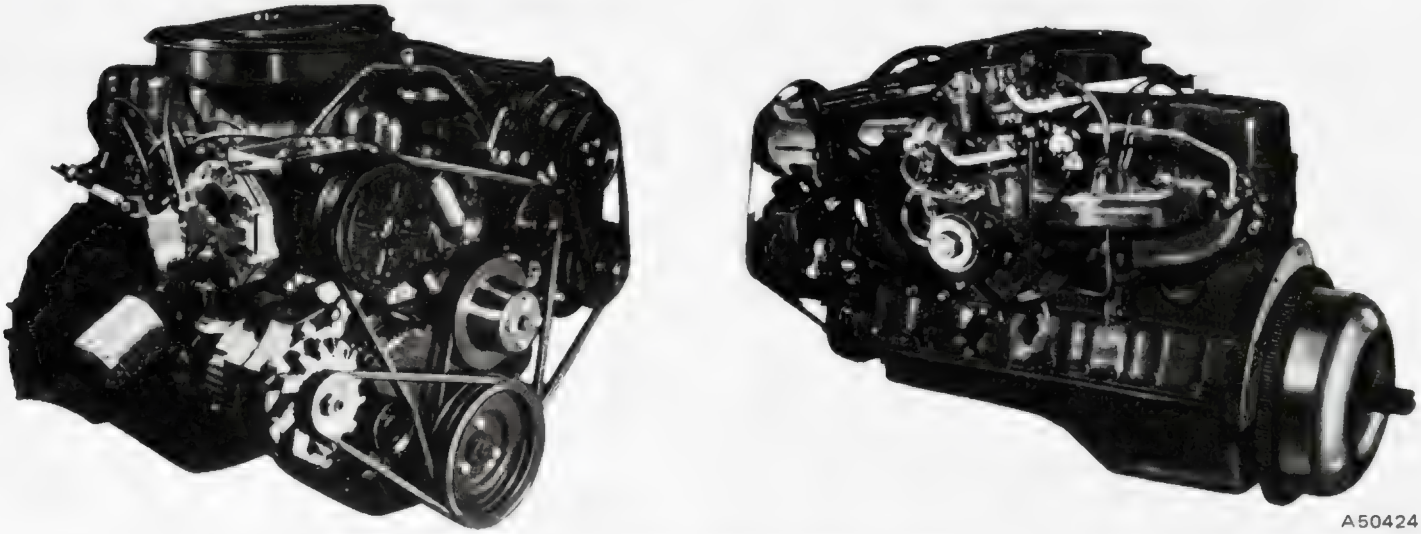


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Fig. 1B-65 Six-Cylinder Engine Assembly—Typical

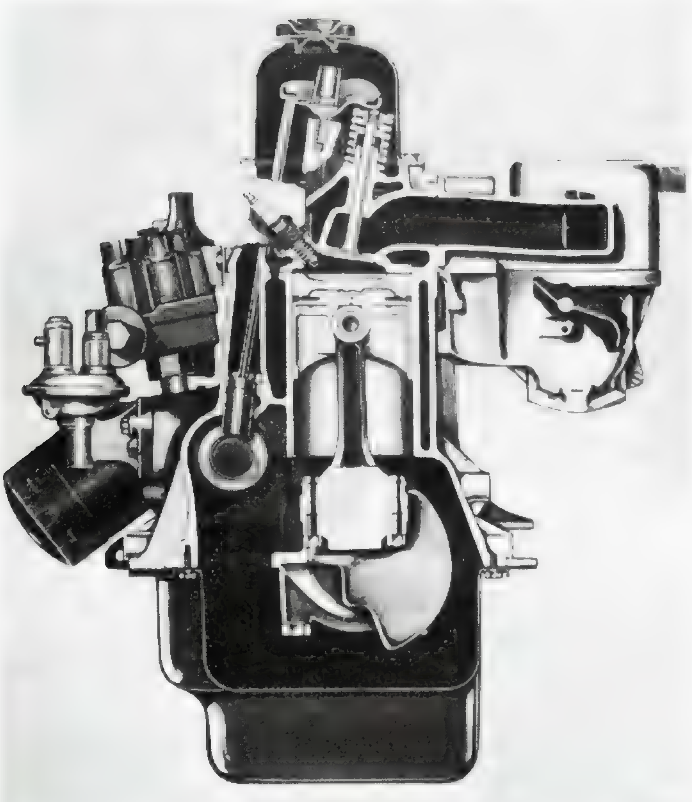

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Fig. 1B-66 Six-Cylinder Engine Assembly—Sectional View

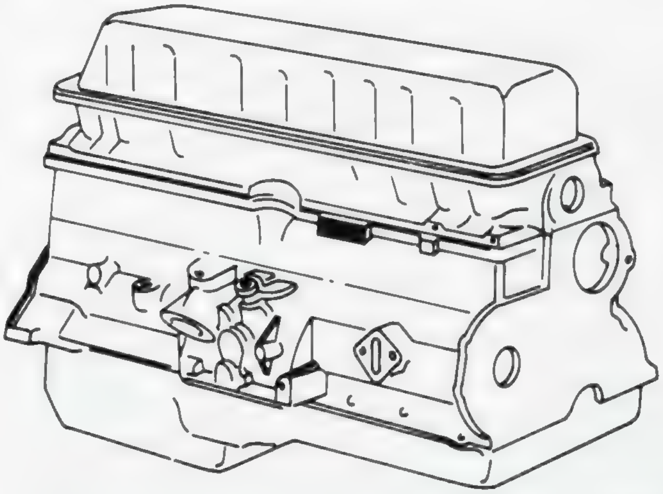

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Fig. 1B-67 Engine Build Date Location

Engine Build Date Code

Letter Code	CID	Carburetor	Comp. Ratio
A	258	1V	8.0:1
C	258	2V	8.0:1
E	232	1V	8.0:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
1 - 1977 2 - 1978	01 - 12	A, C, or E	01 - 31

EXAMPLE: 2 03 A 18

60257

Identification

Build Date Code

The engine Build Date Code is located on a machined surface on the right side of the block between the No. 2 and No. 3 cylinders (fig. 1B-67).

The numbers of the code identify the year, month and day that the engine was built.

The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

The example code identifies a 258 CID with 1V carburetor and 8.00:1 compression ratio built on March 18, 1978.

NOTE: *Engines built for sale in Georgia and Tennessee have an additional, nonrepeating number, located on the right side of the engine below the build date code.*

Example:

Kenosha-Built
E-1197277 or
W-1207177
Brampton (Canada)-Built
CO316477

Oversize or Undersize Components

Some engines may be built with oversize or undersize components such as oversize cylinder bores, undersize crankshaft main bearing journals, undersize connecting rod journals or oversize camshaft bearing bores. These engines are identified by a letter code stamped on a boss between the ignition coil and distributor (fig. 1B-68). The letters are decoded as follows:

Oversize or Undersize Components

Code Letter	Definition	
B	All cylinder bores	- 0.010-inch oversize
M	All crankshaft main bearing journals	- 0.010-inch undersize
P	All connecting rod bearing journals	- 0.010-inch undersize
C	All camshaft bearing bores	- 0.010-inch oversize

EXAMPLE: The code letters PM mean that the crankshaft main bearing journals and connecting rod journals are 0.010-inch undersize.

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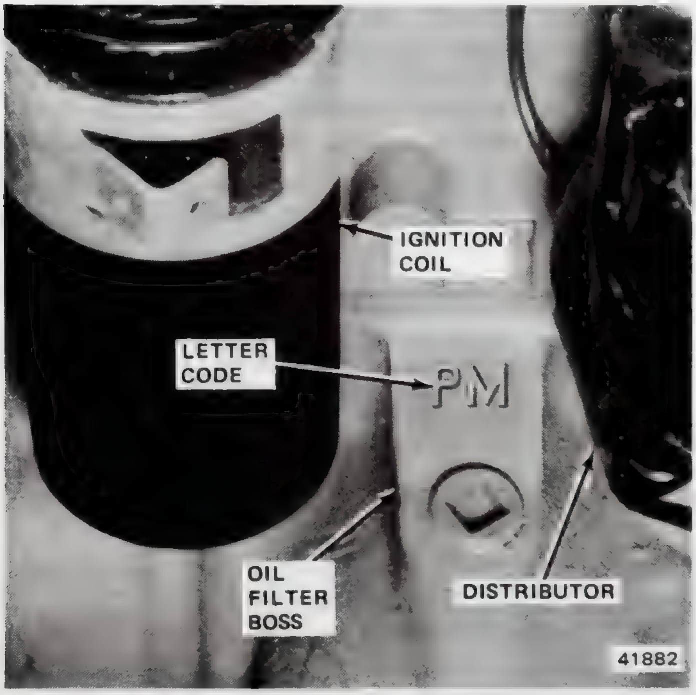


Fig. 1B-68 Oversize or Undersize Letter Code Location

SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly (short block) may be installed whenever the original engine block is worn or damaged beyond repair. It consists of engine block, piston and rod assemblies, crankshaft, camshaft, timing gears and chain.

NOTE: *Short engine assemblies have the letter S stamped on the same surface as the build date code for identification.*

Installation includes transfer of component parts from the worn or damaged original engine. Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this chapter.

ENGINE MOUNTING

Resilient rubber cushions support the engine and transmission at three points: at each side on the centerline of the engine and at the rear between the transmission extension housing and the rear support crossmember (fig. 1B-69). Replacement of a cushion may be accomplished by supporting the weight of the engine or transmission at the area of the cushion.

ENGINE HOLDING FIXTURE

If it is necessary to remove the front engine mounts and front crossmember to perform service such as oil pan removal, an engine holding fixture may be fabricated as illustrated in figure 1B-70.

ENGINE REMOVAL—GREMLIN-CONCORD-AMX-MATADOR

The engine is removed without the transmission.

(1) Remove radiator draincock and radiator cap to drain coolant.

(2) Mark hinge locations on hood panel for alignment during installation.

(3) Disconnect underhood lamp, if equipped, and remove hood.

(4) Disconnect battery cables. Remove battery on Gremlin, Concord and AMX.

(5) Disconnect wires from alternator.

(6) Disconnect ignition coil and distributor sensor leads. Disconnect oil pressure sender lead.

(7) Remove TCS switch bracket from block, if equipped.

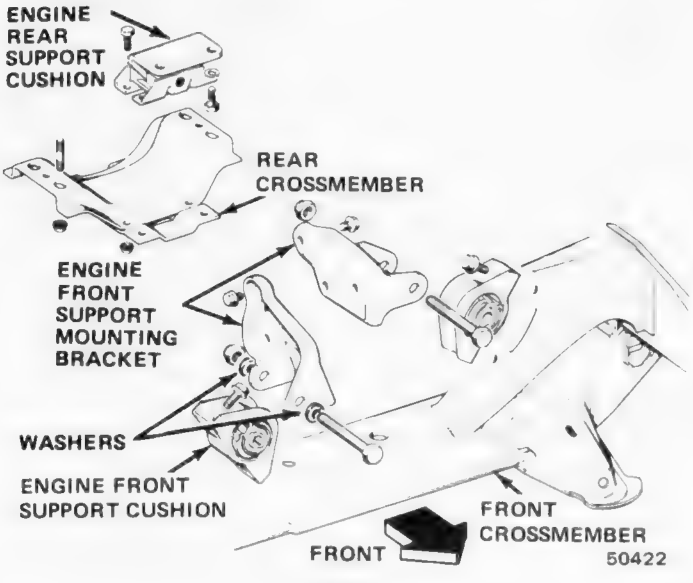
(8) Disconnect flexible fuel line from pump and insert plug.

(9) Disconnect engine ground strap. Remove right front engine support cushion-to-bracket screw.

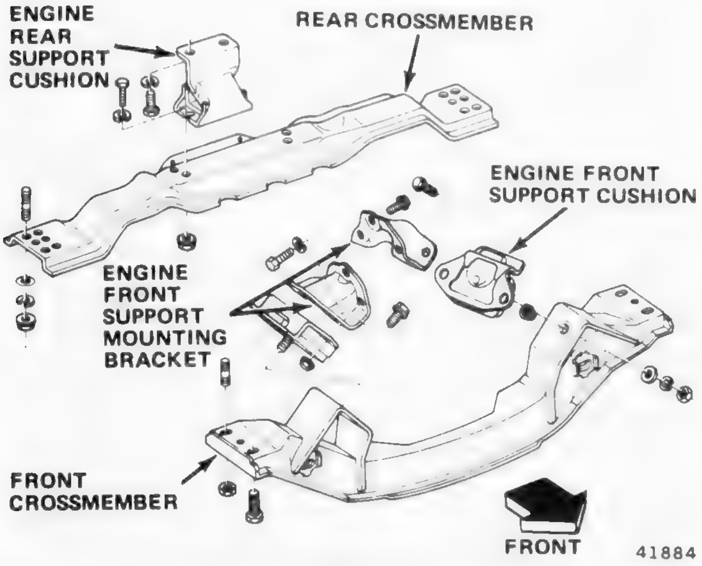
(10) If equipped with air conditioning:

(a) Remove service valve covers and front-seat valves.

(b) Loosen nuts attaching service valves to compressor head.



PACER



GREMLIN-CONCORD-AMX-MATADOR

Fig. 1B-69 Engine Mounting—Typical

(c) Bleed off compressor charge.

(d) Remove service valves and cap compressor ports and service valves.

(e) Disconnect clutch feed wire.

(11) Remove starter cable from starter motor.

(12) Remove air cleaner.

(a) Disconnect purge hose at canister.

(b) Disconnect TAC vacuum hose at manifold, if equipped.

(13) Disconnect throttle stop solenoid lead, if equipped.

(14) Disconnect return hose from fuel filter.

(15) Disconnect carburetor bowl vent hose from canister.

(16) Disconnect throttle cable and remove from bracket. Disconnect throttle valve rod, if equipped. Disconnect throttle rod at bellcrank.

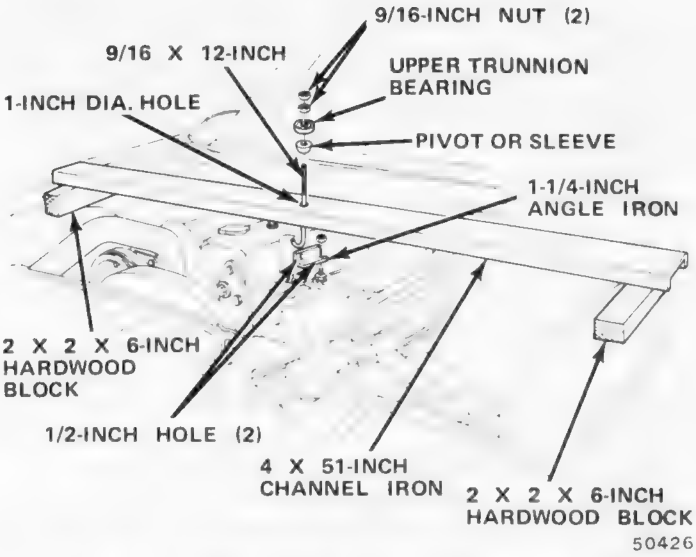


Fig. 1B-70 Engine Holding Fixture—Typical (Pacer shown)

(17) Disconnect heater or air conditioning vacuum hose from intake manifold, if equipped.

(18) Disconnect temperature sender wire and TCS vacuum solenoid wire harness.

(19) Disconnect upper and lower radiator hoses at radiator. Disconnect heater hoses from engine.

(20) Remove fan shroud screws.

(21) Disconnect transmission cooler tube fittings from radiator, if equipped.

(22) Remove radiator attaching screws. Remove radiator and shroud.

(23) Remove fan and spacer.

(24) Install 5/16 x 1/2-inch SAE capscrew through fan pulley into water pump flange to keep pulley and pump aligned when crankshaft is turned.

(25) Remove power brake vacuum check valve from booster, if equipped.

(26) If equipped with power steering:

(a) Disconnect power steering hoses from fittings at gear.

(b) Drain reservoir. Cap fittings on hoses and gear.

(27) Remove automatic transmission filler tube bracket screw, if equipped.

(28) Lift car and support with support stands.

(29) Remove starter motor.

(30) If equipped with automatic transmission:

(a) Remove converter housing spacer cover.

(b) Remove converter drive screws. Rotate crankshaft for access to each screw.

(c) Remove exhaust pipe support from converter housing. This also supports inner end of transmission linkage.

(31) If equipped with manual transmission:

(a) Remove clutch housing cover and clutch bell-crank inner support screws.

(b) Disconnect springs and remove bellcrank.

(c) Remove outer bellcrank-to-strut rod bracket retainer.

(d) Disconnect backup lamp switch wire harness under hood at dash panel for access to clutch housing screw.

(32) Remove engine mount cushion-to-bracket screws.

(33) Disconnect exhaust pipe from manifold.

(34) Remove upper converter (or clutch) housing screws and break bottom screws loose.

(35) Lift car and move support stands to jack pad area.

(36) Remove air conditioning idler pulley and mounting bracket, if equipped.

(37) Install lifting device to engine.

(38) Raise engine off front supports.

(39) Place support stand under converter (or clutch) housing.

(40) Remove remaining housing screws.

(41) Lift engine out of engine compartment.

ENGINE INSTALLATION—GREMLIN-CONCORD-AMX-MATADOR

(1) Lower engine into engine compartment.

(2) If equipped with manual transmission:

(a) Insert transmission shaft into clutch spline.

(b) Align clutch housing to engine. Install and tighten lower clutch housing screws.

(3) If equipped with automatic transmission:

(a) Align transmission converter housing to engine.

(b) Loosely install bottom converter housing screws. Install next-higher screw and nut on each side. Tighten all four screws.

(4) Remove support from transmission.

(5) Lower engine onto mount cushions, aligning screw holes. Install screws and tighten.

(6) Lift car and move supports to front of frame.

(7) Install seal and attach exhaust pipe to manifold. Install and tighten nuts.

(8) If equipped with manual transmission:

(a) Install clutch housing cover.

(b) Install clutch release bellcrank through bushing in strut rod bracket and install retainer.

(c) Install bellcrank-to-throwout lever rod to throwout lever and connect springs.

(d) Attach inner support bracket to clutch housing.

(e) Connect clutch pedal-to-bellcrank rod.

(f) Position backup lamp wiring at cowl and connect plug.

(9) If equipped with automatic transmission:

(a) Install converter drive screws. Turn crankshaft for access to each screw hole.

(b) Install converter housing spacer cover.

(c) Install exhaust pipe support.

(10) Install remaining converter or clutch housing screws.

(11) Install starter motor and connect cable.

(12) Lift car and remove support stands. Lower car to floor.

(13) Remove engine lifting device.

(14) Install air conditioning idler pulley and mounting bracket. Install air pump bracket. Tighten drive belts.

(15) Connect heater hoses and tighten clamps.

(16) Connect power steering hoses at gear.

(17) Remove capscrew and install fan blade and spacer.

(18) Install fan shroud and radiator.

(19) Connect radiator hoses and transmission cooler lines, if equipped.

(20) Connect throttle valve rod and retainer. Connect throttle cable and install rod. Install throttle valve rod spring.

(21) Install vacuum hose and check valve in brake booster.

(22) Connect air conditioning or heater vacuum hose to intake manifold, if removed.

(23) Connect temperature gauge wire.

(24) Connect throttle stop solenoid wire.

(25) Connect carburetor bowl vent hose to canister. Connect return line to fuel filter.

(26) Install transmission filler tube bracket screw.

(27) Install TCS solenoid control switch screw.

(28) Remove plug and connect flexible fuel line to pump with clamp.

(29) Connect alternator wiring.

(30) Install engine ground strap.

(31) Connect oil pressure sender wire.

(32) Connect ignition coil and distributor sensor wires. Install radio capacitor to coil bracket.

(33) If equipped with air conditioning:

(a) Connect clutch feed wire.

(b) Connect service valves to proper ports, using replacement seals. Tighten nuts to 28 foot-pounds (38 Nm) torque, lubricated.

(c) Back-seat service valves and install covers.

(d) Purge compressor of air.

(34) Connect TCS solenoid harness.

(35) Install coolant.

NOTE: *Remove temperature sender to permit air to bleed from block.*

(36) Fill power steering reservoir.

(37) Install battery, if removed. Connect battery cables.

(38) Start engine, check for leaks and check fluid levels. Correct fluid levels as required.

(39) Install air cleaner and connect purge hose at canister. Connect TAC vacuum hose, if equipped.

(40) Install and adjust hood. Connect underhood lamp, if equipped.

ENGINE REMOVAL—PACER

The engine and transmission are removed as an assembly.

(1) Mark hinge locations at hood panel for alignment during installation. Disconnect underhood lamp, if equipped. Remove hood assembly.

(2) Drain cooling system and crankcase.

(3) Disconnect heater and radiator hoses at engine.

(4) Run windshield wiper blade to center of windshield. This provides clearance for cylinder head cover removal.

(5) Remove battery.

(6) Disconnect automatic transmission oil cooler lines and cap, if equipped.

(7) Remove radiator assembly and fan shroud, if equipped.

(8) Remove radiator fan, spacer and pulley.

(9) If equipped with air conditioning:

(a) Turn both service valves clockwise to front-seated position.

(b) Bleed refrigerant charge from compressor by slowly loosening service valve fittings.

(c) Disconnect and cap condenser and evaporator lines from compressor and cap compressor service valve outlets.

(d) Disconnect receiver outlet at disconnect coupling.

(e) Remove condenser and receiver assembly.

(10) Remove air cleaner assembly.

(11) Disconnect wires at the following components, if equipped:

- Starter motor
- Coil terminals
- Distributor
- Alternator
- AC compressor
- Temperature sending unit
- Oil pressure sending unit
- Solenoid vacuum valve
- TCS Solenoid control switch (disconnect at right rear of cylinder head)
- Throttle stop solenoid
- Brake warning lamp switch

(12) Disconnect the following lines, if equipped:

- Fuel line from tank at fuel pump
- Vacuum line for power brake unit at intake manifold
- Fuel return line at fuel filter
- Pressure vent line at carburetor
- Vacuum line for heater damper doors at intake manifold
- Power steering pump (and plug at pump)

(13) Remove carburetor and seal intake manifold.

(14) Remove cylinder head cover.

(15) Remove vibration damper.

(16) Disconnect accelerator cable at accelerator control cable bracket.

(17) Raise and support car.

(18) Disconnect exhaust pipe at manifold.

(19) Disconnect transmission linkage and clutch linkage, if equipped.

(20) Disconnect speedometer cable at transmission.

(21) Remove propeller shaft and cap transmission output shaft.

(22) Support transmission with floor jack and remove rear crossmember.

(23) Attach lifting device and support engine assembly.

(24) Remove engine mount bracket-to-front support cushion attaching bolts.

(25) Lift engine slightly and remove front support cushions.

(26) Lower floor jack supporting transmission.

(27) Raise car with floor jack positioned under front crossmember until bottom of front bumper is approximately three feet from floor. Support car with support stands.

WARNING: *Be sure car is supported firmly.*

(28) Remove oil filter and starter.

(29) Lifting at point near front of cylinder head, partially remove engine assembly by pulling upward until rear of cylinder head clears cowl.

(30) Use floor jack to remove support stands and lower car.

(31) Remove engine assembly completely.

ENGINE INSTALLATION—PACER

(1) Raise car with floor jack positioned under front-crossmember until bottom of front bumper is approximately three feet from floor. Support car with support stands.

WARNING: *Be sure car is supported firmly.*

(2) Lower engine and transmission assembly slowly into engine compartment.

(3) Move lifting device back to center of cylinder head and support engine.

(4) Raise transmission into position with floor jack.

(5) Install rear crossmember.

(6) Using lifting device to position engine, install front support cushions. Tighten support cushion-to-crossmember bolts to 30 foot-pounds (41 Nm) torque and support cushion-to-engine mounting bracket bolts to 55 foot-pounds (75 Nm) torque.

(7) Install transmission linkage and clutch linkage, if removed.

(8) Install speedometer cable.

(9) Install propeller shaft.

(10) Install exhaust pipe.

(11) Install oil filter and starter.

(12) Lower car.

(13) Install vibration damper.

(14) Install cylinder head cover.

(15) Install carburetor.

(16) Install accelerator cable.

(17) Connect all lines disconnected in Engine Removal.

(18) Connect all wires disconnected in Engine Removal.

(19) Install air conditioning condenser and receiver assembly, if equipped, as follows:

(a) Connect receiver outlet to disconnect coupling.

(b) Connect condenser and evaporator lines to compressor.

(c) Purge compressor of air.

CAUTION: *Both service valves must be opened before the air conditioning system is operated.*

(20) Install radiator fan, spacer and pulley.

(21) Install radiator assembly and shroud, if removed.

(22) Connect automatic transmission oil cooler lines, if removed.

(23) Connect radiator and heater hoses.

(24) Fill cooling system, crankcase and transmission to specified levels.

(25) Install and align hood assembly. Connect underhood lamp, if equipped.

(26) Adjust transmission throttle linkage after completing engine installation.

VALVE TRAIN

General

The six-cylinder engine has overhead valves operated by push rods and rocker arms. A chain-driven camshaft is mounted in the cylinder block. Hydraulic valve tappets provide automatic valve lash adjustments.

Rocker Arm Assembly

The intake and exhaust rocker arms of each cylinder pivot on a bridged pivot which is secured with two capscrews as shown in figure 1B-71. The bridged pivot maintains correct rocker arm-to-valve tip alignment. Each rocker arm is actuated by a hollow steel push rod with a hardened steel ball at each end. The hollow push rods channel oil to the rocker arm assemblies.

Removal

(1) Remove cylinder head cover and gasket.

(2) Remove two capscrews at each bridged pivot. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove bridged pivots and corresponding pairs of rocker arms and place on bench in same order as removed.

(4) Remove push rods and place on bench in same order as removed.

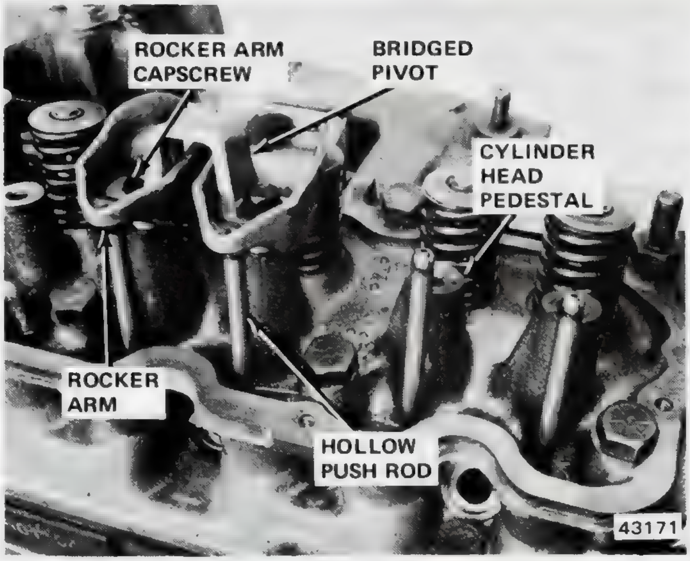


Fig. 1B-71 Rocker Arm Assembly

Cleaning and Inspection

Clean all parts with a cleaning solvent and use compressed air to blow out oil passages in the rocker arms and push rods.

Inspect the pivot surface of each rocker arm and bridged pivot. Replace any parts which are scuffed, pitted or excessively worn. Inspect valve stem tip contact surface of each rocker arm and replace any rocker arm which is deeply pitted. Inspect each push rod end for excessive wear and replace as required. If any push rod is excessively worn due to lack of oil, replace the push rod and inspect the corresponding lifter.

It is not normal to find a wear pattern along the length of the push rod. Check the cylinder head for obstruction if this condition exists.

Installation

(1) Install push rods to cylinders from which they were removed. **Make certain bottom end of each rod is centered in plunger cap of hydraulic valve lifter.**

(2) Install bridged pivots and pair of rocker arms to cylinders from which they were removed.

(3) Loosely install capscrews to each bridged pivot.

(4) At each bridged pivot, tighten capscrews alternately, one turn at a time time, to avoid damaging bridge. Tighten to 19 foot-pounds (26 Nm) torque.

(5) Install cylinder head cover and gasket.

Valves

NOTE: *The following procedures apply only after the cylinder head has been removed from the engine. If head has not been removed, refer to Cylinder Head for removal procedures.*

Removal

(1) Compress each valve spring with Spring Compressor Tool J-21931-01 and remove valve locks, retainers, springs and valve stem oil deflectors.

(2) Remove valves.

NOTE: *Place valves in a rack in the same order as removed from cylinder head.*

Cleaning and Inspection

(1) Clean all carbon buildup from combustion chambers, valve ports, valve stems and head.

(2) Clean all dirt and gasket cement from cylinder head machined surface.

(3) Inspect for cracks in combustion chambers and valve ports.

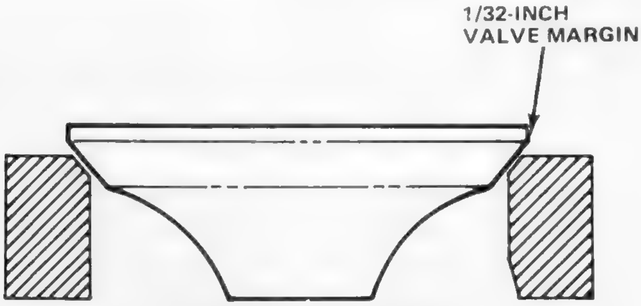
(4) Inspect for cracks in gasket surface at each coolant passage.

(5) Inspect valves for burned, cracked or warped heads. Inspect for scuffed or bent valve stems. Replace valves displaying damage.

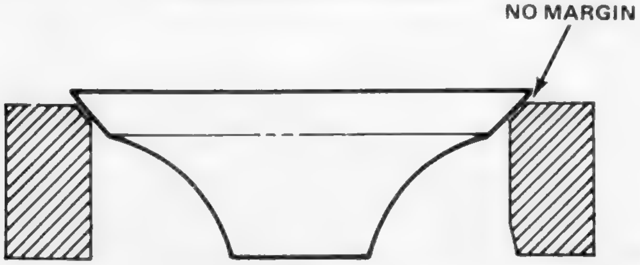
Valve Refacing

Use a valve refacing machine to reface intake and exhaust valves to the specified angle. After refacing, at least 1/32-inch margin must remain. If not, replace the valve. Examples of correct and incorrect valve refacing are shown in figure 1B-72.

The valve stem tip can be resurfaced and rechamfered when worn. Do not remove more than 0.020 inch.



CORRECT VALVE FACING



INCORRECT VALVE FACING

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Fig. 1B-72 Valve Refacing

Valve Seat Refacing

Install a pilot of the correct size in the valve guide and reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish.

Use tapered stones to obtain the specified seat widths when required.

Control seat runout to a maximum of 0.0025 inch (fig. 1B-73).

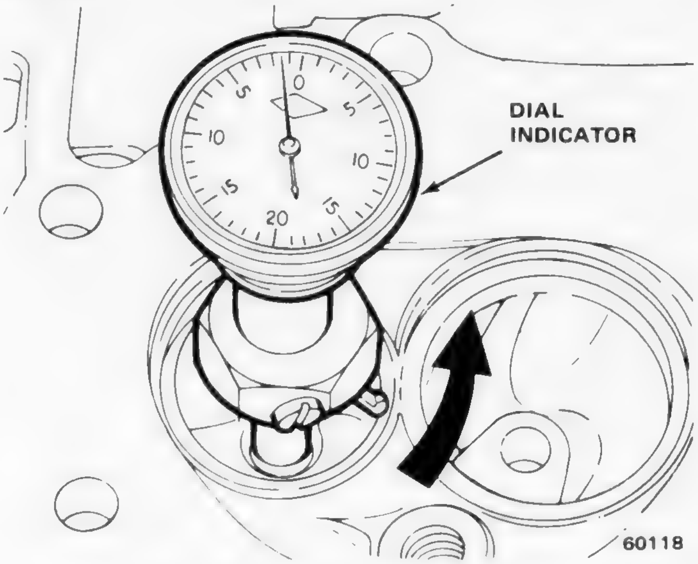

Fig. 1B-73 Checking Valve Seat Runout

Valve Stem Oil Deflector Replacement

Nylon valve stem oil deflectors are installed on each valve stem to prevent rocker arm lubricating oil from entering the combustion chamber through the valve guides. Replace the oil deflectors whenever valve service is performed or if the deflectors have deteriorated.

Valve stem oil deflector replacement requires removal of valve spring(s). Refer to Valve Springs for procedure.

Valve Guides

The valve guides are an integral part of the cylinder head and are not replaceable. When the stem-to-guide clearance is excessive, the valve guides must be reamed to accomodate the next larger oversize valve. Oversize service valves are available in 0.003-inch, 0.015-inch, and 0.030-inch sizes.

Valve Guide Reamer Sizes

Reamer Tool Number	Size
J-6042-1	0.003-inch
J-6042-5	0.015-inch
J-6042-4	0.030-inch

60260

NOTE: *Ream valve guides in steps, starting with the 0.003-inch oversize reamer and progressing to the size required.*

Valve Stem-to-Guide Clearance

Valve stem-to-guide clearance may be checked by either of the following two methods.

Preferred Method:

(1) Remove valve from head and clean valve guide with solvent and bristle brush.

(2) Insert telescoping gauge into valve guide approximately 3/8-inch from valve spring side of head (fig. 1B-74) with contacts crosswise to cylinder head. Measure telescoping gauge with micrometer.

(3) Repeat measurement with contacts lengthwise to cylinder head.

(4) Compare crosswise to lengthwise readings to determine out-of-roundness. If measurements differ by more than 0.0025 inch, ream guide to accomodate oversize valve.

(5) Compare valve guide diameter with diameter listed in Specifications. If measurements differ by more than 0.003 inch, ream guide to accomodate oversize valve.

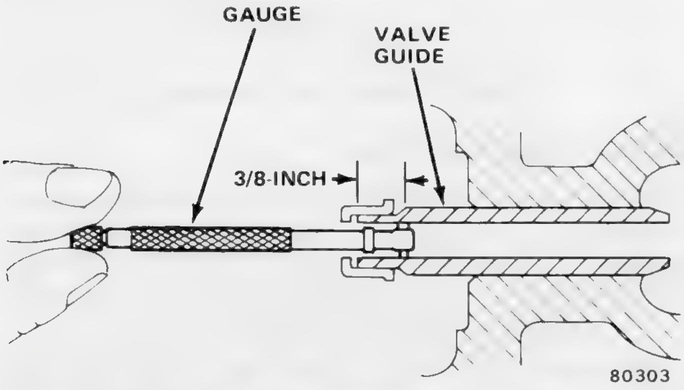

Fig. 1B-74 Measuring Valve Guide with Telescoping Gauge

Alternate Method:

(1) Use dial indicator to measure lateral movement of valve stem with valve installed in its guide and just off valve seat (fig. 1B-75).

(2) Correct clearance is 0.001 to 0.003 inch. If indicated movement exceeds this amount, ream guide to accomodate oversize valve.

Installation

(1) Thoroughly clean valve stems and valve guide bores.

(2) Lightly lubricate stem and install valve in same valve guide from which it was removed.

(3) Install replacement valve stem oil deflector on valve stem.

NOTE: *If oversize valves are used, oversize oil deflectors are required.*

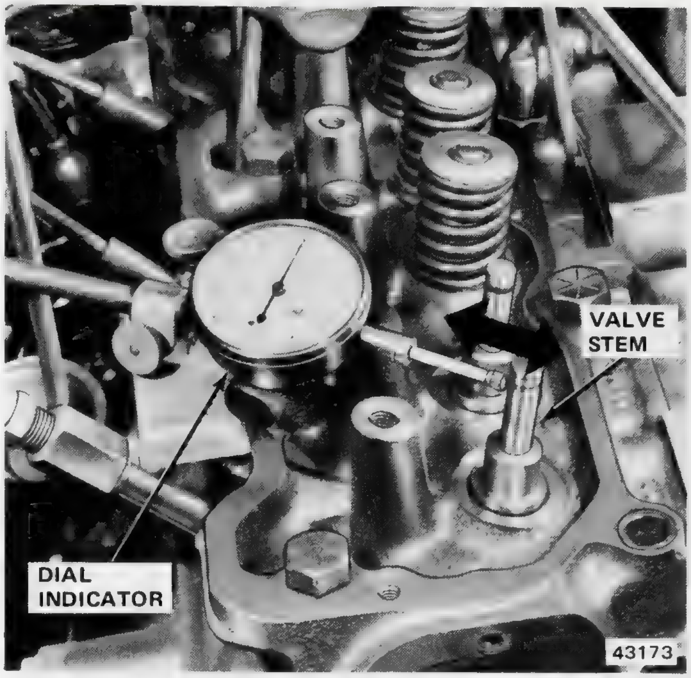

Fig. 1B-75 Checking Stem-to-Guide Clearance

(4) Position valve spring and retainer on cylinder head and compress valve spring with compressor tool. Install valve locks and release tool.

(5) Tap valve spring from side-to-side with hammer to be certain spring is properly seated at cylinder head.

Valve Springs

Valve Spring and Oil Deflector Removal

NOTE: *This procedure is for removal of valve springs and oil deflectors with the cylinder head installed on the engine. Refer to Valves for removal procedure with the head removed.*

The valve spring is held in place on the valve stem by a retainer and a set of conical valve locks. The locks can be removed only by compressing the valve spring.

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assembly.

(3) Remove push rods.

NOTE: *Retain push rods, bridged pivots and rocker arms in same order and position as removed.*

(4) Remove spark plug from cylinder.

(5) Install 14-mm (thread size) air adapter in spark plug hole.

NOTE: *An adapter can be made by welding an air hose connection to the body of a spark plug from which the porcelain has been removed.*

(6) Connect air hose to adapter and maintain at least 90 psi in cylinder to hold valves against their seats.

NOTE: *On cars equipped with air conditioning, use a flexible air adapter when servicing No. 1 cylinder.*

(7) Use Valve Spring Remover and Installer Tools J-22534-1, J-22534-4, and J-22534-5 to compress spring and remove locks (fig. 1B-76).

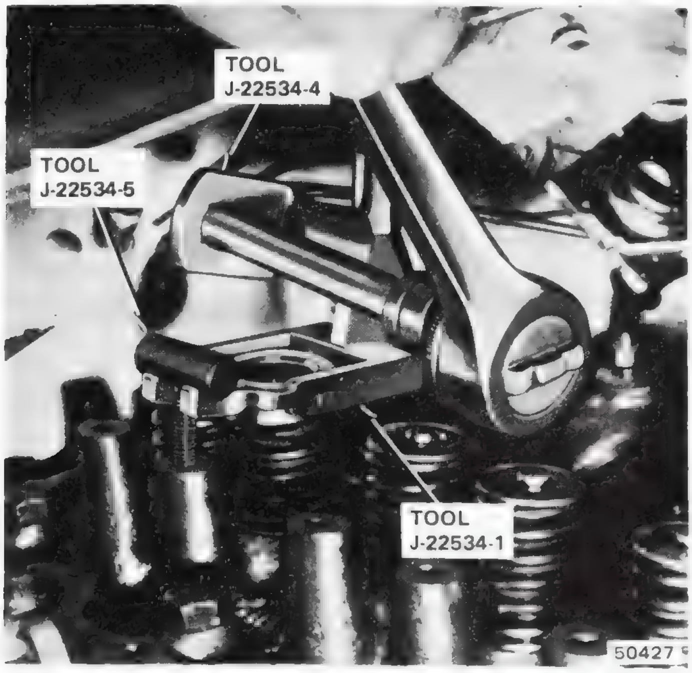

Fig. 1B-76 Valve Spring Removal

(8) Remove valve spring and retainer.
(9) Remove valve stem oil deflector.

Valve Spring Tension Test

Use Valve Spring Tester J-8056 to test each valve spring for the specified tension value (fig. 1B-77). Replace valve springs that are not within specifications.

Oil Deflector and Valve Spring Installation

(1) Use 7/16-inch deep socket and small hammer to gently tap oil deflector onto valve stem.

CAUTION: *Install the deflector carefully to prevent damage from sharp edges of the valve lock grooves.*

(2) Install valve spring and retainer.
(3) Compress valve spring with tools J-22534-1, J-22534-4 and J-22534-5 and insert valve locks. Release spring tension and remove tools.

NOTE: *Tap spring from side-to-side to be certain spring is seated properly at cylinder head.*

(4) Disconnect air hose, remove adapter from spark plug hole and install spark plug.
(5) Install push rods. Make certain bottom end of each rod is centered in plunger cap of hydraulic valve tappet.
(6) Install rocker arms and bridged pivots. At each bridged pivot, tighten capscrews alternately, one turn at a time to avoid damaging bridge.

Fig. 1B-77 Valve Spring Tester

(7) Install cylinder head cover and gasket.

Camshaft and Bearings

All 232 and 258 1V engines use the same camshaft. The camshaft used in 258 2V engines has a different cam lobe configuration. The camshaft is supported by four steel-shelled, babbitt-lined bearings pressed into the block and line reamed. Camshaft bearing bores are step-bored, being larger at the front bearing than at the rear, to permit easy removal and installation of the camshaft. Camshaft bearings are lubricated under pressure.

NOTE: *It is not advisable to replace camshaft bearings unless equipped with special removing and installing tools.*

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear. The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face. Camshaft end play is zero during engine operation.

Measuring Cam Lobe Lift

(1) Remove cylinder head cover and gasket.
(2) Remove rocker arms and bridged pivot assemblies.
(3) Remove spark plugs.
(4) Install dial indicator on end of push rod. Use piece of rubber tubing between dial indicator plunger and push rod (fig. 1B-78).
(5) Rotate crankshaft until cam lobe base circle (push rod down) is under valve tappet. Set dial indicator to zero.
(6) Rotate crankshaft until push rod reaches its maximum upward travel. Read travel at dial indicator.

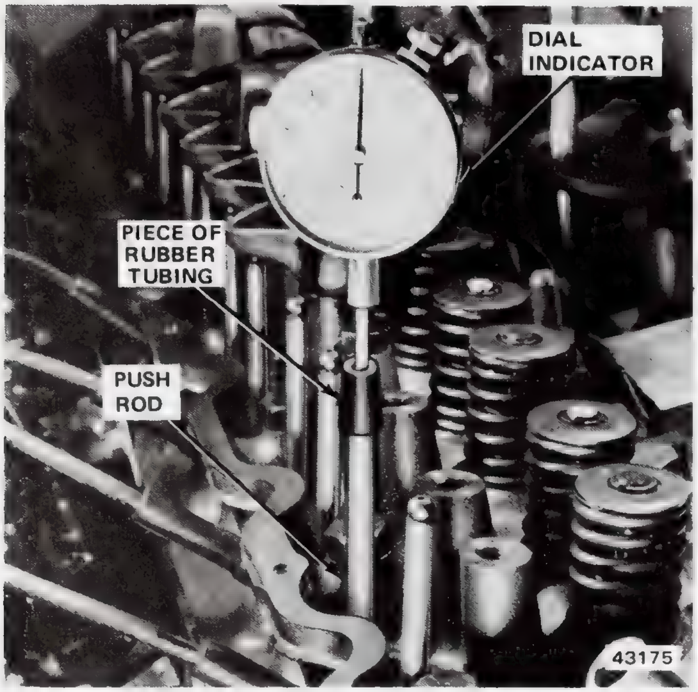

Fig. 1B-78 Cam Lobe Lift Measurement

Correct cam lobe lift is 0.226 to 0.238 inch for 1V engine and 0.242 to 0.254 inch for 2V engine.

Checking Valve Timing

(1) Disconnect ignition wires and remove spark plugs.

(2) Remove cylinder head cover and gasket.

(3) Remove rocker arms and bridged pivot from No. 1 cylinder.

(4) Rotate crankshaft until No. 6 piston is at TDC on compression stroke.

(5) Rotate crankshaft counterclockwise (viewed from front of engine) 90°.

(6) Install dial indicator with end of push rod touching No. 1 cylinder intake valve push rod end. Set dial indicator to zero.

(7) Rotate crankshaft clockwise (viewed from front of engine) until dial indicator shows 0.016-inch lift.

(8) Timing mark on vibration damper should index with TDC mark on timing case cover. If timing mark is more than 1/2 inch off TDC in either direction, valve timing is incorrect.

Camshaft Removal

(1) Remove hood (Pacer only). Mark hinge locations on hood panel for alignment during installation.

(2) Drain cooling system.

(3) Remove radiator.

(4) Remove air conditioning condenser and receiver assembly as a charged unit, if equipped.

(5) Remove fuel pump.

(6) Remove distributor and ignition wires.

(7) Remove cylinder head cover and gasket.

(8) Remove rocker arms and bridged pivot assemblies.

(9) Remove push rods.

NOTE: *Keep push rods and tappets in the same order as removed.*

(10) Remove cylinder head and gasket.

(11) Remove hydraulic tappets.

(12) Remove timing case cover. Refer to Timing Case Cover Removal.

(13) Remove timing chain and sprockets. Refer to Timing Chain Removal.

(14) Pacer only:

(a) Support engine assembly with lifting device.

(b) Disconnect front suppport cushions from crossmember.

(c) Lift engine assembly sufficiently to allow camshaft removal.

(15) Gremlin, Concord, AMX and Matador only:

(a) Remove front bumper or grille as required.

(b) Remove camshaft.

Camshaft Inspection

Inspect the camshaft bearing journals for an uneven wear pattern or rough finish. If either condition exists, inspect camshaft bearings. Inspect loaded (bottom) side of bearing. This is the most probable location of bearing damage. Replace camshaft and bearings as required. Refer to Bearing Replacement for procedure.

Inspect the distributor drive gear for damage or excessive wear. Replace if necessary.

Inspect each cam lobe and the matching hydraulic valve tappet for wear. If the face of the tappet(s) is worn concave, the matching camshaft lobe(s) will also be worn. Both the camshaft and the tappet(s) must be replaced.

If the camshaft appears to be bearing heavily against the timing case cover, check the relief holes in the rear cam journal. These holes relieve oil pressure between the end of the camshaft and the rear bearing plug.

Camshaft Installation

(1) Lubricate camshaft with AMC Engine Oil Supplement, or equivalent.

(2) Install camshaft carefully to prevent damaging camshaft bearings.

(3) Pacer only:

(a) Lower engine to installed position.

(b) Connect front support cushions to crossmember.

(c) Remove engine lifting device.

(4) Install timing chain, crankshaft sprocket and camshaft sprocket with timing marks aligned. Refer to Timing Chain Installation.

(5) Install camshaft sprocket retaining screw and tighten to 50 foot-pounds (68 Nm) torque.

(6) Install timing case cover with replacement oil seal. Refer to Timing Case Cover Installation.

(7) Install vibration damper.

(8) Install damper pulley, if removed.

(9) Install engine fan and hub assembly.

(10) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

(11) Install fuel pump.

(12) Rotate crankshaft until No. 1 piston is at TDC position on compression stroke.

(13) Install distributor cap and ignition wires.

NOTE: *Install distributor so that the rotor is aligned with the No. 1 terminal of the cap when distributor housing is fully seated on block.*

(14) Install hydraulic tappets.

(15) Install cylinder head and gasket.

(16) Install push rods.

(17) Install rocker arms and bridged pivot assemblies, tightening each of the two capscrews for each bridge a turn at a time to avoid damaging bridge.

(18) Install cylinder head cover and gasket.

NOTE: *Lubricate the hydraulic valve tappets and all valve train components with AMC Engine Oil Supplement (EOS), or equivalent, during installation. The EOS must remain in the engine for at least 1,000 miles but need not be drained until the next scheduled oil change.*

(19) Install air conditioning condenser and receiver assembly, if equipped.

CAUTION: *Both service valves must be opened before the air conditioning system is operated.*

(20) Install radiator, connect hoses and fill cooling system to specified level. Refer to Chapter 1C—Cooling.

(21) Install front bumper or grille, if removed.

(22) Install hood, if removed.

(23) Check ignition timing and adjust as required.

Camshaft Bearing Replacement

Camshaft bearing replacement requires that the engine be removed from the car. Remove timing case cover, crankshaft and camshaft rear bearing plug. When installing bearings, use a screw-type tool that provides steady pressure. Do not use a driver-type tool to install bearings. Care must be taken to align oil holes in bearings with oil galleries in the block. It is not necessary to line ream camshaft bearings after installation.

Hydraulic Valve Tappets

The hydraulic valve tappet consists of a tappet body, plunger, plunger return spring, check valve assembly metering disc, plunger cap and lockring (fig. 1B-79).

The tappet operates in a guide bore which intersects with the main oil gallery.

The operating cycle of the hydraulic tappet begins when the tappet is on the heel of the cam lobe (engine valve closed). A groove in the tappet body aligns with the tappet oil gallery, admitting pressurized oil into the tappet (fig. 1B-80). A hole and groove arrangement admits the oil to the inside of the plunger. Oil is forced past the plunger check valve and fills the chamber between the plunger and tappet body. When the chamber is full, additional oil in the plunger body unseats the metering disc, and a spurt of oil flows up the pushrod to lubricate the rocker assembly. These events all take place while the tappet is on the heel of the cam lobe. As the cam turns, the lobe begins exerting force on the tappet body. This force is transmitted by the trapped oil in the tappet chamber to the plunger and finally to the pushrod and rocker assembly. The engine valve opens. While the valve is open, the trapped oil is subjected to considerable pressure and some of it escapes between the plunger and the tappet body (leak-down). The cycle is completed as the cam lobe rotates back to the starting position and another charging cycle begins. In this way, zero valve lash is maintained.

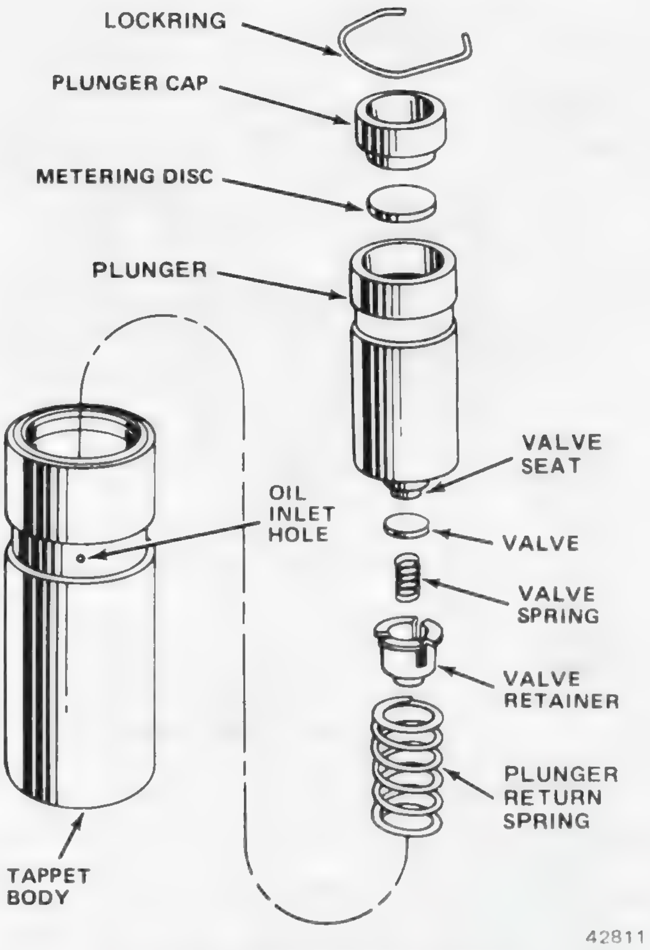

Fig. 1B-79 Hydraulic Tappet Components

Removal and Disassembly

(1) Remove cylinder head cover and gasket.

(2) Remove rocker arms and bridged pivot assemblies. Remove two capscrews at each bridged pivot. Alternately loosen each capscrew one turn at a time to avoid damaging bridge.

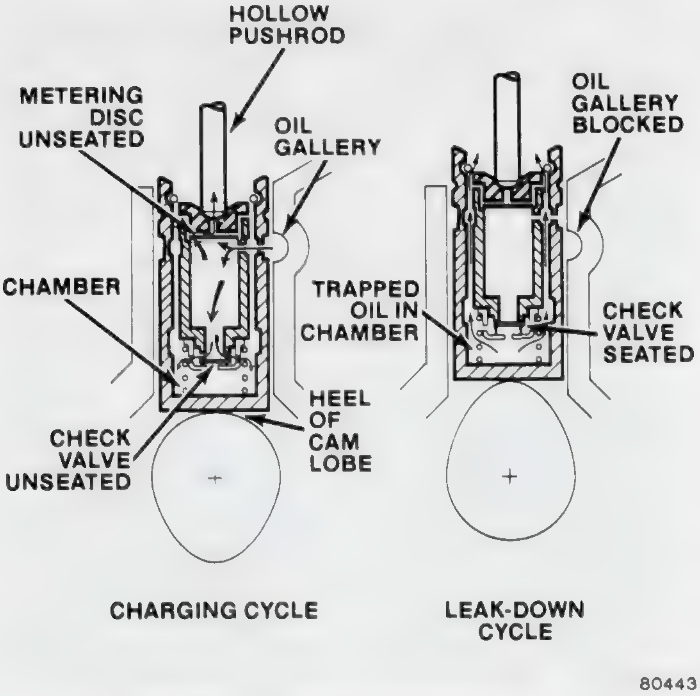

Fig. 1B-80 Hydraulic Tappet Operation

(3) Remove push rods.

NOTE: *Retain push rods in the same order as removed.*

(4) Remove cylinder head and gasket.

(5) Remove tappets through push rod openings of block with Hydraulic Valve Tappet Remover and Installer Tool J-21884 (fig. 1B-81).

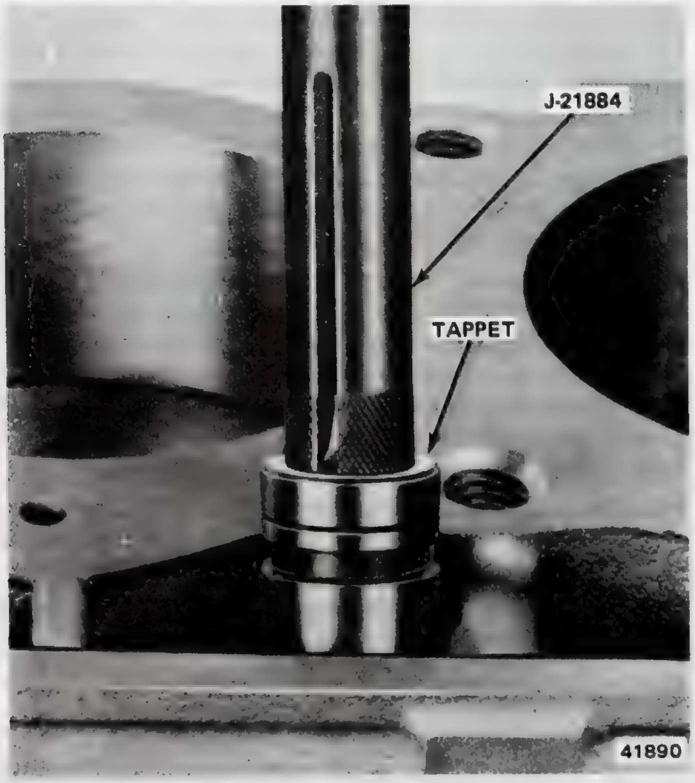

Fig. 1B-81 Hydraulic Tappet Removal

Cleaning and Inspection

NOTE: *Retain tappet components in the same order as removed.*

(1) Release lockring and remove plunger cap, metering disc, plunger and plunger return spring from tappet body.

(2) Clean components of the hydraulic tappet assembly in cleaning solvent to remove all varnish or gum deposits.

(3) Check for signs of scuffing on side and face of tappet body.

(4) Inspect tappet face for concave wear by laying straightedge across face. If face is concave, corresponding lobe on camshaft is worn. Replace camshaft and tappets.

(5) Install plunger return spring, plunger, metering disc and plunger cap in tappet body.

(6) Compress plunger assembly using push rod on plunger cap, and install lockring.

Hydraulic Tappet Leak-Down Test

After cleaning and inspection, test the tappet for leak-down to ensure its zero-lash operating ability (fig. 1B-82).

Fig. 1B-82 Hydraulic Tappet Leak-Down Tester

(1) Swing weighted arm of Tester J-5790 away from ram of tester.

(2) Place 0.312 to 0.313 diameter ball bearing on plunger cap of tappet.

(3) Lift ram and place tappet with ball bearing inside tester cup.

(4) Lower ram, then adjust nose of ram until it contacts ball bearing. Do not tighten hex nut on ram.

(5) Fill tester cup with Valve Tappet Test Oil J-5268 until tappet is completely covered.

(6) Swing weighted arm onto ram and pump up and down on tappet to remove air. When air bubbles cease, swing weighted arm away and allow plunger to rise to normal position.

(7) Adjust nose of ram to align pointer with SET mark on scale of tester and tighten hex nut.

(8) Slowly swing weighted arm onto ram. Rotate cup by turning handle at base of tester clockwise one revolution every two seconds.

(9) Time leak-down from instant pointer aligns with START mark on scale until pointer aligns with 0.125 mark. A good tappet will take 20 to 110 seconds to leak down. Discard tappets outside this range.

NOTE: *Do not charge the tappet assemblies with engine oil. They will charge themselves within 3 to 8 minutes of engine operation.*

Installation

(1) Dip tappet assembly in AMC Engine Oil Supplement (EOS), or equivalent.

(2) Use Hydraulic Valve Tappet Remover and Installer Tool J-21884 to install each tappet in same bore from which it was removed.

(3) Install cylinder head and replacement gasket and tighten screws. Refer to Cylinder Head Installation for tightening sequence.

(4) Install push rods in same order as removed.

(5) Install rocker arms and bridged pivot assemblies. Loosely install capscrews to each bridged pivot. At each bridged pivot, tighten capscrews alternately, one turn at a time to avoid damaging bridge.

(6) Pour remaining EOS over entire valve train.

NOTE: *The EOS must remain in the engine for at least 1,000 miles but need not be drained until the next scheduled oil change.*

(7) Install cylinder head cover and gasket.

Timing Case Cover

The timing case cover is provided with a seal and oil slinger to prevent oil leakage at the vibration damper hub (fig. 1B-83). A hole is provided in the cover for the use of a timing probe during production. A graduated degree scale cast into the cover is used for ignition timing.

It is important that the timing case cover be properly aligned with the crankshaft to prevent eventual damage to the oil seal. The oil seal may be replaced without removing the timing case cover.

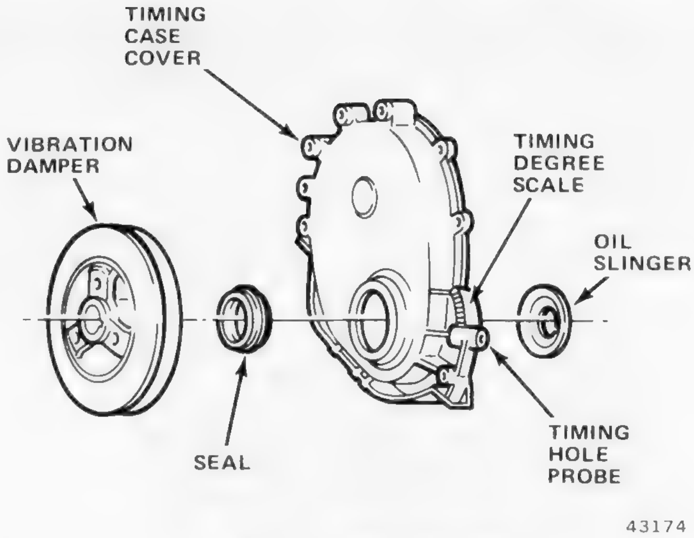

Fig. 1B-83 Timing Case Cover

Removal

(1) Remove drive belt(s), engine fan and hub assembly, damper pulley and vibration damper. Refer to Vibration Damper.

(2) Remove oil pan-to-timing case cover screws and cover-to-block screws.

(3) Remove timing case cover and gasket from engine.

(4) Cut off oil pan gasket end tabs flush with front face of cylinder block and remove gasket tabs.

(5) Clean timing case cover, oil pan and cylinder block gasket surfaces.

(6) Remove crankshaft oil seal from timing case cover.

Installation

(1) Apply seal compound (Perfect Seal, or equivalent) to both sides of replacement timing case cover gasket and position gasket on cylinder block.

(2) Cut end tabs off replacement oil pan gasket as cut off original gasket. Install these pieces on oil pan and cement in place.

(3) Coat seal end tabs generously with Permatex No. 2, or equivalent, and position seal on timing case cover (fig. 1B-84).

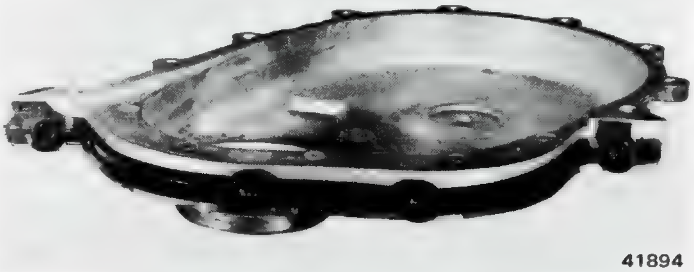

Fig. 1B-84 Oil Pan Front Seal Installation

(4) Position timing case cover on engine. Place Timing Case Cover Alignment Tool and Seal Installer J-22248 in crankshaft opening of cover (fig. 1B-85).

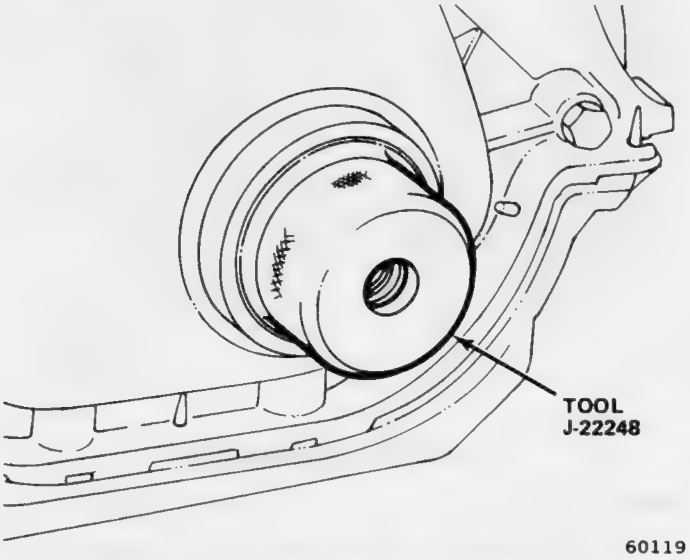

Fig. 1B-85 Timing Case Cover Alignment

(5) Install cover-to-block screws and oil pan-to-cover screws. Tighten cover-to-block screws to 5 foot-pounds (7 Nm) torque and oil pan-to-cover screws to 11 foot-pounds (13 Nm) torque.

(6) Remove cover aligning tool and position replacement oil seal on tool with seal lip facing outward. Apply light film of Perfect Seal, or equivalent, on outside diameter of seal.

(7) Insert draw screw from Tool J-9163 into seal installing tool. Tighten nut against tool until tool bottoms against cover (fig. 1B-86).

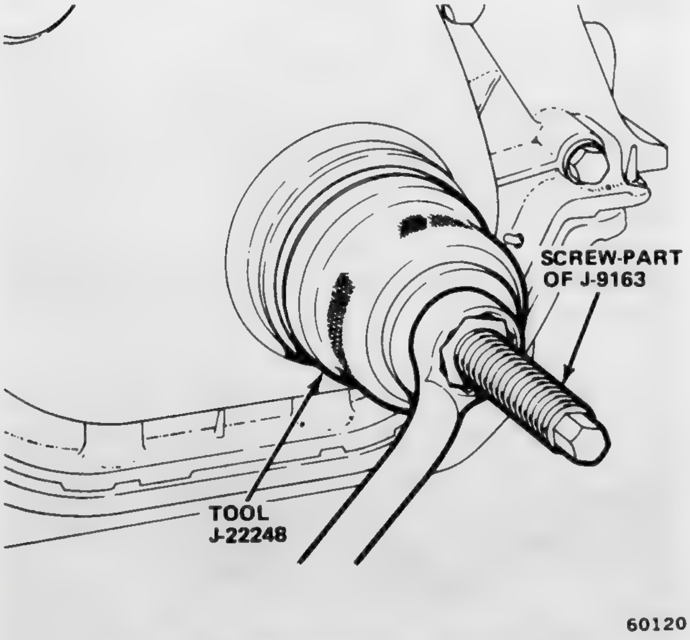

Fig. 1B-86 Timing Case Cover Oil Seal Installation

(8) Remove tools, and apply light film of engine oil on seal lip.

(9) Install vibration damper and tighten retaining screw to 80 foot-pounds (108 Nm) torque.

(10) Install damper pulley.

(11) Install engine fan and hub assembly.

(12) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

Timing Case Cover Oil Seal Replacement (Cover not Removed)

(1) Remove drive belts.

(2) Remove vibration damper pulley.

(3) Remove vibration damper.

(4) Remove oil seal with Tool J-9256 (fig. 1B-87).

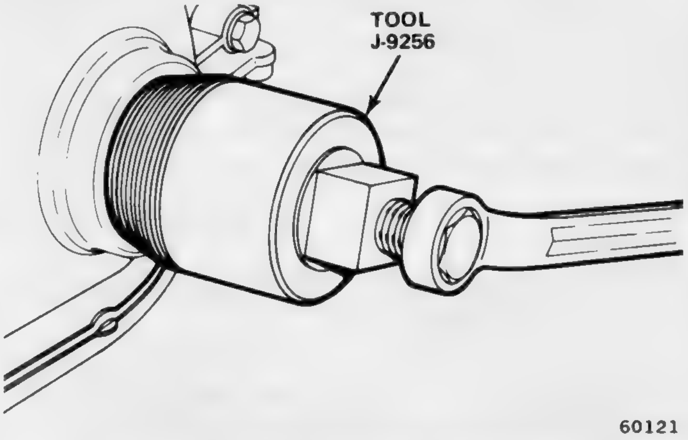

Fig. 1B-87 Timing Case Cover Oil Seal Removal

(5) Position replacement oil seal on Timing Case Cover Alignment Tool and Seal Installer J-22248 with seal lip facing outward. Apply light film of Perfect Seal, or equivalent, on outside diameter of seal.

(6) Insert draw screw from Tool J-9163 into seal installing tool (fig. 1B-86). Tighten nut against tool until tool bottoms against cover.

(7) Remove tools. Apply light film of engine oil on seal lip.

(8) Install vibration damper and tighten retaining screw to 80 foot-pounds (108 Nm) torque.

(9) Install damper pulley, if removed.

(10) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

Timing Chain

Installation of the timing chain with the timing marks of the crankshaft and camshaft sprockets properly aligned assures correct valve timing. A worn or stretched timing chain will adversely affect valve timing. If the timing chain deflects more than 1/2 inch, replace it.

The correct timing chain has 48 pins. A chain with more than 48 pins will cause excessive slack.

Removal

(1) Remove drive belt(s).

(2) Remove engine fan and hub assembly.

(3) Remove vibration damper pulley.

(4) Remove vibration damper.

(5) Remove timing case cover.

(6) Remove oil seal from timing case cover.

(7) Remove camshaft sprocket retaining screw and washer.

(8) Rotate crankshaft until 0 timing mark on crankshaft sprocket is closest to and on centerline with timing pointer of camshaft sprocket (fig. 1B-88).

(9) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly. Disassemble chain and sprockets.

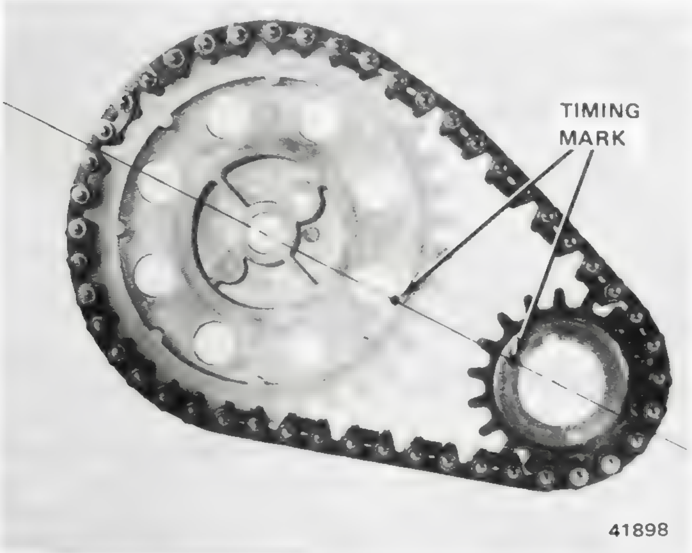

Fig. 1B-88 Timing Sprocket Alignment

Installation

(1) Assemble timing chain, crankshaft sprocket and camshaft sprocket with timing marks aligned as shown in figure 1B-88.

(2) Install assembly to crankshaft and camshaft.

(3) Install camshaft sprocket retaining screw and washer and tighten to 50 foot-pounds (68 Nm) torque.

NOTE: *To check correct installation of the timing chain, turn crankshaft to locate timing mark of the camshaft sprocket at approximately one o'clock position. This places timing mark of crankshaft sprocket where it meshes with chain (fig. 1B-89). Count number of chain pins between timing mark of both sprockets. There must be 15 pins.*

(4) Install timing case cover and replacement oil seal.

(5) Install vibration damper.

(6) Install damper pulley.

(7) Install engine fan and hub assembly.

(8) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

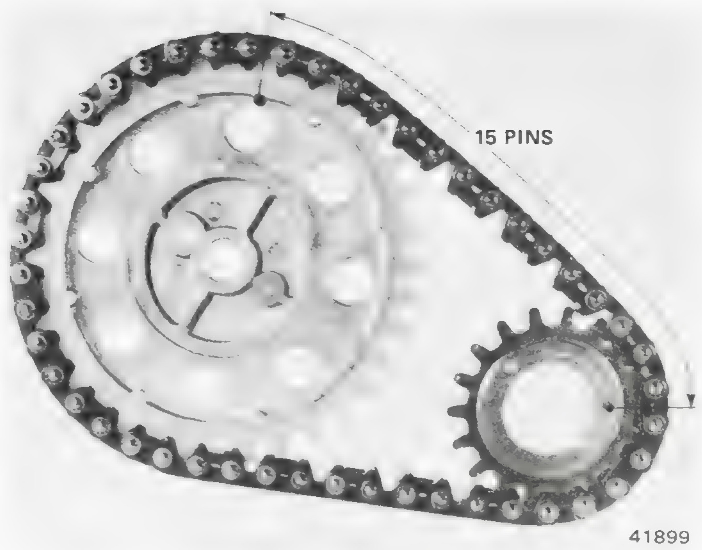

Fig. 1B-89 Timing Chain Installation

INTAKE AND EXHAUST MANIFOLDS

The intake and exhaust manifolds are attached to the cylinder head on the left side of the engine. A gasket is used between the intake manifold and the cylinder head. No gasket is used between the exhaust manifold and cylinder head. An asbestos gasket is used at the mating surfaces between the intake manifold and exhaust manifold (fig. 1B-90).

An exhaust gas recirculation valve (EGR) is mounted on the side of the intake manifold. The intake manifold has a metal plate incorporated into the area above the exhaust manifold heat valve to create a hot spot that improves fuel vaporization during warmup and shortens choke operation time.

Intake and Exhaust Manifold Assembly Removal

(1) Remove air cleaner. Disconnect fuel line and carburetor air horn vent hose and solenoid wire, if equipped.

(2) Disconnect accelerator cable from accelerator bellcrank.

(3) Disconnect PCV vacuum hose from intake manifold.

(4) Remove spark CTO vacuum tubes and disconnect TCS solenoid vacuum valve wiring, if equipped.

(5) Disconnect vacuum hose from EGR valve.

(6) Disconnect Air Guard hoses at air pump and air injection manifold check valve. Disconnect diverter vacuum hose and remove diverter valve with hoses.

(7) Remove air pump/power steering mounting bracket, if equipped.

(8) Remove air pump.

(9) Detach power steering pump and set aside, if equipped. Do not remove hoses.

(10) Remove air conditioning drive belt idler assembly from cylinder head, if equipped.

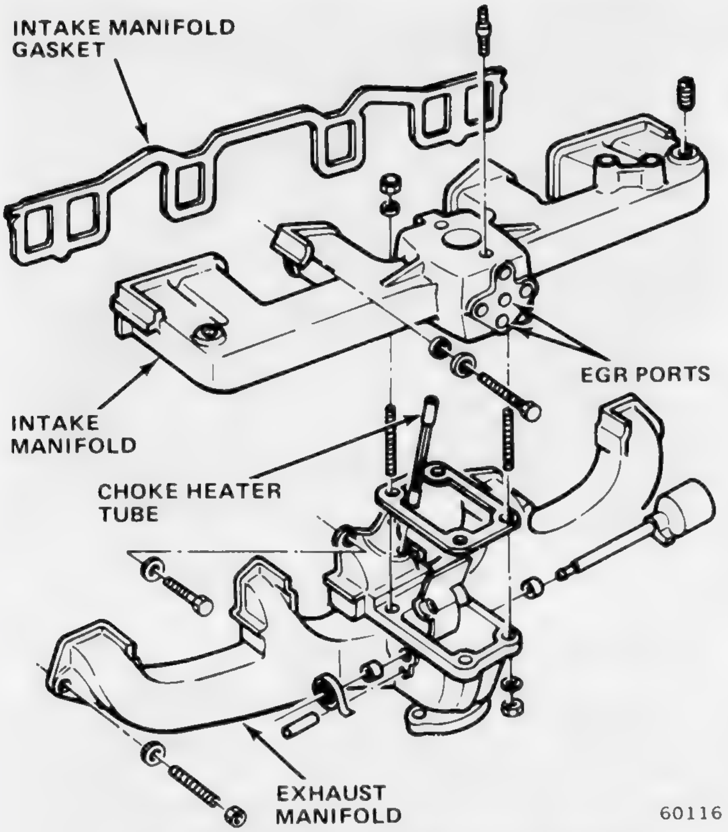

Fig. 1B-90 Intake and Exhaust Manifold Assembly

(11) Disconnect throttle valve linkage, if equipped with automatic transmission.

(12) Disconnect exhaust pipe from manifold flange.

(13) Remove manifold attaching screws, nuts and clamps. Remove intake and exhaust manifold as an assembly. Discard gasket.

(14) Clean mating surfaces of manifolds and cylinder head.

Intake and Exhaust Manifold Assembly Installation

(1) Position replacement intake manifold gasket on cylinder head and install manifold assembly. Tighten manifold attaching screws and nuts in sequence (fig. 1B-91) to 23 foot-pounds (31 Nm) torque.

(2) Install flange gasket and connect exhaust pipe to manifold flange.

(3) Connect fuel line and air horn vent hose to carburetor. Connect solenoid wire, if equipped.

(4) Install AC drive belt idler assembly, if removed.

(5) Install air pump, if removed.

(6) Install air pump/power steering pump mounting bracket, if removed.

(7) Install diverter valve. Connect hoses to air pump and check valve.

(8) Connect throttle valve linkage and adjust (automatic transmission only).

(9) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

(10) Install spark CTO vacuum tubes. Connect TCS wiring, if removed.

(11) Connect vacuum hose to EGR valve.

(12) Connect accelerator cable and PCV hose.

(13) Install air cleaner.

(14) Start engine and check for vacuum and exhaust leaks.

(15) Adjust transmission throttle linkage after completing manifold installation.

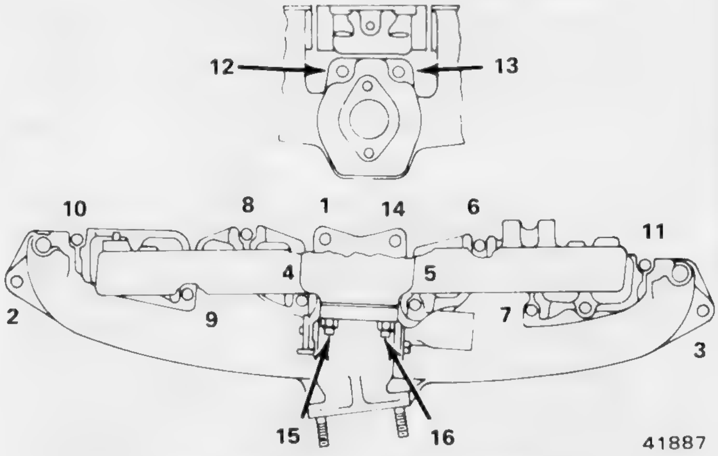

Fig. 1B-91 Manifold Torque Sequence

Intake Manifold Replacement

NOTE: *It is necessary to remove intake and exhaust manifold assembly from the engine before separating the manifolds. It is not necessary to remove the carburetor from the vehicle. After removing the carburetor from the intake manifold, it may be set to one side with vacuum lines still attached.*

(1) Remove air cleaner.

(2) Disconnect choke heater tube from choke coil housing. Disconnect clean air tube from carburetor.

(3) Disconnect carburetor control shaft from carburetor.

(4) Remove carburetor from intake manifold and set aside. Remove carburetor insulator block.

(5) Remove carburetor mounting studs from intake manifold.

(6) Remove intake and exhaust manifold assembly from engine. Refer to Intake and Exhaust Manifold Assembly Removal for procedures.

(7) Remove accelerator control bracket.

(8) Separate manifolds.

(9) Install replacement gasket between manifolds. Install accelerator control bracket. Tighten nuts to 5 foot-pounds (7 Nm) torque.

CAUTION: *Do not overtighten. Manifolds must be held together loosely enough to slide when manifolds are attached to cylinder head.*

(10) Install vacuum fittings.

(11) Install manifold assembly to head. Refer to Intake and Exhaust Manifold Assembly Installation for procedure.

(12) Install carburetor studs, replacement gaskets and spacer.

(13) Install carburetor and connect linkage and hoses.

(14) Connect clean air tube and choke heater tube to carburetor.

(15) Tighten intake manifold-to-exhaust manifold nuts. Start engine and check for leaks.

(16) Install air cleaner.

Exhaust Manifold Replacement

NOTE: *It is necessary to remove intake and exhaust manifold assembly from the engine before separating the manifolds. It is not necessary to remove the carburetor from the vehicle. After removing the carburetor from the intake manifold, it may be set to one side with vacuum lines still attached.*

(1) Remove air cleaner.

(2) Disconnect choke heater tube from choke coil housing. Disconnect clean air tube from carburetor.

(3) Disconnect carburetor control shaft from carburetor.

(4) Remove carburetor from intake manifold and set aside.

(5) Remove EGR valve.

(6) Remove intake and exhaust manifold assembly from engine. Refer to Intake and Exhaust Manifold Assembly Removal for procedure.

(7) Remove accelerator control bracket.

(8) Separate manifolds.

(9) Remove EGR valve studs and intall in replacement manifold.

(10) Remove distributor CTO tube clamp and install on replacement manifold.

(11) Remove air injection manifold and screws and install on replacement manifold.

(12) Install replacement gasket between manifolds. Install accelerator control bracket. Tighten nuts to 5 foot-pounds (7 Nm) torque.

CAUTION: *Do not overtighten. Manifolds must be held together loosely enough to slide when manifolds are attached to cylinder head.*

(13) Install choke clean air tube into bottom of exhaust manifold and install tube clip.

(14) Install manifold assembly to cylinder head. Refer to Intake and Exhaust Manifold Assembly Installation for procedure.

(15) Install EGR valve and carburetor spring bracket.

(16) Install carburetor to intake manifold.

(17) Install carburetor control shaft. Install throttle return spring.

(18) Install choke heater tube and clean air tube to carburetor.

(19) Torque intake manifold-to-exhaust manifold nuts. Start engine and check for leaks.

(20) Install air cleaner.

CYLINDER HEAD AND COVER

Cylinder heads are interchangeable between 232 and 258 CID engines. All incorporate hardened exhaust valve seats and exhaust valves with flash chrome stems.

Cylinder Head Cover

Removal

NOTE: *On Pacer models, cylinder head cover removal is easier if windshield wiper blades are parked at the center of the windshield.*

(1) Remove air cleaner and PCV molded hose.

(2) Disconnect distributor vacuum advance line at spark CTO tube. Disconnect fuel line at fuel pump. Swivel fuel line to allow removal of cylinder head cover.

(3) Disconnect PCV valve from grommet in cylinder head cover.

(4) Remove cylinder head cover screws. Strike cover with rubber mallet to break loose from head.

(5) Inspect cylinder head cover for cracks.

Installation—Silicone Method

A room temperature vulcanizing (RTV) silicone rubber adhesive is required for this procedure. Use AMC Gasket-in-a-Tube, or equivalent.

(1) Clean gasket surface of adhesive and gasket material.

(2) Wipe gasket surface of cylinder head with oily rag. This prevents adhesion but permits sealing.

(3) Apply 1/8-inch bead of silicone along entire length of cover flange.

(4) Before silicone begins to cure, install cover to cylinder head. Be careful to not touch rocker arms with silicone.

(5) Apply dab of silicone to each screw hole. Insert screw through silicone.

(6) Tighten all screws by hand. Then tighten all screws to specification.

Installation—Gasket Method

(1) Position gasket on cylinder head cover flange. Cement several places for ease of handling. Use quick-drying adhesive such as AMC Part No. 8127960, or equivalent.

(2) Position cylinder head cover and gasket on engine and install screws.

CAUTION: *Do not overtighten screws as this may crack cover or split gasket. Tighten screws to 50 inch-pounds (5.6 Nm) torque.*

(3) Connect fuel and distributor vacuum advance lines.

(4) Connect PCV valve to grommet in cylinder head cover. Connect canister hoses.

(5) Install air cleaner and connect PCV hose.

Cylinder Head

Removal

NOTE: *On Pacer models, cylinder head removal is easier if windshield wiper blades are parked at the center of the windshield.*

(1) Drain coolant and disconnect hoses at thermostat housing.

(2) Remove air cleaner.

(3) Remove fuel line and vacuum advance line.

(4) Remove cylinder head cover and gasket.

(5) Remove rocker arms and bridged pivot assemblies. Alternately loosen each capscrew one turn at a time to avoid damaging bridge.

(6) Remove push rods.

NOTE: *Retain push rods, bridged pivots and rocker arms in same order as removed.*

(7) Disconnect power steering pump bracket and Air Guard pump. Lay pumps and brackets aside. Do not disconnect hoses.

(8) Remove intake and exhaust manifold assembly from cylinder head.

(9) If equipped with air conditioning, perform the following:

(a) Remove air conditioning drive belt idler bracket from cylinder head.

(b) Loosen alternator drive belt. Remove alternator bracket-to-head mounting screw.

(c) Remove bolts from compressor mounting bracket and set compressor aside.

(10) Disconnect ignition wires and remove spark plugs.

(11) Disconnect temperature sending unit wire and battery ground cable.

(12) Remove ignition coil and bracket assembly.

(13) Remove cylinder head screws, cylinder head and gasket.

Cleaning and Inspection

(1) Thoroughly clean machined surfaces of cylinder head and block. Remove all dirt and gasket cement.

(2) Remove carbon deposits from combustion chambers and top of pistons.

(3) Use straightedge and feeler gauge to check flatness of cylinder head and block mating surfaces. Refer to Specifications.

Installation

(1) If cylinder head is to be replaced and original valves used, measure valve stem diameter. Only standard size valves can be used with service replacement head unless replacement head valve guides are reamed to accomodate oversize valve stems. Remove all carbon buildup and reface valves as outlined under Valve Refacing.

(2) Install valves in cylinder head using replacement valve stem oil deflectors.

(3) Transfer all attached components from original head which are not included with replacement head. Do not install temperature sending unit until coolant is installed. This permits trapped air to escape from block and head.

CAUTION: *Do not apply sealing compound on head and block surfaces. Do not allow sealing compound to enter cylinder bore.*

(4) Apply even coat of Perfect Seal sealing compound, or equivalent, to both sides of replacement head gasket and position gasket on block with word TOP facing upward.

(5) Install cylinder head. Tighten bolts in sequence to 105 foot-pounds (145 Nm) torque (fig. 1B-92).

NOTE: *The head gasket is made of aluminum-coated embossed steel and does not require that the head screws be retightened.*

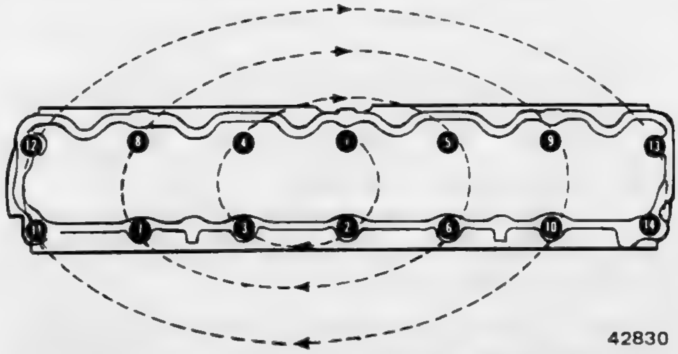

Fig. 1B-92 Cylinder Head Torque Sequence

(6) Connect battery negative cable.

(7) Install ignition coil and bracket assembly.

(8) Install spark plugs and connect ignition wires.

(9) Attach air conditioning air compressor mounting bracket to cylinder head, if removed.

(10) Install intake and exhaust manifold assembly. Refer to figure 1B-91 for correct torque tightening sequence.

(11) Install alternator bracket screw to head. Install alternator belt and adjust tension.

(12) Install power steering bracket and pump. Adjust belt tension.

(13) Install Air Guard pump bracket screws to head. Adjust belt tension.

(14) Install push rods in order removed.

(15) Install rocker arms and bridged pivot assemblies in order removed. Loosely install capscrews to each bridged pivot. At each bridged pivot, tighten capscrews alternately one turn at a time to avoid damaging bridge. Tighten screws to 19 foot-pounds (26 Nm) torque.

(16) Install cylinder head cover. Use replacement gasket or silicone rubber material.

(17) Connect hoses to thermostat housing and fill cooling system to specified level. Refer to Chapter 1C—Cooling.

NOTE: *Automatic transmission throttle valve linkage must be adjusted after completing the cylinder head installation.*

(18) Install temperature sending unit and connect wire.

(19) Install fuel and vacuum advance lines.

(20) Operate engine with radiator cap off. Check for leaks and continue running engine until thermostat opens. Add coolant, if required.

(21) Install air cleaner.

LUBRICATION SYSTEM

General

A gear-type positive displacement pump is mounted at the underside of the block opposite the No. 4 main bearing (fig. 1B-93). The pump draws oil through the screen and inlet tube from the sump at the rear of the oil pan. The oil is driven between the drive and idler gears and the pump body, then is forced through the outlet to the block. An oil gallery in the block channels oil to the inlet side of the full flow oil filter. After passing through the filter element, the oil passes from the center outlet of the filter through an oil gallery up to the main oil gallery which extends the entire length of the block.

Galleries extend downward from the main oil gallery to the upper shell of each main bearing. The crankshaft is drilled internally to pass oil from the main bearing journals (except No. 4) to the connecting rod journals. Each connecting rod bearing cap has a small squirt hole. Oil passes through the squirt hole and is thrown off as the rod rotates. This oil throwoff lubricates the camshaft lobes, distributor drive gear, cylinder walls and piston pins.

Oil is supplied to the hydraulic valve tappets from the main oil gallery. Oil is provided to the camshaft bearings through galleries. The front camshaft bearing journal passes oil through the camshaft sprocket to the

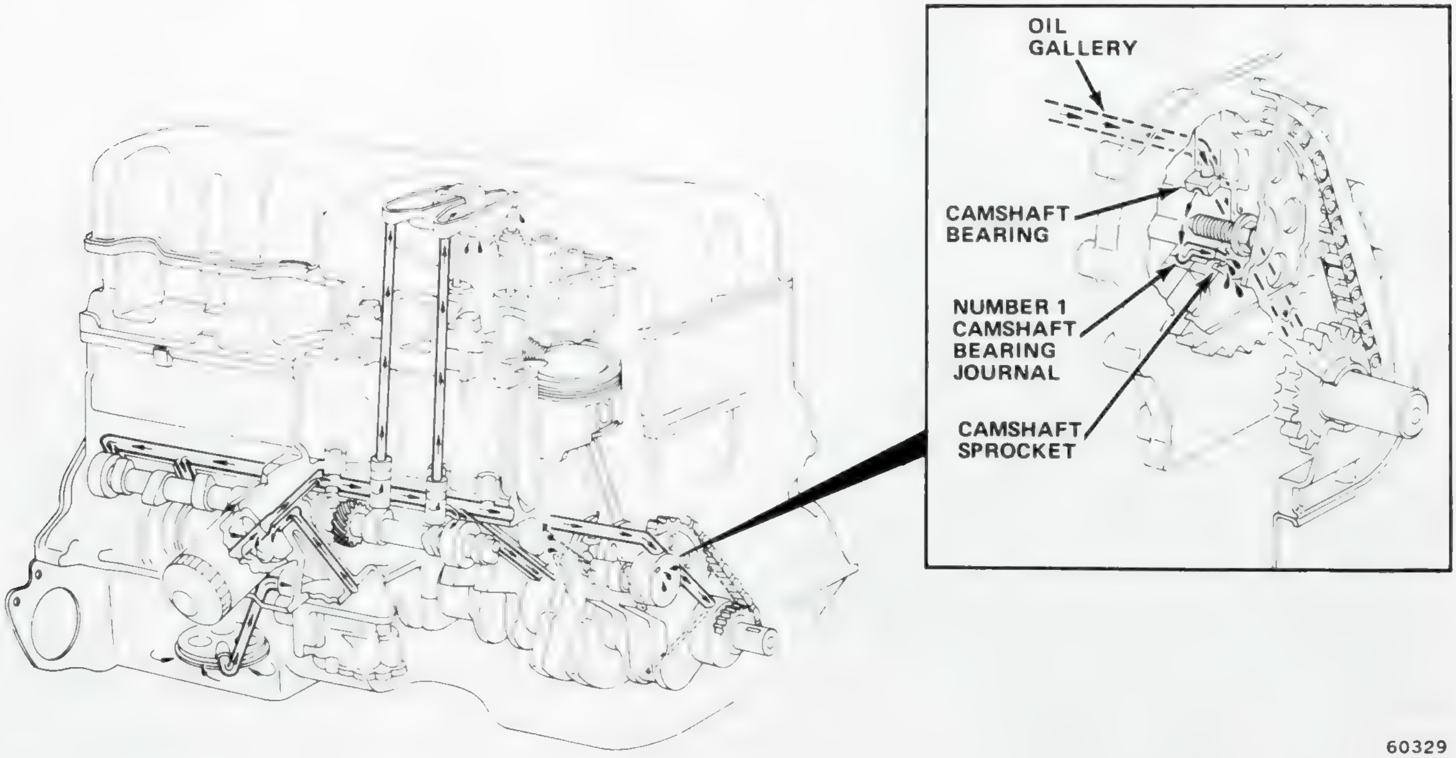

Fig. 1B-93 Lubrication System

timing chain. Rotation of the sprocket lubricates the crankshaft sprocket and chain. Oil drains back to the oil pan under the No. 1 main bearing cap.

The oil supply for the rocker arms and bridged pivot assemblies is provided by the hydraulic valve tappets. Oil passes from the tappet through the hollow push rod to a hole in the corresponding rocker arm. Oil from the rocker arms lubricates the valve train components, then passes down through the push rod guide holes in the cylinder head past the valve tappet area, and returns to the oil pan.

Oil Filter

A full flow oil filter, mounted on the lower right hand side of the engine, is accessible through the hood opening. A bypass valve incorporated in the filter mounting boss on the cylinder block provides a safety factor if the filter becomes inoperative as a result of dirt or sludge accumulation (fig. 1B-94).

Use Tool J-22700 to remove the oil filter. Before installation, apply a thin film of oil to the replacement filter gasket. Install filter until gasket contacts the seat of the adapter. Then tighten securely, by hand only, about 3/4 turn. Operate engine at fast idle and check for leaks.

Oil Pump

The positive-displacement gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft. Crankcase oil is drawn into the pump through an inlet tube and screen assembly which is pressed into the pump body (fig. 1B-94). The pump incorporates a non-adjustable pressure relief valve to limit maximum pressure to 75 pounds. In the relief position, the valve permits oil to bypass through a passage in the pump body to the inlet side of the pump.

Removal

NOTE: *Oil pump removal or replacement will not affect distributor timing as the distributor drive gear remains in mesh with the camshaft gear.*

(1) Drain engine oil.

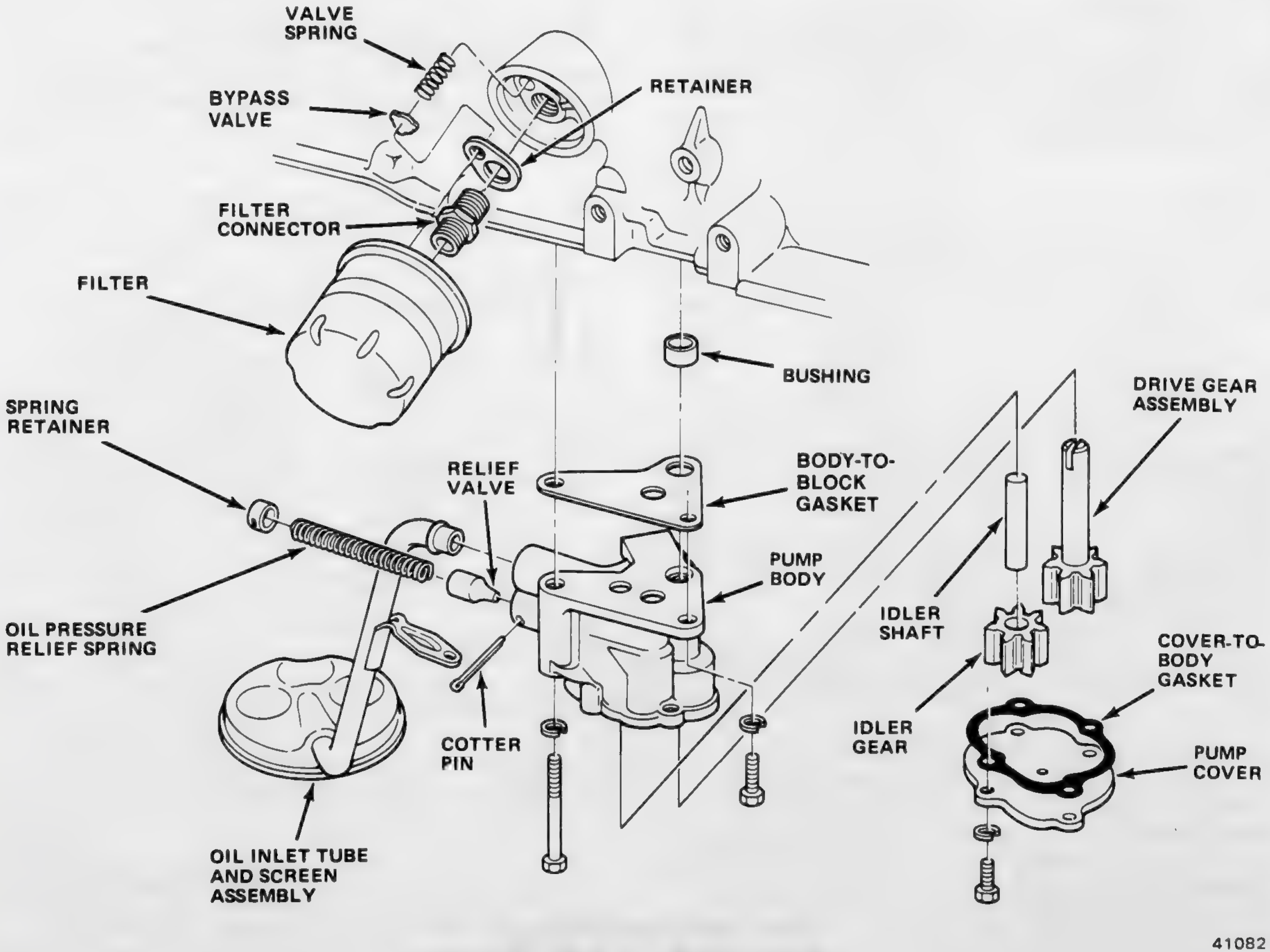

Fig. 1B-94 Oil Filter and Oil Pump Assembly

(2) Remove oil pan. Refer to Oil Pan Removal.

(3) Remove oil pump retaining screws, oil pump and gasket.

CAUTION: *Do not disturb position of oil inlet tube and screen assembly in pump body. If tube is moved within pump body, a replacement tube and screen assembly must be installed to assure an airtight seal.*

Disassembly and Inspection

(1) Remove cover retaining screws, cover and gasket from pump body.

(2) Measure gear end clearance.

- **Preferred Method:**

(a) Place strip of Plastigage across full width of each gear (fig. 1B-95).

(b) Install pump cover and gasket. Tighten screws to 70 inch-pounds (7.9 Nm) torque.

(c) Remove pump cover and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope. Correct clearance by this method is 0.002 to 0.008 inch (0.002 inch preferred).

- **Alternate Method:**

(a) Place straightedge across ends of gears and pump body.

(b) Select feeler gauge which fits snugly but freely between straightedge and pump body (fig. 1B-96). Correct clearance by this method is 0.004 to 0.008 inch (0.007 preferred).

If gear end clearance is excessive, replace oil pump assembly.

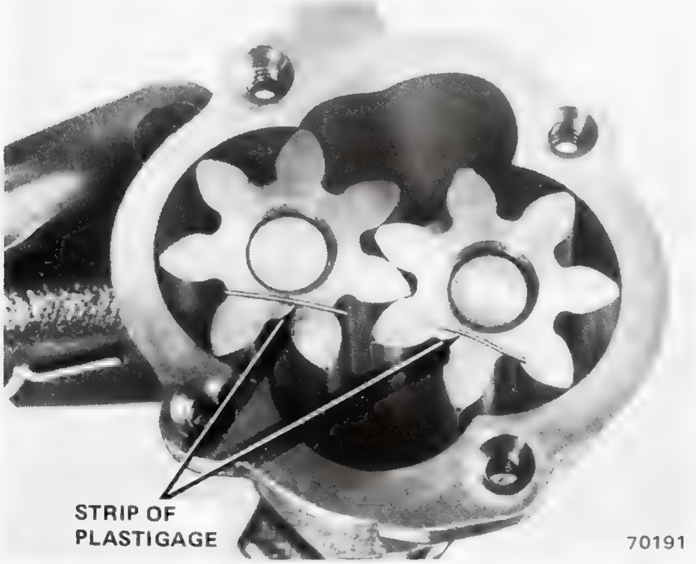

Fig. 1B-95 Oil Pump Gear End Clearance—Plastigage Method

(3) Measure gear-to-body clearance by inserting feeler gauge between gear tooth and pump body inner wall directly opposite the point of gear mesh. Select feeler gauge which fits snugly but freely (fig. 1B-97). Rotate gears to check each tooth in this manner. Correct clearance is 0.0005 to 0.0025 inch (0.0005 preferred).

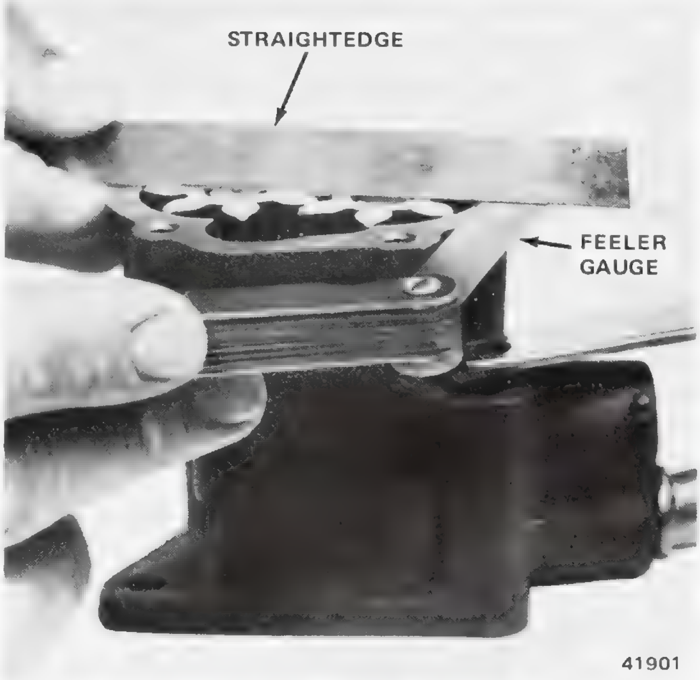

Fig. 1B-96 Oil Pump Gear End Clearance Measurement—Feeler Gauge Method

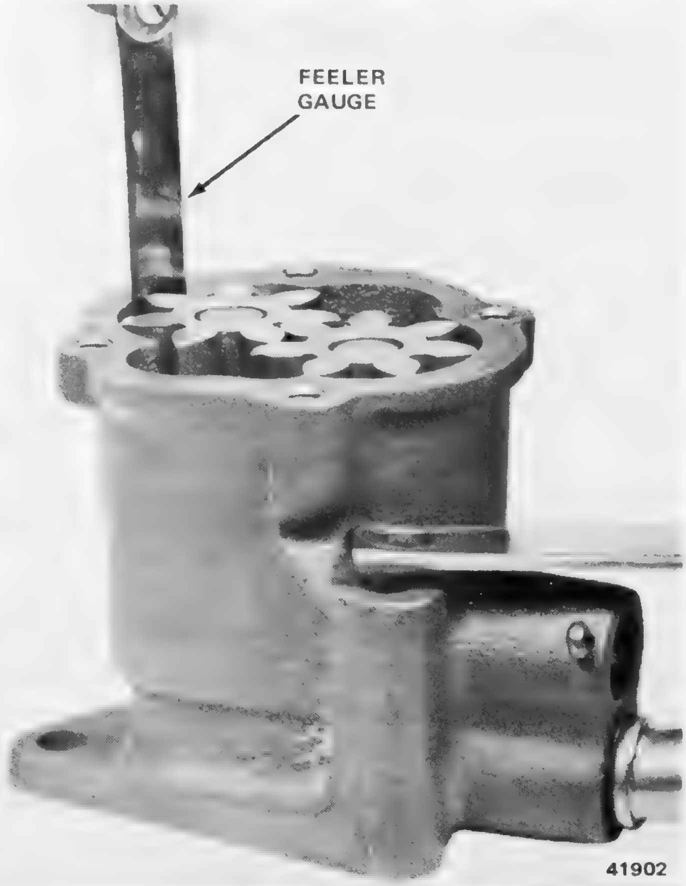

Fig. 1B-97 Oil Gear-to-Body Clearance Measurement

If gear-to-body clearance is more than specified, replace idler gear, idler shaft and drive gear assembly.

(4) Remove cotter pin and slide spring retainer, spring and oil pressure relief valve out of pump body.

Check for sticking condition during disassembly. Clean or replace as necessary.

NOTE: *The oil inlet tube must be moved to allow removal of the relief valve. Install a replacement pickup tube assembly.*

Assembly and Installation

(1) Install oil pressure relief valve, spring, retainer and cotter pin.

(2) If position of the inlet tube in the pump body has been disturbed, install replacement tube and screen assembly. Apply light film of Permatex No. 2, or equivalent, around end of tube. Use tool J-21882 to drive tube into body, making sure support bracket is properly aligned (fig. 1B-98).

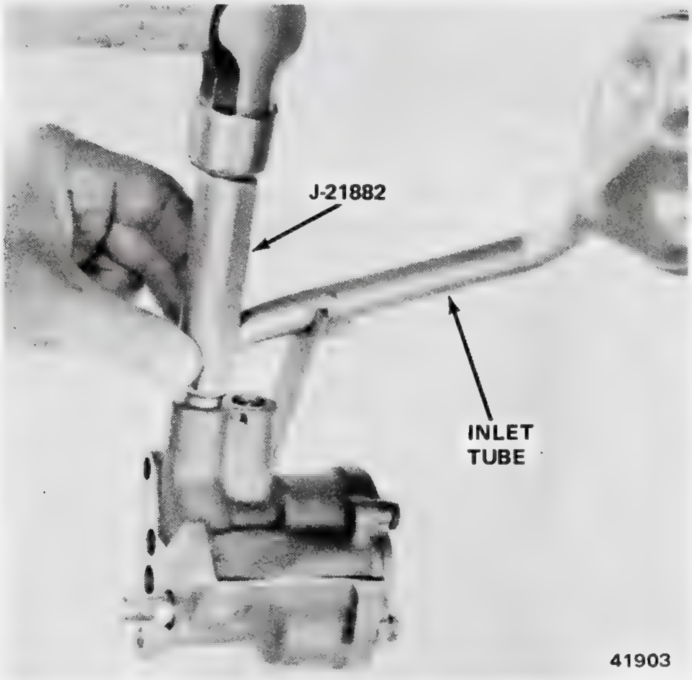

Fig. 1B-98 Oil Pump Inlet Tube Installation

(3) Install idler shaft, idler gear and drive gear assembly.

NOTE: *To ensure self-priming of the oil pump, fill pump with petroleum jelly before installing the oil pump cover. Do not use grease.*

(4) Install pump cover and replacement gasket. Tighten cover screws to 70 inch-pounds (7.9 Nm) torque.

NOTE: *Check gears for binding before installing the oil pump.*

(5) Install oil pump and replacement gasket. Tighten short screws to 10 foot-pounds (14 Nm) torque and long screws to 17 foot-pounds (23 Nm) torque.

(6) Install oil pan using replacement gaskets and seals. Refer to Oil Pan Installation. Fill crankcase with clean oil to specified level.

Oil Pan

Removal—Gremlin-Concord-AMX-Matador

(1) Turn steering wheel to full left lock.

(2) Support engine with holding fixture as shown in figure 1B-70.

(3) Raise car and support with support stands at side sills.

(4) Disconnect steering idler arm at side sill.

(5) Disconnect engine front support cushions at engine brackets.

(6) Loosen sway bar link nuts to the end of bolt threads, if equipped.

(7) Remove front crossmember-to-side sill bolts and nuts and pull crossmember down.

(8) Remove engine right support bracket from engine.

(9) Loosen strut rods at lower control arm. Do not remove screws.

(10) Drain engine oil.

(11) Remove starter motor.

(12) Remove oil pan screws and oil pan.

(13) Remove oil pan front and rear neoprene oil seals.

(14) Thoroughly clean gasket surfaces of oil pan and engine block.

(15) Remove all sludge and dirt from oil pan sump.

Installation—Gremlin-Concord-AMX-Matador

(1) Install replacement oil pan front seal to timing case cover and apply generous amount of RTV silicone (AMC Gasket-in-a-Tube, or equivalent) to end tabs.

(2) Cement replacement oil pan side gaskets into position on engine block. Apply generous amount of RTV silicone to ends of gaskets.

(3) Coat inside curved surface of replacement oil pan rear seal with soap. Apply generous amount of RTV silicone to gasket contacting surface of seal end tabs.

(4) Install seal in recess of rear main bearing cap. Make certain it is fully seated.

(5) Apply engine oil to oil pan contacting surface of front and rear oil pan seals.

(6) Install oil pan. Tighten screws and drain plug securely.

NOTE: *Tighten 1/4-20 oil pan screws to 7 foot-pounds (9 Nm) torque and 5/16-18 oil pan screws to 11 foot-pounds (15 Nm) torque.*

(7) Install starter motor.

(8) Install engine right support bracket.

(9) Install crossmember-to-side sill screws and nuts and tighten to 65 foot-pounds (88 NM) torque.

(10) Tighten strut rod screws.

(11) Install engine front support cushion-to-bracket screws and tighten to 33 foot-pounds (45 Nm) torque.

(12) Tighten sway bar link nuts to 7 foot-pounds (9 Nm) torque, if equipped.

(13) Install steering idler arm to side sill and tighten retaining nuts to 50 foot-pounds (68 Nm) torque.

(14) Lower car and remove engine holding fixture.

(15) Fill crankcase to specified level with clean oil. Run engine and check for leaks.

Removal—Pacer

(1) Drain engine oil.

(2) Install engine holding fixture (fig. 1B-70).

(3) Disconnect steering shaft flexible coupling (rag joint) and use wire to position it aside.

(4) Raise and support car.

(5) Remove front engine support cushion through-screws.

(6) Disconnect front brake lines at wheel cylinders.

(7) Disconnect upper ball joints from spindles.

WARNING: *Be sure shock absorbers are securely attached.*

(8) Remove upper control arms and move aside.

(9) Support front crossmember with jack.

(10) Remove nuts from front crossmember rear mounts and swing crossmember forward (fig. 1B-99).

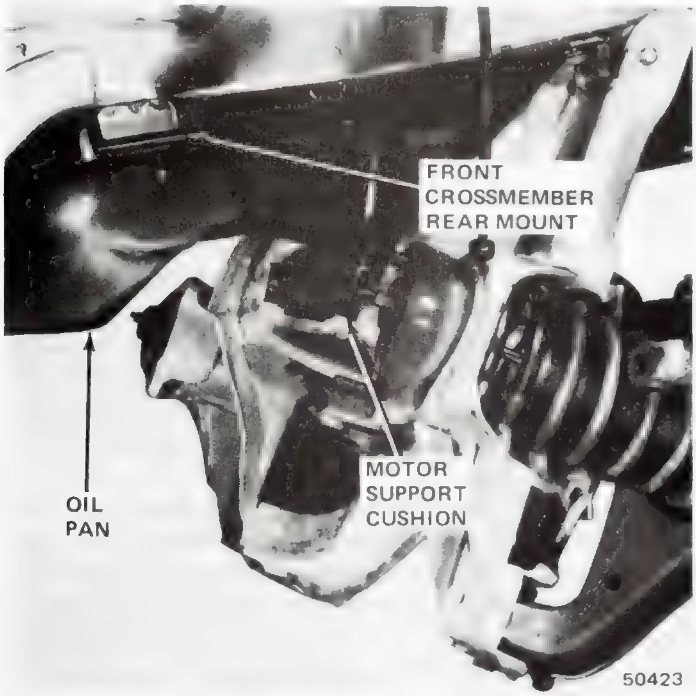

Fig. 1B-99 Oil Pan Removal—Pacer

(11) Remove starter motor.

(12) Remove oil pan attaching screws and oil pan.

(13) Remove oil pan front and rear neoprene oil seals.

(14) Thoroughly clean gasket surface of oil pan and cylinder block.

(15) Clean all sludge and dirt from oil pan sump.

Installation—Pacer

(1) Install replacement oil pan front seal to timing case cover. Apply generous amount of AMC Gasket-in-a-Tube, or equivalent, to end tabs.

(2) Cement replacement oil pan side gaskets into position on engine block. Apply generous amount of RTV silicone to gasket ends.

(3) Coat inside curved surface of replacement oil pan rear seal with soap. Apply generous amount of RTV silicone to side gasket contacting surface of seal end tabs.

(4) Install seal in recess of rear main bearing cap. Make sure it is fully seated.

(5) Apply engine oil to oil pan contacting surface of front and rear oil pan seals.

(6) Install oil pan. Tighten screws and drain plug securely.

NOTE: *Tighten 1/4-20 oil pan screws to 7 foot-pounds (9 Nm) torque and 5/16-18 oil pan screws to 11 foot-pounds (15 Nm) torque.*

(7) Install starter motor.

(8) Swing front crossmember back into position and support with jack. Install front engine support cushion screws and tighten to 55 foot-pounds (75 Nm) torque.

(9) Install crossmember rear screws and tighten to 50 foot-pounds (68 Nm) torque.

(10) Remove jack.

(11) Install upper control arms and tighten cross shaft bolts and nuts to 60 foot-pounds (81 Nm) torque.

(12) Attach ball joints to spindles and tighten nuts to 75 foot-pounds (102 Nm) torque.

(13) Attach front brake lines to wheel cylinders and tighten to 100 inch-pounds (11.3 Nm) torque.

(14) Lower car.

(15) Connect steering shaft flexible coupling and tighten nuts to 25 foot-pounds (34 Nm) torque.

(16) Remove engine holding fixture.

(17) Fill crankcase with clean oil to specified dipstick level.

(18) Bleed brakes.

Oil Pressure Indicator—All Models

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and replacement of oil pressure indicator.

Oil Pressure Gauge

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and replacement of oil pressure gauge.

CONNECTING ROD AND PISTON ASSEMBLY

NOTE: *The following procedure is used to service connecting rod and piston assemblies with engine in the car.*

Removal

(1) Remove cylinder head cover.

NOTE: *On Pacer models, cylinder head cover removal is easier if windshield wiper blades are parked at the center of the windshield.*

(2) Remove rocker arms and bridged pivot assemblies. Remove two capscrews at each bridged pivot. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove push rods.

(4) Remove cylinder head and gasket.

(5) Position pistons one at a time near bottom of stroke and use ridge reamer to remove ridge from top end of cylinder walls.

(6) Drain engine oil.

(7) Remove oil pan and gaskets.

(8) Remove connecting rod bearing caps and inserts and retain in same order as removed.

NOTE: *Connecting rods and caps are stamped with the corresponding cylinder number.*

(9) Remove connecting rod and piston assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod screws do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over the rod screws will provide protection during removal.*

Installation

(1) Clean cylinder bores thoroughly. Apply light film of clean engine oil to bores with clean, lint-free cloth.

(2) Install piston rings on pistons. Refer to Piston Rings for sequence.

(3) Lubricate piston and rings with clean engine oil.

(4) Use Piston Ring Compressor Tool J-5601 to install connecting rod and piston assemblies from top of cylinder bores (fig. 1B-100).

NOTE: *Be careful that connecting rod screws do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over the connecting rod screws will provide protection during installation.*

(5) Install connecting rod bearing caps and inserts in same order as removed.

NOTE: *Oil squirt holes in connecting rods must face camshaft.*

(6) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(7) Install gasket and cylinder head.

(8) Install push rods.

(9) Install rocker arms and bridged pivot assemblies. Tighten capscrews for each bridge a turn at a time to avoid damaging bridge.

(10) Install cylinder head cover. Use replacement gasket or silicone rubber material.

(11) Fill crankcase with clean oil to specified dipstick level.

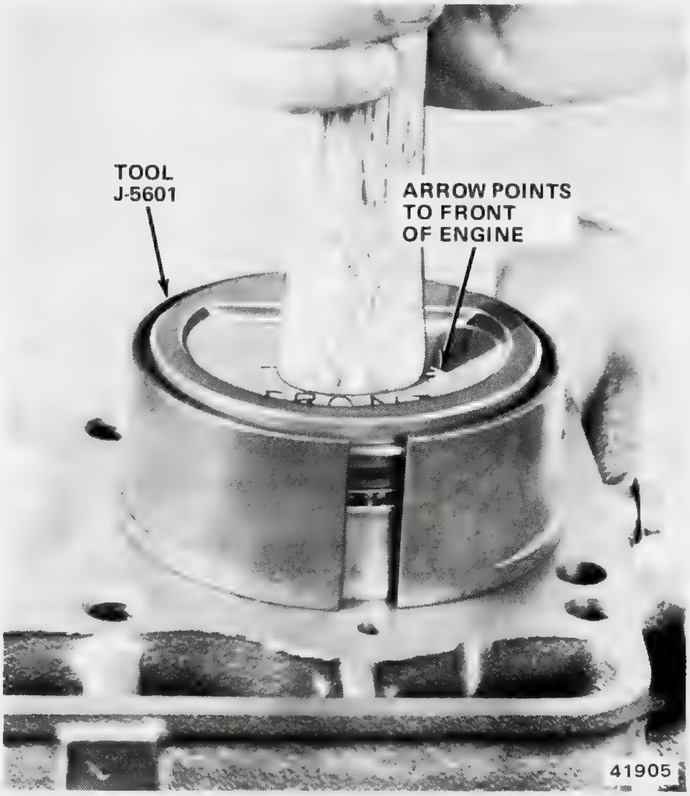

Fig. 1B-100 Piston Installation

CONNECTING RODS

The connecting rods are malleable iron, balanced assemblies with bearing inserts at the crankshaft journal end. The piston pin is a 2,000 pound press-fit.

A squirt hole in the crankshaft end of the connecting rod provides lubrication for the camshaft lobes, distributor drive gear, cylinder walls and piston pins. The squirt hole faces the camshaft when the connecting rod is installed.

Misaligned or bent connecting rods cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearing or crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, check rod alignment. Replace misaligned or bent rods.

Side Clearance Measurement

Slide snug-fitting feeler gauge between connecting rod and crankshaft rod journal flange. Correct clearance is 0.005 to 0.014 inch. Replace connecting rod if side clearance is not to specifications.

Connecting Rod Bearings

The connecting rod bearings are steel-backed aluminum-alloy.

Each bearing is selectively fitted to its respective journal to obtain the desired operating clearance. **In production,** the select fit is obtained by using various-sized, color-coded bearing inserts as shown in the bearing fitting chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on inserts used in production.*

The rod journal size is identified in production by a color coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. The color codes used to indicate journal size are shown in the bearing fitting chart.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance 0.0005 inch.

NOTE: *Never use a pair of bearing inserts with more than 0.001-inch difference in size.*

Example:

Correct	Incorrect
Upper—Standard Lower—0.001-inch undersize	Standard 0.002-inch undersize

70242

Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-, 0.002-, 0.010-, and 0.012-inch undersize. The bearing size is stamped on the back of service replacement inserts.

NOTE: *The 0.002- and 0.012-inch undersize inserts are not used in production.*

Removal

(1) Drain engine oil.

(2) Remove oil pan and gaskets.

(3) Rotate crankshaft as required to position two connecting rods at a time at bottom of stroke.

(4) Remove connecting rod bearing cap. Remove lower bearing insert.

(5) Remove upper bearing insert by rotating it out of connecting rod.

NOTE: *Do not mix bearing caps. Each connecting rod and its matching cap is stamped with the cylinder number on a machined surface adjacent to the oil squirt hole which faces the camshaft side of the engine block.*

Inspection

(1) Clean inserts.

(2) Inspect linings and backs of inserts for irregular wear pattern. Note any scraping, stress cracks or discoloration (fig. 1B-101). If bearing has spun in rod, replace bearing and connecting rod and inspect crankshaft journal for scoring.

(3) Inspect for material imbedded in linings which may indicate piston, timing gear, distributor gear or oil pump gear problems. Figures 1B-102 and 1B-103 show common score patterns.

(4) Inspect fit of bearing locking tab in rod cap. If inspection indicates that insert may have been caught between rod and rod cap, replace upper and lower bearing inserts.

(5) Inspect insert in area of locking tab. Abnormal wear indicates bent tabs or improper installation of inserts (fig. 1B-104).

(6) Replace bearing inserts that are damaged or worn.

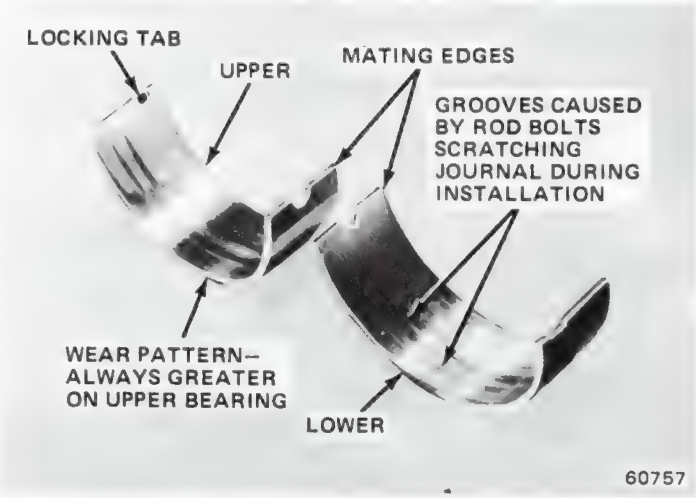

Fig. 1B-101 Connecting Rod Bearing Inspection

Connecting Rod Bearing Fitting Chart

Crankshaft Connecting Rod Journal Color and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow —2.0955 to 2.0948 (Standard)	Yellow — Standard	Yellow — Standard
Orange —2.0948 to 2.0941 (0.0007 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black —2.0941 to 2.0934 (0.0014 Undersize)	Black — .001-Inch Undersize	Black — .001-inch Undersize
Red —2.0855 to 2.0848 (0.010 Undersize)	Red — .010-Inch Undersize	Red — .010-inch Undersize

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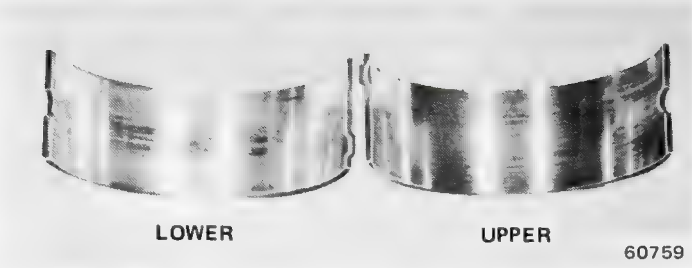


Fig. 1B-102 Scoring Caused by Insufficient Lubrication

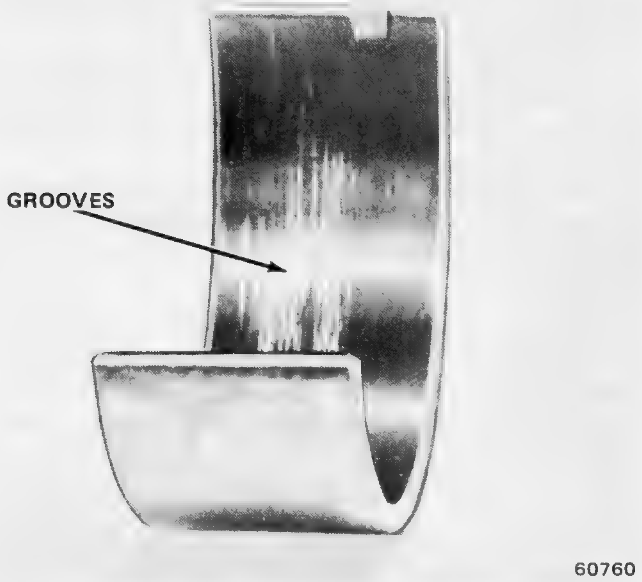


Fig. 1B-103 Scoring Caused by Dirt

Fig. 1B-104 Locking Tab Inspection

Measuring Bearing Clearance with Plastigage

(1) Wipe journal clean.

(2) Lubricate upper insert and install in rod.

(3) Install lower insert in bearing cap. Lower insert must by dry. Place strip of Plastigage across full width of lower insert at center of bearing cap.

(4) Install bearing cap to connecting rod and tighten nuts to 28 foot-pounds (38 Nm) torque.

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading.*

NOTE: *Plastigage must not crumble in use. If brittle, obtain fresh stock.*

(5) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope (fig. 1B-105). Correct clearance is 0.001 to 0.0025 inch.

NOTE: *Plastigage should maintain the same size across the entire width of the insert. If size varies, it may indicate a tapered journal, bent connecting rod or dirt trapped between the insert and rod.*

(6) If correct clearance is indicated, bearing fitting is not necessary. Remove Plastigage from crankshaft and bearing and proceed to Installation.

(7) If oil clearance exceeds specification, install 0.001 inch undersize bearing inserts and check clearance as described in steps (1) through (5).

The clearance indicated with 0.001-inch undersize bearing installed will determine if 0.001-inch undersize inserts or some other combination is needed to provide correct clearance. For example, if the initial clearance was 0.003 inch, 0.001-inch undersize inserts would reduce clearance by 0.001 inch. Oil clearance would be 0.002 inch and within specification. A 0.002-inch undersize insert and a 0.001-inch undersize insert would reduce this clearance an additional 0.0005 inch. Oil clearance would then be 0.0015 inch.

CAUTION: *Never use inserts which differ more than one bearing size as a pair. For example, do not use a standard upper and 0.002-inch undersize lower.*

(8) If oil clearance exceeds specification when 0.002-inch undersize inserts are installed, measure connecting rod journal with micrometer. If journal size is correct (not under 2.0934 inch), inside diameter of connecting rod is incorrect and rod must be replaced.

If journal size is incorrect, replace crankshaft or grind journal to accept a suitable undersize bearing.

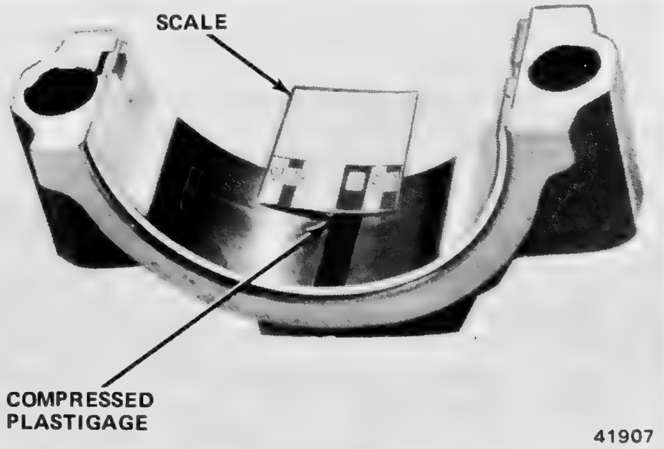


Fig. 1B-105 Bearing Clearance Measurement with Plastigage

Measuring Bearing Clearance with Micrometer

(1) Wipe connecting rod journal clean.

(2) Use micrometer to measure maximum diameter of rod journal at four points. Take two readings 90° apart at each end of journal.

(3) Check for taper and out-of-round condition. Correct tolerance is 0.0005 inch maximum for both taper and out-of-round. If any rod journal is not within specifications, replace the crankshaft.

(4) Compare reading obtained with journal diameters listed in Connecting Rod Bearing Fitting Chart and select inserts required to obtain specified bearing clearance.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Install bearing inserts, cap and retaining nuts. Tighten to 33 foot-pounds (45 Nm) torque.

CAUTION: *Be careful when rotating the crankshaft with bearing caps removed. Be sure the connecting rod screws do not accidentally come in contact with the rod journals and scratch the finish. Bearing failure would result. Short pieces of rubber hose slipped over the connecting rod screws will provide protection during installation.*

(3) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(4) Fill crankcase with clean oil to specified level.

PISTONS

Aluminum alloy Autothermic pistons, steel reinforced for strength and controlled expansion, are used. The ring belt area above the piston pin provides for three piston rings: two compression rings and one oil control ring.

The piston pin boss is offset from the centerline of the piston to place it nearer the thrust side of the piston, minimizing piston slap.

An arrow on the top surface of the piston ensures correct installation in the bore. The arrow points toward the front of engine when installed (fig. 1B-106).

Piston Fitting

Micrometer Method

(1) Measure inside diameter of cylinder bore at point 2-5/16 inches below top of bore.

(2) Measure outside diameter of piston.

NOTE: *Because pistons are cam ground, measure at right angle to piston pin at centerline of pin (fig. 1B-107).*

(3) The difference between cylinder bore diameter and piston diameter is piston-to-bore clearance.

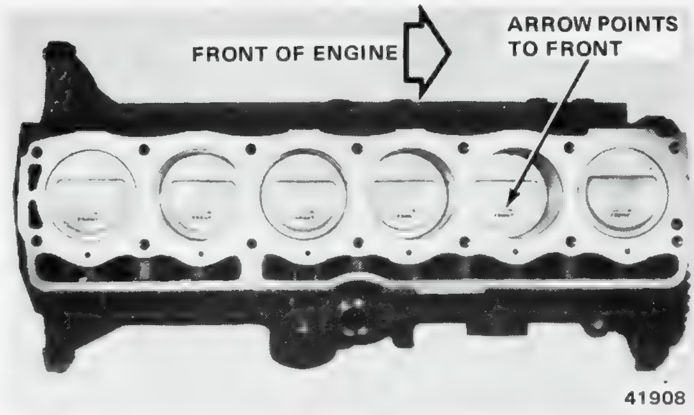


Fig. 1B-106 Pistons Correctly Positioned in Bores

Feeler Gauge Method

(1) Remove rings from piston.

(2) Insert long 0.001-inch feeler gauge into cylinder bore.

(3) Insert piston, top first, into bore alongside feeler gauge. With entire piston inserted in bore, piston should not bind against feeler gauge.

(4) Repeat steps (2) and (3) with long 0.002-inch feeler gauge. Piston should bind.

If piston binds on 0.001-inch gauge, piston is too large or bore is too small. If piston does not bind on 0.002-inch gauge, piston is too small for bore. Piston may be enlarged by knurling or shot-peening. Replace pistons that are 0.004-inch or more undersize.

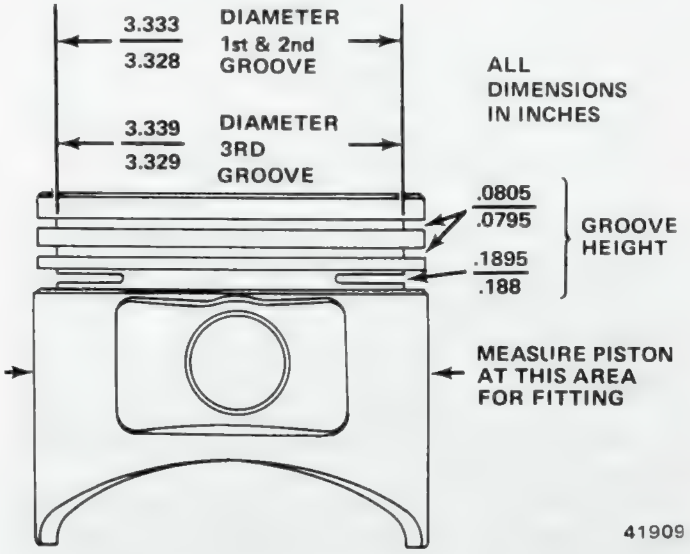


Fig. 1B-107 Piston Measurement

Piston Rings

The two compression rings are made of cast iron. The oil control ring is a three-piece steel design.

Ring Fitting

(1) Clean carbon from all ring grooves. Oil drain openings in oil ring grooves and pin boss must be open.

Do not remove metal from grooves or lands. This will change ring groove clearances and will damage ring-to-land seating.

(2) Check ring side clearance with feeler gauge fitted snugly between ring land and ring. Rotate ring in groove. It must move freely at all points (fig. 1B-108). Refer to Specifications for correct ring side clearance.

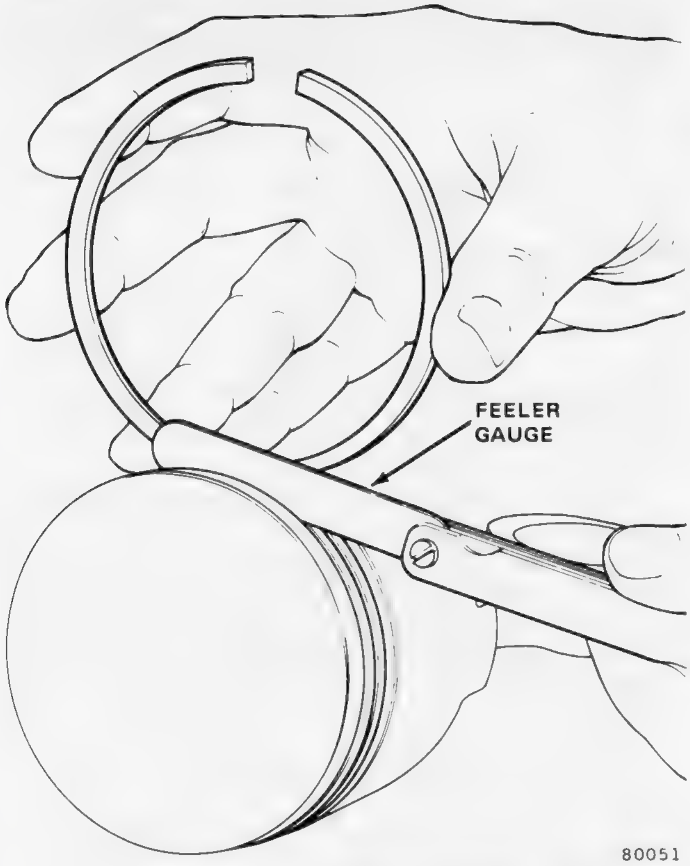


Fig. 1B-108 Ring Side Clearance

(3) Place ring in bore and push down with inverted piston to position near lower end of ring travel. Measure ring gap clearance with feeler gauge fitting snugly in ring opening (fig. 1B-109).

Installation

Refer to figure 1B-110 for position of ring gaps when installing piston rings.

(1) Install oil control rings as indicated by instructions in package. It is not necessary to use a tool to install upper and lower rails (fig. 1B-111). Insert expander ring first, then side rails.

(2) Install lower compression ring using ring installer to expand ring around piston (fig. 1B-112).

NOTE: *Make certain upper and lower compression rings are installed properly. Figure 1B-113 shows typical ring markings indicating the top side of the ring.*

Fig. 1B-109 Ring Gap Clearance

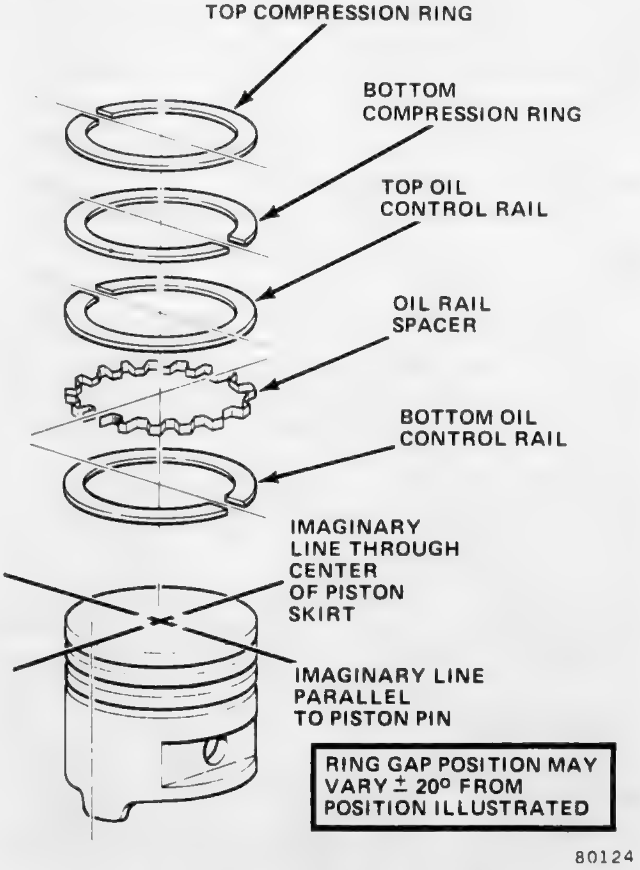


Fig. 1B-110 Piston Ring Gap Position

(3) Install upper compression ring using ring installer to expand ring around piston (fig. 1B-112).

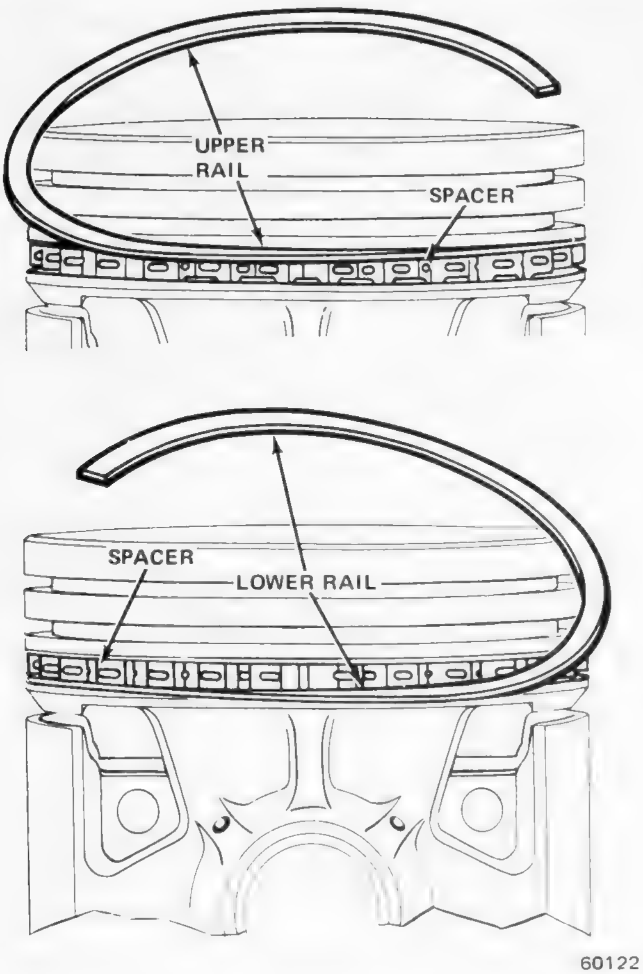


Fig. 1B-111 Oil Control Ring Rail Installation

Fig. 1B-112 Compression Ring Installation

Fig. 1B-113 Typical Piston Ring Markings

Piston Pins

Piston pins are press fit into the connecting rod and require no locking device.

Removal

(1) Using Piston Pin Remover J-21872 and arbor press, place piston on Remover Support J-21872-1 (fig. 1B-114).

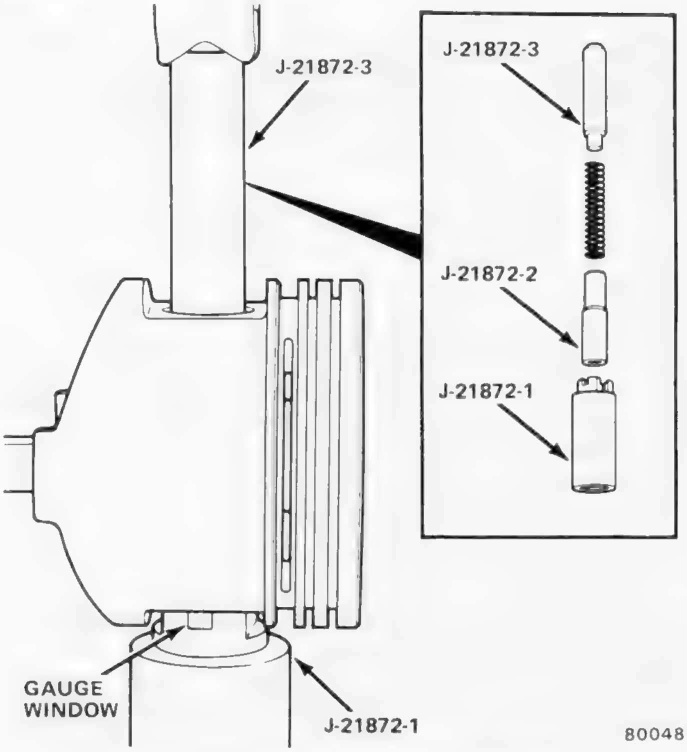


Fig. 1B-114 Piston Pin Removal or Installation

(2) Use Piloted Driver J-21872-3 to press pin completely out of piston. Note position of pin through gauge window of remover support.

Pin Inspection

(1) Inspect pin and pin bore for nicks and burrs. Remove as necessary.

NOTE: *Never reuse piston pin after it has been installed in and removed from a connecting rod.*

(2) With pin removed from piston, clean and dry piston pin bore and replacement piston pin.

(3) Position piston so that pin bore is in vertical position. Insert pin in bore. At room temperature, pin

should slide completely through pin bore without pushing.

(4) Replace piston and pin if pin jams in pin bore.

Installation

(1) Insert Pin Pilot J-21872-2 through piston and connecting rod pin bores (fig. 1B-114).

(2) Position pin pilot, piston and connecting rod on Support J-21872-1.

(3) Insert piston pin through upper piston pin bore and into connecting rod pin bore.

(4) Position Piloted Driver J-21872-3 inside piston pin.

(5) Using arbor press, press piston pin through connecting rod and piston until pin pilot indexes with mark on support.

NOTE: *The piston pin requires a 2,000 pound press-fit. If little effort is required to install piston pin in connecting rod, or if rod moves along pin, connecting rod must be replaced.*

(6) Remove piston and connecting rod assembly from press. Pin should be centered in rod, ±0.0312 inch.

CRANKSHAFT

The crankshaft is nodular iron and is counterweighted and balanced. The 232 CID engine crankshaft has eight counterweights, and the 258 CID engine crankshaft has twelve counterweights. Both have seven main bearing journals and six connecting rod journals. End thrust is controlled by the No. 3 main bearing.

An oil slinger is provided at the rear main journal, inboard of the rear oil seal. The component parts and crankshaft are individually balanced. Then the complete assembly is balanced as a unit.

NOTE: *On engines equipped with automatic transmissions, mark the torque converter and converter flexplate before removal. Install in the same position.*

Service replacement dampers, crankshafts, flywheels, torque converters and clutch components are balanced individually and may be replaced as required without balancing the complete assembly.

Removal or Replacement

Replace the crankshaft if it is damaged to the extent that reconditioning is not feasible. Removal and installation procedures are outlined under Cylinder Block.

Crankshaft End Play Measurement

The crankshaft end play is controlled at the No. 3 main bearing insert which is flanged for this purpose.

(1) Attach dial indicator to cylinder block adjacent to No. 3 main bearing (fig. 1B-115).

(2) Pry shaft forward with flat-bladed screwdriver, position dial indicator push rod on face of crankshaft counterweight and set dial to zero.

(3) Pry shaft fore and aft. Read dial indicator. End play is difference between high and low readings. Correct crankshaft end play is 0.0015 to 0.0065 inch (0.002 to 0.0025 desired).

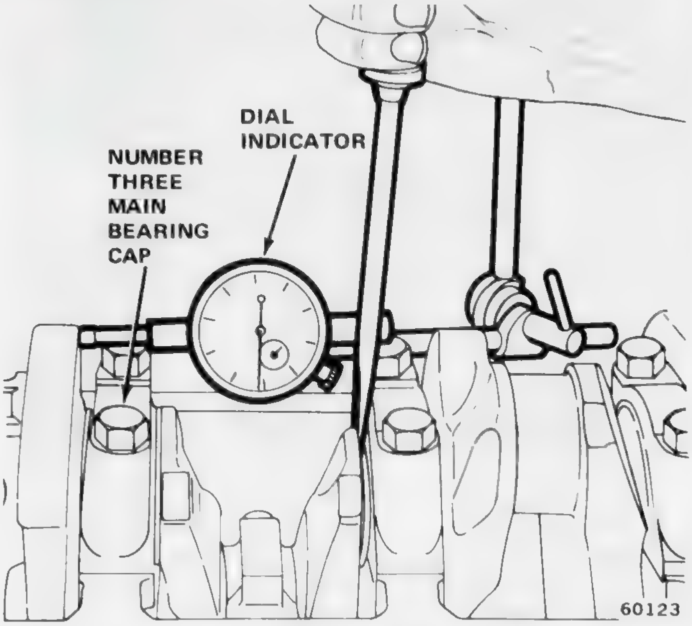


Fig. 1B-115 Measuring Crankshaft End Play

(4) If end play is out of specifications, inspect crankshaft thrust faces for wear. If no wear is apparent, replace thrust bearing and check end play. If end play is still out of specifications, replace crankshaft.

NOTE: *When replacing the thrust bearings, pry the crankshaft fore and aft to align the faces of the thrust bearings before final torque tightening.*

Crankshaft Main Bearings

The main bearings are steel-backed, micro-babbitt, precision type. The main bearing caps, numbered (front to rear) from 1 through 7, have an arrow to indicate forward position. The upper main bearing inserts are grooved while the lower inserts are smooth.

Each bearing is selectively fitted to its respective journal to obtain the desired operating clearance. **In production,** the select fit is obtained by using various-sized color-coded bearing inserts as shown in Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on inserts used in production.*

The main bearing journal size is identified **in production** by a color-coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft, except for the rear main journal which is on the crankshaft rear flange.

When required, upper and lower bearing inserts of different sizes may be used as a pair. A standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance by 0.0005 inch. Example:

Correct	Incorrect
Upper Standard Lower 0.001 inch undersize	Standard 0.002-inch undersize

70242

CAUTION: *Never use a pair of bearing inserts with greater than 0.001-inch difference in size.*

CAUTION: *When replacing inserts, all the odd size inserts must be either all on the top (in block) or all on the bottom (in main cap).*

Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-, 0.002-, 0.010-, and 0.012-inch undersize. The size is stamped on the back of service replacement inserts.

NOTE: *The 0.012-inch undersize insert is not used in production.*

Removal

(1) Drain engine oil.
(2) Remove oil pan.
(3) Remove main bearing cap and insert.
(4) Remove lower insert from bearing cap.
(5) Remove upper insert by loosening all of other bearing caps and inserting small cotter pin in crankshaft oil hole. Bend cotter pin as shown in figure 1B-116.
(6) With pin in place, rotate crankshaft so that upper bearing insert will rotate in direction of its locking tab.

NOTE: *Since there is no hole in the number 4 main journal, use a tongue depressor or similar soft-faced tool to remove the bearing (fig. 1B-117). After moving the insert approximately one inch, the insert can be removed by applying pressure under the tab.*

(7) In the same manner, remove remaining bearings one at a time for inspection.

Inspection

(1) Wipe lower insert clean and inspect for abnormal wear pattern and for dirt or metal imbedded in lining. A normal main bearing wear pattern is shown in figure 1B-118.

NOTE: *If the crankshaft journal is scored, remove the engine for crankshaft repair.*

(2) Inspect back of insert for fractures, scrapings or irregular wear pattern.
(3) Inspect locking tabs for damage.
(4) Replace bearing inserts that are damaged or worn.

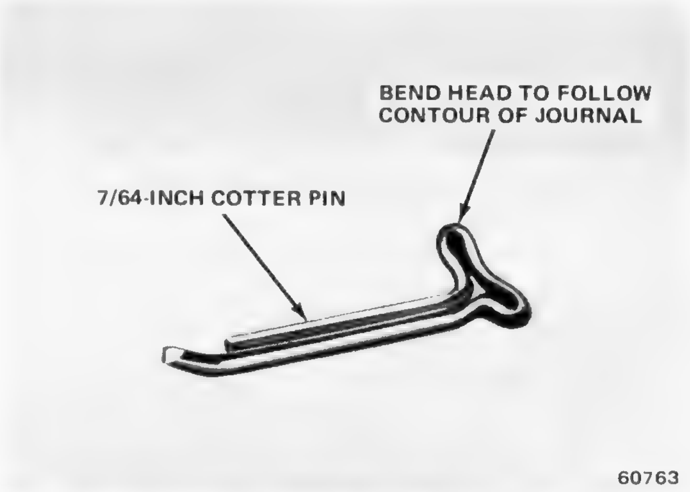


Fig. 1B-116 Upper Main Bearing Removal Tool

Measuring Bearing Clearance with Plastigage (Crankshaft Installed)

NOTE: *Check clearance of one bearing at a time. All other bearings must remain tightened.*

(1) Remove main bearing cap and insert.
(2) Clean insert and exposed portion of crankshaft journal.
(3) Place strip of Plastigage across full width of bearing insert.
(4) Install bearing cap and tighten screws to 80 foot-pounds (108 Nm) torque.

Main Bearing Fitting Chart

Crankshaft Main Bearing Journal Color Code and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow —2.5001 to 2.4996 (Standard)	Yellow — Standard	Yellow — Standard
Orange —2.4996 to 2.4991 (0.0005 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black —2.4991 to 2.4986 (0.001 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Green —2.4986 to 2.4981 (0.0015 Undersize)	Black — .001-inch Undersize	Green — .002-inch Undersize
Red —2.4901 to 2.4896 (0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize

60262

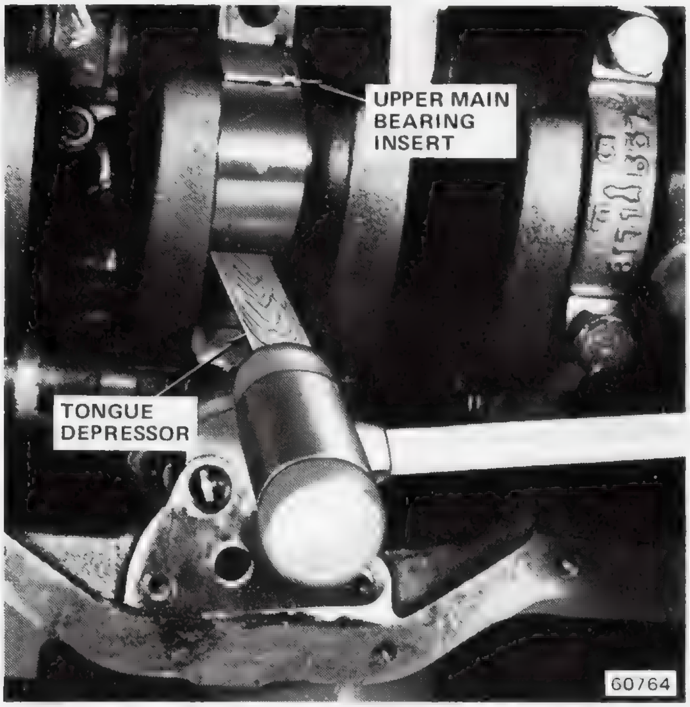


Fig. 1B-117 Removing No. 4 Main Bearing Insert

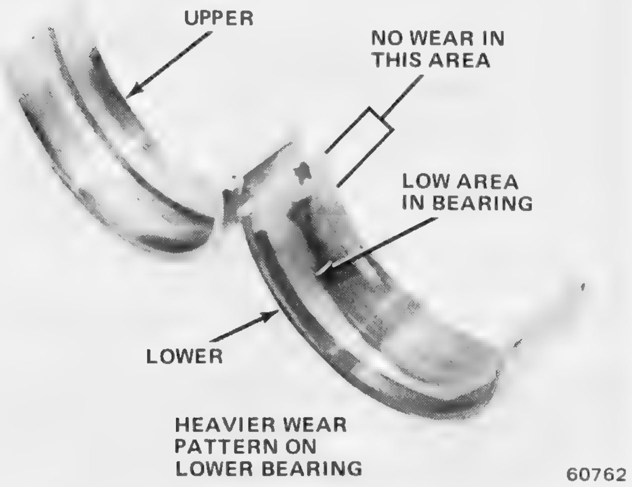


Fig. 1B-118 Normal Main Bearing Wear Pattern

(5) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope (fig. 1B-119). Correct clearance is 0.001 to 0.003 inch. Plastigage should maintain same size across entire width of insert. If size varies, it may indicate tapered journal or dirt trapped behind insert.

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading. Plastigage must not crumble. If brittle, obtain fresh stock.*

(6) If correct clearance is indicated, bearing fitting is not necessary. Remove Plastigage from crankshaft and bearing and proceed to Installation.

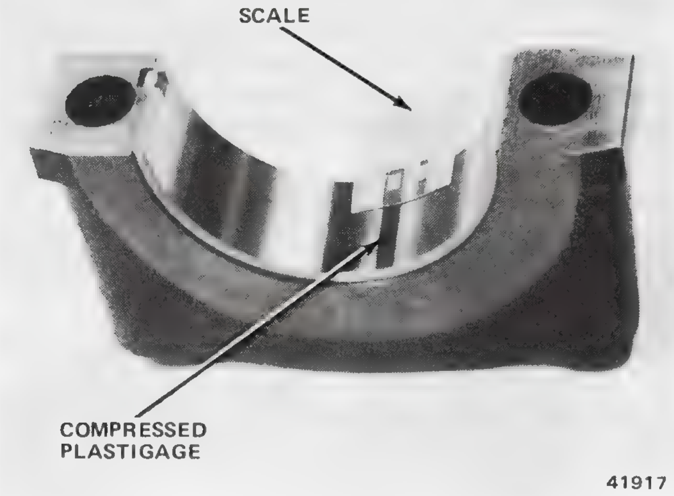


Fig. 1B-119 Checking Main Bearing Clearance with Plastigage

(7) If oil clearance exceeds specification, install pair of 0.001-inch undersize bearing inserts and check clearance as described in steps (4) through (6).
The clearance indicated with the 0.001-inch undersize inserts installed will determine if the 0.001-inch undersize inserts or some other combination will provide correct clearance. For example, if the clearance was 0.0035 inch originally, a pair of 0.001-inch undersize inserts would reduce clearance by 0.001 inch. Oil clearance would be 0.0025 inch and within specification. A 0.002-inch undersize bearing half and a 0.001-inch undersize half would reduce this clearance an additional 0.0005 inch and oil clearance would be 0.002 inch.

CAUTION: *Never use a pair of inserts which differ more than one bearing size as a pair. For example, do not use a standard upper and 0.002-inch undersize lower.*

(8) If oil clearance exceeds specification using 0.002-inch undersize bearings, measure crankshaft journal with micrometer. If journal size is correct, crankshaft bore of cylinder block may be misaligned which requires cylinder block replacement or machining to true bore. If journal size is less than 2.4981 inches, replace crankshaft or grind to accept suitable undersize bearing.

Measuring Main Bearing Journal with a Micrometer (Crankshaft Removed)

(1) Clean main bearing journal.

(2) Measure maximum diameter of journal with micrometer. Take two readings 90° apart at each end of journal.

(3) Compare reading obtained with journal diameters listed in Main Bearing Fitting Chart and select inserts required to obtain specified bearing clearance.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Loosen all main bearing caps and install main bearing upper insert(s).

(3) Install main bearing cap(s) and lower insert(s). Tighten screws to 40 foot-pounds (54 Nm) torque. Then tighten to 60 foot-pounds (81 Nm). Finally, tighten to 80 foot-pounds (108 Nm). Rotate crankshaft after tightening each main cap to make sure crankshaft rotates freely.

NOTE: *When installing a crankshaft kit (crankshaft plus bearing inserts), check each bearing for fit, using Plastigage.*

(4) Install oil pan, using replacement gaskets and seals. Tighten drain plug securely.

(5) Fill crankcase with clean oil to specified dipstick level.

Rear Main Bearing Oil Seal

The rear main bearing crankshaft oil seal consists of two pieces of neoprene with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves in pairs to ensure leak-free operation.

Removal

(1) Drain engine oil.

(2) Remove oil pan. Refer to Oil Pan Removal.

(3) Remove rear main bearing cap and discard lower seal.

(4) Loosen all remaining bearing capscrews.

(5) Tap upper seal with brass drift and hammer until seal protrudes enough to permit pulling it out completely.

(6) Remove oil pan front and rear neoprene oil seals and oil pan side gaskets.

(7) Clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan sump.

(8) Clean main bearing cap thoroughly to remove all sealer.

Installation

(1) Wipe seal surface of crankshaft clean and lightly coat with engine oil.

(2) Coat lip of seal with engine oil.

(3) Install upper seal into engine block.

NOTE: *Lip of seal faces toward front of engine.*

(4) Coat both sides of lower seal end tabs with AMC Gasket-in-a-Tube, or equivalent. Be careful to not apply sealer to lip of seal.

(5) Coat outer curved surface of lower seal with soap and lip of seal with engine oil.

(6) Install seal into cap recess and seat it firmly.

(7) Coat both chamfered edges of rear main bearing cap with RTV silicone (fig. 1B-120).

CAUTION: *Do not apply sealer to cylinder block mating surfaces of rear main bearing cap as bearing clearance would be affected.*

(8) Install rear main bearing cap.

(9) Tighten all main bearing capscrews to 80 foot-pounds (108 Nm) torque.

(10) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(11) Fill crankcase with clean oil to specified dipstick level.

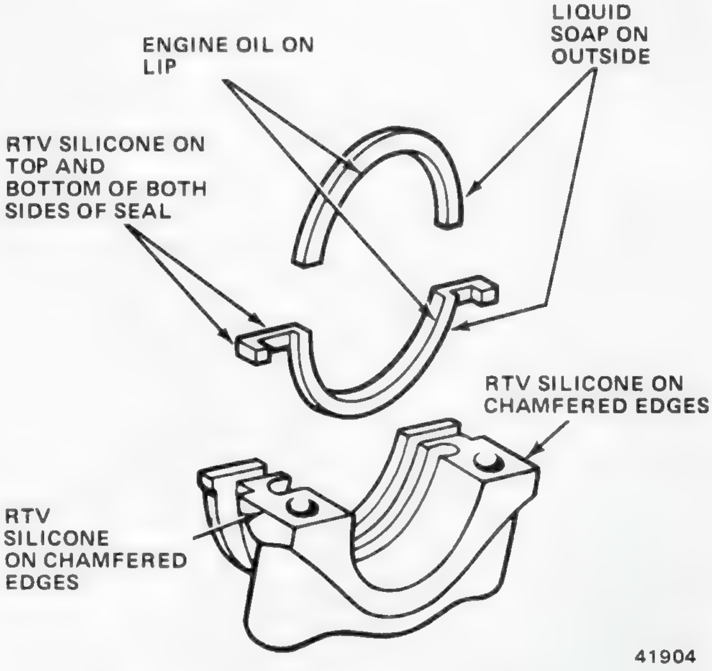


Fig. 1B-120 Rear Main Oil Seal and Cap Installation

Vibration Damper

The vibration damper is balanced independently and then rebalanced as part of the complete crankshaft assembly.

Do not attempt to duplicate the damper balance holes when installing a service replacement. The vibration damper is not repairable and is serviced only as a complete assembly.

Removal

(1) Remove drive belt(s).

(2) Remove retaining capscrews and separate vibration damper pulley from vibration damper.

(3) Remove vibration damper retaining screw and washer.

(4) Use Vibration Damper Remover Tool J-21791 to remove damper from crankshaft (fig. 1B-121).

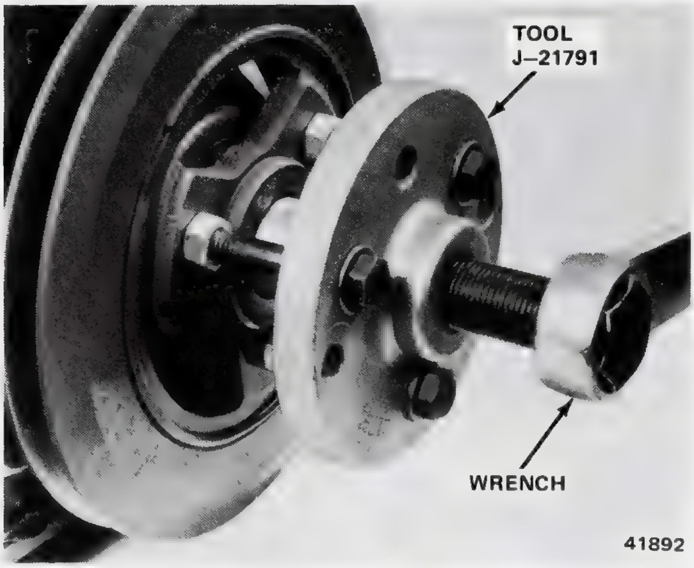


Fig. 1B-121 Vibration Damper Removal

Installation

(1) Align key slot of the vibration damper with crankshaft key and tap damper onto crankshaft.

(2) Install vibration damper retaining screw and washer. Tighten screw to 80 foot-pounds (108 Nm) torque.

(3) Install damper pulley and retaining capscrews. Tighten screws to 20 foot-pounds (27 Nm) torque.

(4) Install drive belt(s) and tighten to specified tension. Refer to Chapter 1C—Cooling.

Flywheel and Starter Ring Gear Assembly

The starter ring gear can be replaced only on cars with manual transmission. The starter ring gear is welded to and balanced as part of the converter drive plate on cars with automatic transmissions. The entire drive plate and ring assembly must be replaced on automatic transmission equipped cars.

Ring Gear Replacement (Manual Transmission)

(1) Position flywheel on arbor press with steel blocks equally spaced under gear.

(2) Press flywheel through ring gear.

NOTE: *Ring gear can also be removed by breaking with chisel.*

(3) Apply heat to expand inside diameter of replacement ring gear.

(4) Press flywheel into replacement ring gear.

NOTE: *On manual transmission equipped cars, the flywheel is balanced as an individual component and also as part of the crankshaft assembly. Do not attempt to duplicate original flywheel balance holes when installing a service replacement. Service flywheels are balanced during manufacture.*

CYLINDER BLOCK

Disassembly

(1) Remove engine as outlined under Engine Removal.

(2) On Pacer only, remove transmission from engine.

(3) Place engine assembly on engine stand.

(4) Remove intake and exhaust manifolds.

(5) Remove cylinder head cover and gasket.

(6) Remove rocker arms and bridged pivot assemblies. Back off each capscrew a turn at a time to avoid damaging bridge.

(7) Remove push rods.

(8) Remove cylinder head and gasket.

(9) Remove valve tappets.

(10) Remove drive pulley and vibration damper.

(11) Removing timing case cover.

(12) Remove timing chain and sprockets.

(13) Remove camshaft.

(14) Position pistons, two at a time, near bottom of stroke and use a ridge reamer to remove any ridge from top end of cylinder walls.

(15) Remove oil pan and gaskets.

(16) Remove oil pump.

(17) Remove connecting rod bearing caps and inserts and retain in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(18) Remove piston and connecting rod assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod screws do not scratch the connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over the rod screws will prevent damage to the cylinder bores or crankshaft.*

(19) Remove main bearing caps and inserts.

(20) Remove crankshaft.

Cylinder Bore Reconditioning

Measuring Cylinder Bore

Use a bore gauge to measure the cylinder bore (fig. 1B-122). If a bore gauge is not available, use an inside micrometer.

(1) Measure cylinder bore crosswise to block near top of bore. Repeat measurement at bottom of bore.

(2) Determine taper by subtracting smaller dimension from larger dimension.

(3) Turn measuring device 120° and repeat step (1). Then turn another 120° and repeat measurements.

(4) Determine out-of-round by comparing difference between readings taken 120° apart.

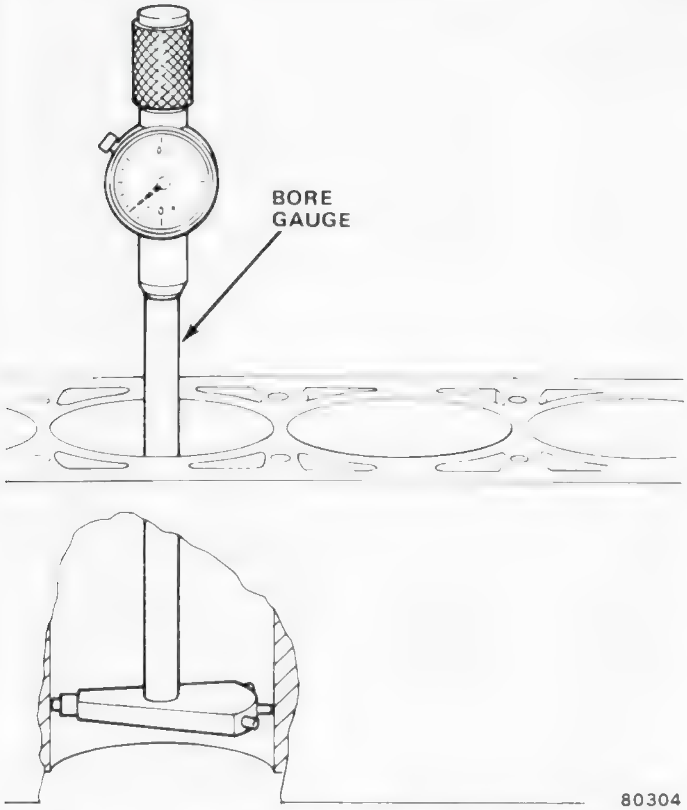


Fig. 1B-122 Measuring Cylinder Bore with Bore Gauge

If cylinder taper does not exceed 0.005 inch and out-of-round does not exceed 0.003 inch, cylinder bore may be trued by honing. If cylinder taper or out-of-round condition exceeds these limits, cylinder must be bored and then honed for an oversize piston.

Resurfacing Cylinder Bore

CAUTION: *Do not use rigid type hones to remove cylinder glaze. A slight amount of taper always exists in cylinder walls after engine has been in service.*

(1) Use expanding hone to true cylinder bore and to remove glaze for faster ring seating. Move hone up and down at sufficient speed to produce uniform 60° angle crosshatch pattern on cylinder walls. Do not use more than ten strokes per cylinder (a stroke is one down-and-up movement).

CAUTION: *Protect engine bearings and lubrication system from abrasives.*

(2) Scrub cylinder bores clean with solution of hot water and detergent.

(3) Immediately apply light engine oil to cylinder walls. Wipe with clean, lint-free cloth.

Assembly

(1) Install upper main bearing inserts in cylinder block.

(2) Install crankshaft.

(3) Install main bearing caps and inserts. Apply oil to insert before installing. Tighten screws tq 80 foot-pounds (108 Nm) torque. Plastigage all bearings if replacement bearings or crankshaft have been installed.

(4) Clean cylinder bores thorougly. Apply a light film of clean engine oil to bores with a clean, lint-free cloth.

(5) Install piston rings on piston. Refer to Piston Rings for sequence.

(6) Lubricate piston and rings with clean engine oil.

(7) Use Piston Ring Compressor Tool J-5601 to install connecting rod and piston assemblies through the top of the cylinder bores (fig. 1B-100).

NOTE: *Be careful that connecting rod screws do not scratch the connecting rod journals or cylinder walls. Short lengths of rubber hose slipped over the connecting rod screws will provide protection during installation.*

(8) Install connecting rod bearing caps and inserts in the same order as removed. Apply oil to inserts before installing. Tighten retaining nuts to 33 foot-pounds (45 Nm) torque.

NOTE: *Oil squirt holes in connecting rods must face camshaft.*

(9) Install oil pump using replacement pick-up tube and screen.

(10) Install engine oil pan using replacement gaskets and seals. Tighten drain plug securely.

(11) Install camshaft and timing chain.

(12) Install timing case cover.

(13) Install vibration damper and drive pulley.

(14) Install valve tappets.

(15) Install gasket and cylinder head.

(16) Install push rods.

(17) Install rocker arms and bridged pivot assemblies. Loosely install capscrews to each bridged pivot. At each bridged pivot, tighten capscrews alternately, one turn at a time to avoid damaging bridge.

(18) Install cylinder head cover, using replacement gasket or silicone rubber material.

(19) Install intake and exhaust manifolds.

(20) Remove engine from engine stand.

(21) On Pacer only, install transmission to engine.

(22) Install engine assembly as outlined under Engine Installation.

SPECIFICATIONS

Six-Cylinder Engine Specifications

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Type	In Line, OHV, Six-cylinder	
Bore	3.75	95.25
Stroke		
232	3.50	88.90
258	3.895	98.93
Displacement		
232	232 cubic inches	3.8 liter
258	258 cubic inches	4.2 liter
Compression Ratio	8.0:1	
Compression Pressure		
232	140 psi	965.3 kPa
258	150 psi	1034.3 kPa
Maximum Variation Between Cylinders	20 psi	137.9 kPa
Firing Order	1-5-3-6-2-4	
Taxable Horsepower	33.75 Bhp	25.2 kW
Fuel	unleaded	
Camshaft		
Fuel Pump Eccentric Diameter	1.615-1.625	41.02-41.28
Tappet Clearance	Zero Lash (Hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003	0.025-0.076
Bearing Journal Diameter		
No. 1	2.029-2.030	51.54-51.56
No. 2	2.019-2.020	51.28-51.31
No. 3	2.009-2.010	51.03-51.05
No. 4	1.999-2.000	50.78-50.80
Base Circle Runout	0.001 (max)	0.03 (max)
Cam Lobe Lift		
232/258 with 1V Carb	0.232	5.89
258 with 2V Carb	0.248	6.30
Intake Valve Timing		
Opens		
232/258 with 1V Carb	12.12° BTDC	
258 with 2V Carb	14.58° BTDC	
Closes		
232/258 with 1V Carb	64.80° ABDC	
258 with 2V Carb	68.79° ABDC	
Exhaust Valve Timing		
Opens		
232/258 with 1V Carb	53.12° BBDC	
258 with 2V Carb	55.59° BBDC	
Closes		
232/258 with 1V Carb	23.80° ATDC	
258 with 2V Carb	27.78° ATDC	
Valve Overlap		
232/258 with 1V Carb	35.92°	
258 with 2V Carb	42.36°	
Intake Duration		
232/258 with 1V Carb	256.92°	
258 with 2V Carb	263.37°	
Exhaust Duration		
232/258 with 1V Carb	256.92°	
258 with 2V Carb	263.37°	
Connecting Rods		
Total Weight (less bearings)		
232	557-665 grams	
258	695-703 grams	
Total Length (center-to-center)		
232	6.123-6.127	155.52-155.63
258	5.873-5.877	149.17-140.28
Piston Pin Bore Diameter	0.9288-0.9298	23.59-23.62
Connecting Rod Bore (less bearings)	2.2085-2.2080	56.09-56.08
Bearing Clearance	0.001-0.0025 (0.0015-0.002 preferred)	0.03-0.06 (0.044 preferred)
Side Clearance	0.005-0.014	0.13-0.36
Maximum Twist	0.001 per inch	0.025 per 25.4 mm
Maximum Bend	0.0005 per inch	0.0127 per 25.4 mm
Crankshaft		
End Play	0.0015-0.0065	0.038-0.165
Main Bearing Journal Diameter	2.4986-2.5001	63.464-63.502
Main Bearing Journal Width		
No. 1	1.086-1.098	27.58-27.89
No. 3	1.271-1.273	32.28-32.33
No. 2-4-5-6-7	1.182-1.188	30.02-30.18
Main Bearing Clearance	0.001-0.003 (0.0025 preferred)	0.03-0.08 (0.064 preferred)
Connecting Rod Journal Diameter	2.0934-2.0955	53.17-53.23
Connecting Rod Journal Width	1.070-1.076	27.18-27.33
Connecting Rod Bearing Clearance	0.001-0.0025 (0.0015-0.002 preferred)	0.03-0.06 (0.038-0.051 preferred)
Maximum Out-of-Round (All Journals)	0.0005	0.013
Maximum Taper (All Journals)	0.0005	0.013
Cylinder Block		
Deck Height	9.487-9.493	240.97-241.12
Deck Clearance		
232	.0165 (below block)	0.419 (below block)
258	0.69 (below block)	1.753 (below block)
Cylinder Bore (standard)	3.7501-3.7533	95.253-95.334
Maximum Cylinder Taper	0.005	0.13
Maximum Cylinder (Out-of-Round)	0.003	0.08
Tappet Bore Diameter	0.905-0.906	22.99-23.01
Cylinder Block Flatness	0.001/1-0.002/6 0.0008 (max)	0.03/25-0.05/152 0.20 (max)
Cylinder Head		
Combustion Chamber Volume	67.84-70.84cc	
Valve Arrangement	EI-IE-IE-EI-EI-IE	
Valve Guide ID (Integral)	0.3735-0.3745	9.487-9.512
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	30°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025	0.064
Cylinder Head Flatness	0.001/1-0.002/6 0.008 (max)	0.03/25-0.05/152 0.20 (max)
Lubrication System		
Engine Oil Capacity	4 quarts (Add 1 quart with filter change)	3.8 liters (Add 0.9 liter with filter change)
Normal Operating Pressure	13 psi at 600 rpm; 37-75 psi (max) at 1600+ rpm	89.6 kPa at 600 rpm; 255.1-517.1 kPa (max) at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517.1 kPa (max)
Gear-to-Body Clearance	0.0005-0.0025 (0.0005 preferred)	0.0127-0.0635 (0.0127 preferred)
Gear End Clearance, Plastigage	0.002-0.008 (0.002 preferred)	0.0508-0.2032 (0.0508 preferred)

60263A

Six-Cylinder Engine Specifications (Continued)

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Gear End Clearance, Feeler Gauge	0.004-0.008 (0.007 preferred)	0.1016-0.2032 (0.1778 preferred)
Pistons		
Weight (less pin)	498-502 grams	
Piston Pin Bore Centerline-to-Piston Top	1.599-1.603	40.61-40.72
Piston-to-Bore Clearance	0.0009-0.0017 (0.0012-0.0013 preferred)	0.023-0.043 (0.030-0.033 preferred)
Piston Ring Gap Clearance — Compression (both)	0.010-0.020	0.25-0.51
Piston Ring Gap Clearance — Oil Control Steel Rails	0.010-0.025	0.25-0.64
Piston Ring Side Clearance		
No. 1 Compression	0.0015-0.003 (0.0015 preferred)	0.038-0.076 (0.038 preferred)
No. 2 Compression	0.0015-0.003 (0.0015 preferred)	0.038-0.076 (0.038 preferred)
Oil Control	0.001-0.008 (0.003 preferred)	0.03-0.20 (0.08 preferred)
Piston Ring Groove Height		
Compression (both)	0.0795-0.0805	2.019-2.045
Oil Control	0.188-0.1895	4.78-4.80
Piston Ring Groove Diameter		
No. 1 and No. 2	3.328-3.333	84.53-84.66
Oil Control	3.329-3.339	84.56-84.81
Piston Pin Bore Diameter	0.9308-0.9313	23.642-23.655
Piston Pin Diameter	0.9304-0.9309	23.632-23.645

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Piston-to-Pin Clearance	0.0003-0.0005 loose (0.0005 preferred)	0.008-0.013 loose (0.013 preferred)
Piston-to-Pin Connecting Rod	2000 lb. press-fit	907.2 kg press-fit
Rocker Arms, Push Rods and Tappets		
Rocker Arm Ratio	1.6:1	
Push Rod Length	9.640-9.660	244.856-245.364
Push Rod Diameter	.313-.312	7.95-7.93
Hydraulic Tappet Diameter	0.904-0.9045	22.96-22.97
Tappet-to-Bore Clearance	0.001-0.002	0.03-0.05
Valves		
Valve Length (Tip-to-Gauge Dim. Line)	4.7895-4.8045	121.653-122.034
Valve Stem Diameter	0.3715-0.3725	9.436-9.462
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter	1.782-1.792	45.26-45.52
Intake Valve Face Angle	29°	
Exhaust Valve Head Diameter	1.401-1.411	35.59-35.84
Exhaust Valve Face Angle	44°	
Maximum Allowable Removed for Tip Refinishing	0.010	0.25
Valve Springs		
Free Length	1.99 approx.	50.55 approx.
Spring Tension		
Valve Closed	64-72 lbs. at 1.786	29.0-32.7 bg. at 45.24
Valve Open	188-202 lbs. at 1.411	85.3-91.6 bg. at 36.51
Inside Diameter	0.948-0.968	24.08-24.59

60263B

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Air Injection Tube-to-Manifold	27	20-27	20	15-20
Air Pump-to-Bracket	27	20-30	20	15-22
Air Pump Brackets-to-Engine (A. Compressor or Pedestals)	34	24-38	25	18-28
Air Pump Adjusting Strap-to-Pump	27	20-30	20	15-22
Alternator Pivot Bolt or Nut	38	27-47	28	20-35
Alternator Adjusting Bolt	24	20-27	18	15-20
Alternator Mounting Bracket-to-Engine	38	31-41	28	23-30
Alternator Pivot Mounting Bolt-to-Head	45	41-47	33	30-35
Block Heater Nut	2	2-3	20 in-lbs.	17-25 in-lbs.
Camshaft Sprocket Screw	68	61-75	50	45-55
Carburetor Hold-Down Nuts	19	16-27	14	12-20
Coil Bracket-to-Cylinder Head	19	14-24	14	10-18
Connecting Rod Bolt Nuts	45	41-47	33	30-35
Cylinder Head Capscrews	142	129-156	105	95-115
Cylinder Head Cover Screws	6	5-7	50 in-lbs.	42-58 in-lbs.
Crankshaft Pulley-to-Damper	27	20-34	20	15-25
Clutch Housing Spacer to Block Screws	16	12-20	12	9-15
Clutch Housing-to-Block Screws (top)	37	30-41	27	22-30

Torque Specifications (Continued)

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Clutch Housing-to-Block Screws (bottom)	58	50-64	43	37-47
Distributor Clamp Bracket Screw	18	14-24	13	10-18
EGR Valve	18	12-24	13	9-18
Exhaust Manifold Bolts	31	24-38	23	18-28
Exhaust Pipe-to-Manifold	27	20-34	20	15-25
Fan and Hub Assembly Bolts	24	16-34	18	12-25
Drive Plate-to-Converter Screw	30	27-34	22	20-25
Flywheel or Drive Plate-to-Crankshaft	142	129-163	105	95-120
Front Crossmember-to-Sill	88	75 min.	65	55 min.
Front Support Bracket-to-Block	47	34-54	35	25-40
Front Support Cushion-to-Bracket	45	36-52	33	27-38
Front Support Cushion-to-Crossmember	50	41-61	37	30-45
Fuel Pump Screws	22	18-26	16	13-19
Idler Arm Bracket-to-Sill	68	47-81	50	35-60
Idler Pulley Bracket-to-Front Cover Nut	9	5-12	7	4-9
Idler Pulley Bearing Shaft-to-Bracket Nut	45	38-52	33	28-38
Intake Manifold Screws	31	24-38	23	18-28
Main Bearing Capscrews	108	102-115	80	75-85
Oil Filter Adapter	65	57-75	48	42-55
Oil Pump Cover Screws	8	7-9	70 in-lbs.	60-80 in-lbs.
Oil Pump Attaching Screws (Short)	14	11-18	10	8-13
Oil Pump Attaching Screws (Long)	23	16-27	17	12-20
Oil Pan Screws—1/4 inch—20	9	7-12	7	5-9
Oil Pan Screws—5/16 inch—18	15	12-18	11	9-13
Power Steering Pump Adapter Screw	31	24-38	23	18-28
Power Steering Pump Bracket Screw	58	50-64	43	37-47
Power Steering Pump Mounting Screw	38	34-47	28	25-35
Power Steering Pump Pressure Line Nut	52	41-61	38	30-45
Power Steering Pump Pulley Nut	79	54-88	58	40-65
Rear Crossmember-to-Side Sill Nut	41	27-47	30	20-35
Rear Support Cushion-to-Bracket	65	54-75	48	40-55
Rear Support Bracket-to-Transmission	45	37-52	33	27-38
Rear Support Cushion-to-Crossmember	24	16-34	18	12-25
Rocker Arm Assembly-to-Cylinder Head	26	22-35	19	16-26
Spark Plug	38	30-45	28	22-33
Timing Case Cover-to-Block Screws	7	5-11	5	4-8
Timing Case Cover-to-Block Studs	22	18-26	16	13-19
Thermostat Housing Screw	18	14-24	13	10-18
Vibration Damper Screw, Lubricated	108	95-122	80	70-90
Water Pump Screws	18	12-24	13	9-18

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

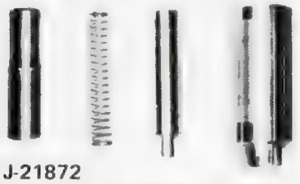
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

60264

Special Tools

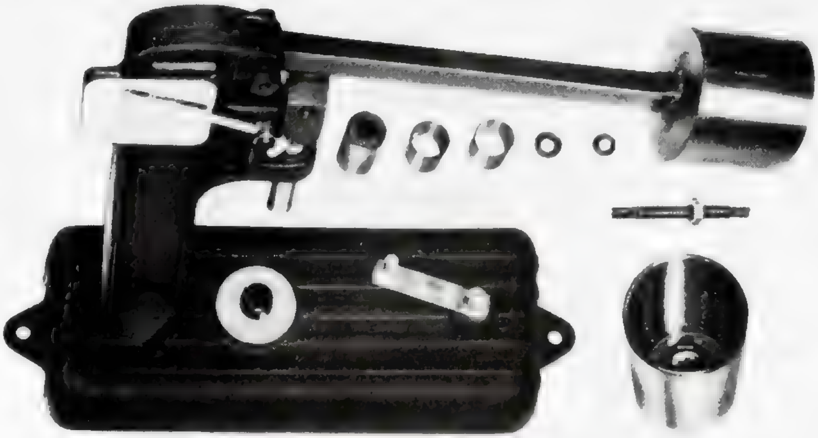
J-22248
TIMING CASE COVER
ALIGNMENT TOOL AND
SEAL INSTALLER

SCREW, TIMING CASE
COVER CRANKSHAFT
SEAL INSTALLER
PART OF TOOL J-9163



J-21872
PISTON PIN REMOVER
AND INSTALLER

J-21882
OIL PUMP INLET
TUBE INSTALLER



J-5790
HYDRAULIC VALVE
LIFTER TESTER

TOOL J-22534-1
VALVE SPRING REMOVER
AND INSTALLATION TOOL

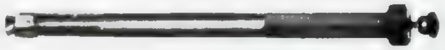
TOOL
J-22534-4

TOOL
J-22534-5

J-22534 VALVE SPRING REMOVER AND INSTALLATION TOOL

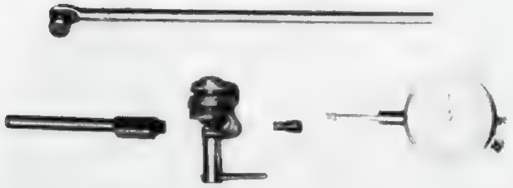
J-9256
TIMING CASE COVER
OIL SEAL REMOVER

J-22700
OIL FILTER WRENCH

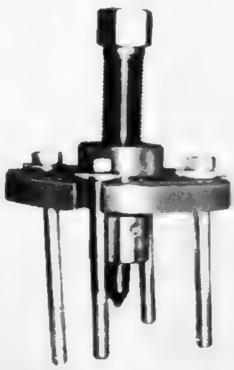


J-21884
HYDRAULIC VALVE TAPPET
REMOVER AND INSTALLER

J-6042-1,4 5
VALVE GUIDE REAMERS

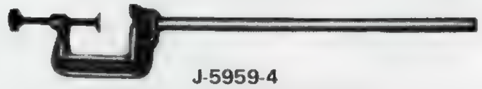


J-8520
DIAL INDICATOR SET
(0 - 1" - .001" GRADUATION)



J-21791
VIBRATION DAMPER
REMOVER

J-5601
PISTON RING
COMPRESSOR 3-3/4"



J-5959-4
C-CLAMP AND
ROD EXTENSION

J-8056
VALVE AND CLUTCH
SPRING TESTER

A50428

EIGHT-CYLINDER ENGINE

GENERAL

The 304 and 360 CID engines are 90-degree V-8 designs incorporating overhead valves. All engines operate only on unleaded fuel with a minimum of anti-knock index (AKI) of 87. The cylinders are numbered from front to rear: 1-3-5-7 on the left bank and 2-4-6-8 on the right bank. The cylinder firing order is 1-8-4-3-6-5-7-2.

The crankshaft, supported by five two-piece main bearings, rotates in a clockwise direction as viewed from the front. The camshaft is supported by five one-piece, line-bored bearings.

Bridged pivot assemblies control movement of intake and exhaust rocker arms and are paired by cylinders.

Because of the similarity of these engines, service procedures have been consolidated and typical illustrations are used (fig. 1B-123 and 1B-124).

Identification

The cubic-inch displacement numbers are cast into both sides of the cylinder block. These numbers are located between the engine mounting bracket bosses.

Build Date Code

The engine Build Date Code is located on a tag attached to the right bank cylinder head cover (fig. 1B-125).

The code numbers identify the year, month and day that the engine was built. The code letter identifies the cubic inch displacement, carburetor type and compression ratio.

The example code identifies a 304 CID with 2V carburetor and 8.4:1 compression ratio built on May 15, 1978.

NOTE: *A nonrepeating number is used to identify engines built for use in Georgia and Tennessee. It is located on a machined pad on the left side of the block, adjacent to the front core plug.*

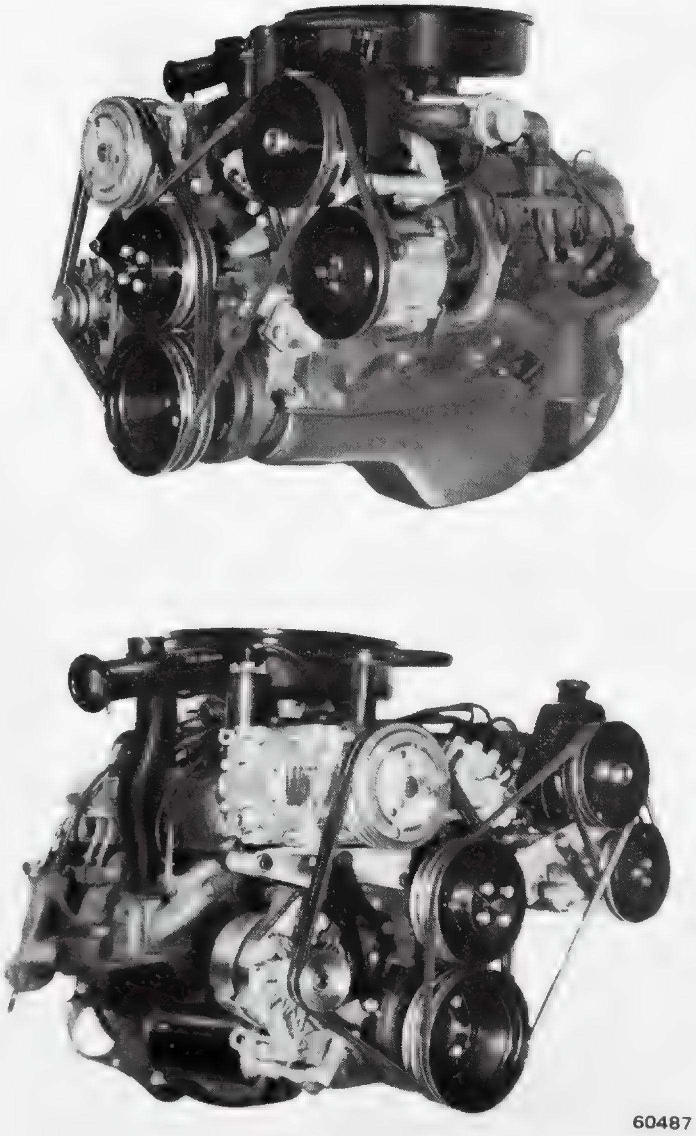


Fig. 1B-123 Typical Eight-Cylinder Engine Assembly

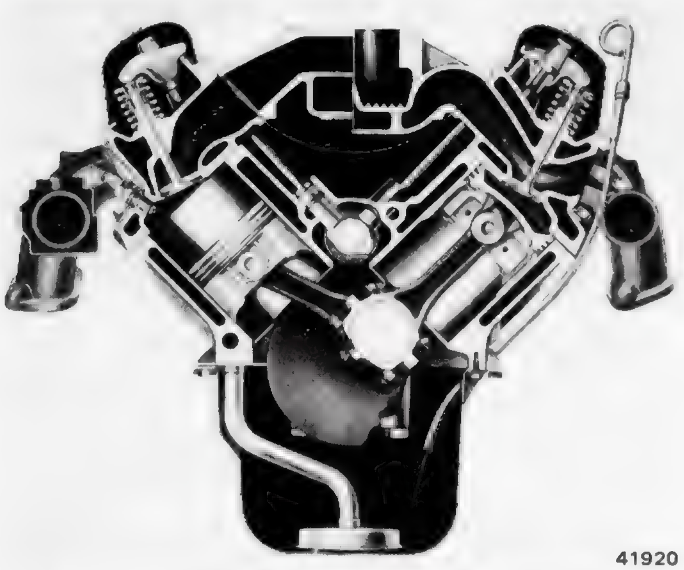


Fig. 1B-124 Sectional View of Eight-Cylinder Engine Assembly

Engine Build Date Code

Letter Code	CID	Carburetor	Compression Ratio
H	304	2V	8.4:1
N	360	2V	8.25:1

1st Character (Year)	2nd and 3rd Characters (Month)	4th Character (Engine Type)	5th and 6th Characters (Day)
1 – 1977 2 – 1978	01 – 12	H or N	01 – 31

Example: 2 05 H 15

70297

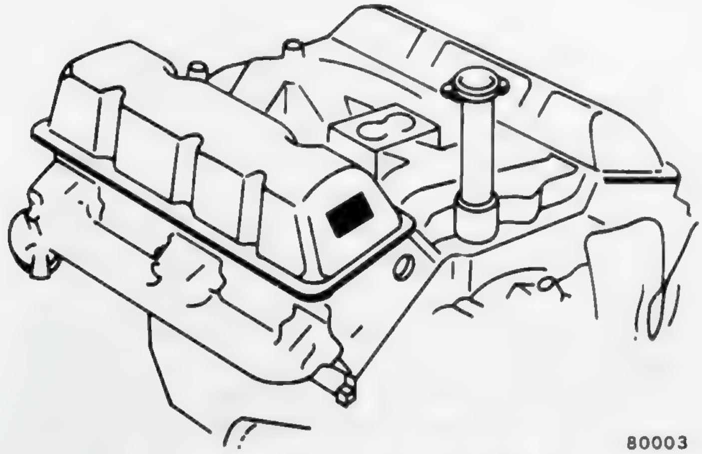


Fig. 1B-125 Build Date Code Location

Example:

Kenosha-Built
E-1197277 or
W-1207177
Brampton (Canada)-Built
CO316477

Oversize or Undersize Components

It is sometimes necessary to machine all cylinder bores to 0.010-inch oversize, all crankshaft main bearing journals or all connecting rod journals to 0.010-inch undersize, or all camshaft bearing bores 0.010-inch oversize. These engines have a single or double letter code stamped adjacent to the Build Date Code on the tag attached to the right bank cylinder head cover. The letters are coded as follows:

Oversize or Undersize Components

Code Letter	Definition	
B	All cylinder bores	- 0.010-inch oversize
M	All crankshaft main bearing journals	- 0.010-inch undersize
P	All connecting rod bearing journals	- 0.010-inch undersize
C	All camshaft bearing bores	- 0.010-inch oversize

EXAMPLE: The code letters PM mean that the crankshaft main bearing journals and connecting rod journals are 0.010-inch undersize.

60258

SHORT ENGINE ASSEMBLY (SHORT BLOCK)

A service replacement short engine assembly may be installed whenever the original engine block is damaged beyond repair. The short engine assembly consists of engine block, piston and rod assemblies, crankshaft, camshaft, timing gears and chain. Whenever installing a short engine assembly, always install a replacement engine oil pump pickup tube and screen assembly.

NOTE: *Short engine assemblies include a replacement engine build date tag. Remove original tag and attach replacement tag to right cylinder head cover.*

Installation includes transfer of component parts from the worn or damaged original engine. Follow the appropriate procedures for cleaning, inspection and torque tightening as outlined in this chapter.

ENGINE MOUNTING

Resilient rubber mounting cushions support the engine and transmission at three points. A cushion is located at each side on the centerline of the engine. The rear is supported by a cushion between the transmission extension housing and the rear support crossmember (fig. 1B-126).

Removal or replacement of any cushion may be accomplished by supporting the weight of the engine or transmission in the area of the cushion.

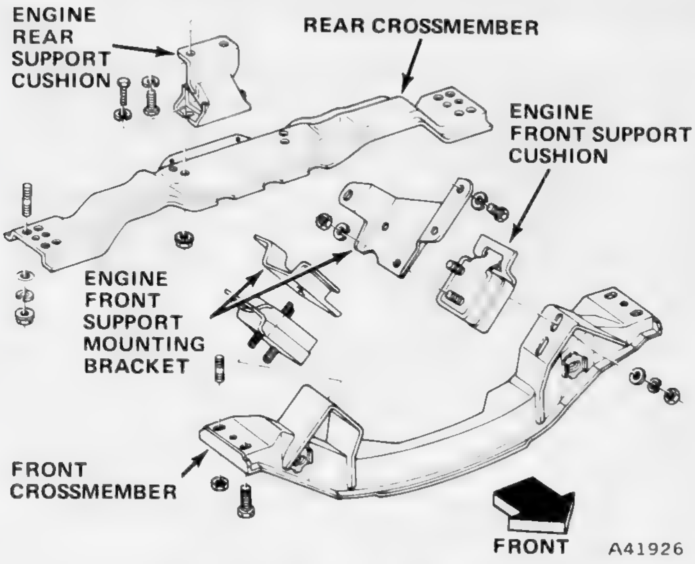


Fig. 1B-126 Typical Engine Mounting

ENGINE HOLDING FIXTURE

If necessary to remove the front engine mounts and front crossmember to perform service such as oil pan removal, an engine holding fixture may be fabricated as illustrated in figure 1B-127.

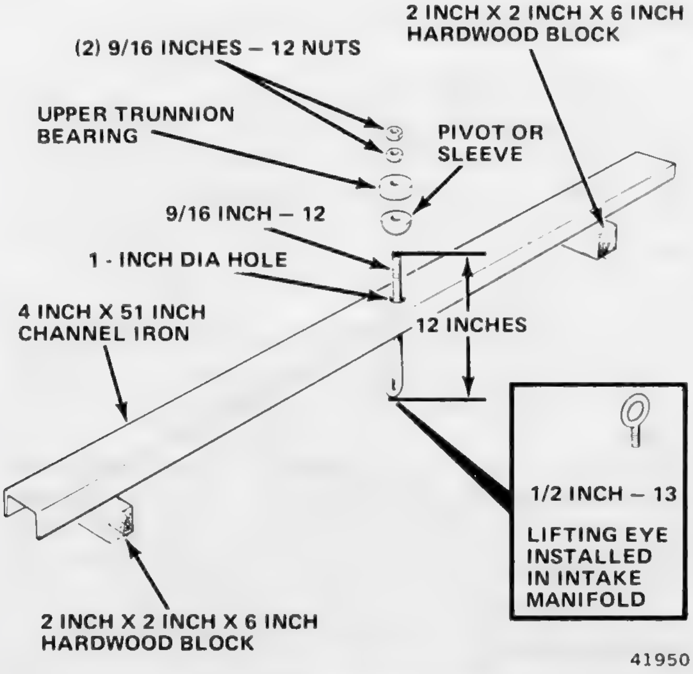


Fig. 1B-127 Engine Holding Fixture

ENGINE REMOVAL

The engine is removed without the transmission.

(1) Mark hinge locations on hood panel for alignment during installation.

(2) Disconnect underhood lamp, if equipped. Remove hood.

(3) Remove radiator draincock and radiator cap to drain coolant.

(4) Disconnect transmission cooler tube fittings from radiator.

(5) Loosen clamps and remove upper and lower radiator hoses. Install draincock in radiator.

(6) Remove fan shroud screws and move shroud away from radiator.

(7) Remove radiator, radiator attaching screws and shroud.

(8) Remove fan and spacer.

(9) Remove air cleaner.

(a) Disconnect cannister purge hose and vacuum sensor hose at engine.

(b) Disconnect TAC vacuum hose at manifold.

(c) Remove TAC heat tube.

(10) Install 5/16 x 1/2-inch SAE capscrew through fan pulley into water pump flange. This will keep pulley and pump aligned when crankshaft is turned.

(11) Disconnect wires from alternator.

(12) Disconnect neutral safety switch harness at cowl. Disconnect TCS harness at solenoid control switch and solenoid vacuum, if equipped. Open clip on intake manifold and position harness on cowl.

(13) Disconnect heater outlet hose at heater core. Remove clip holding hoses together. Disconnect heater inlet hose from intake manifold.

(14) Disconnect heater and air conditioning vacuum hose at intake manifold.

(15) Disconnect throttle cable and remove from bracket. Position behind power brake booster.

(16) Remove power brake vacuum check valve from booster.

(17) Disconnect temperature sender wire and throttle stop solenoid wire at connector near ignition coil.

(18) Disconnect TCS solenoid control switch tube.

(19) Disconnect distributor sensor leads and primary ignition leads at coil.

(20) Cut clamp off return hose at fuel filter and remove hose.

(21) Remove vapor canister and bracket (not required on models having canister mounted inside wheelhouse).

(22) Disconnect flexible fuel line from steel fuel line and install plug.

(23) If equipped with air conditioning:

(a) Remove service valve covers and front-seat valves.

(b) Loosen nuts attaching service valves to compressor head.

(c) Bleed off compressor charge.

(d) Remove service valves and cap compressor ports and service valves.

(e) Disconnect clutch feed wire.

(24) If equipped with power steering:

(a) Disconnect power steering hoses from fittings at gear.

(b) Drain reservoir. Cap fittings on hoses and gear.

(25) Lift car and support with support stands.

(26) Disconnect starter cable. Remove starter motor.

(27) Remove exhaust flange nuts, seals and heat valve.

(28) Remove converter housing spacer cover.

(29) Remove lower throttle valve bellcrank and inner manual linkage support. Disconnect throttle valve rod at lower end of bellcrank.

(30) Remove torque converter drive screws. Rotate crankshaft for access to each screw.

(31) Remove exhaust support screws at transmission extension housing bracket. Lower exhaust system.

(32) Remove screws attaching front engine mounts to block.

(33) Remove four upper torque converter housing screws. Break loose lower screws.

(34) Lift car and move support stands to jack pad area.

(35) Remove throttle cable housing retainer bracket and install lift device to engine.

(36) Raise engine off front supports.

(37) Place support stand under converter housing in raised position.

(38) Remove remaining converter housing screws.

(39) Lift engine out of engine compartment.

ENGINE INSTALLATION

(1) Lower engine into engine compartment.

(2) Align with converter housing and install lower converter housing screws.

(3) With engine supported by lifting device, remove support stand from converter housing.

(4) Lower engine and align with front supports. Install and tighten screws. Install engine ground strap under right front upper screw.

(5) Remove lifting device.

(6) Raise front of car and move support stands to front of frame.

(7) Reach through starter hole in converter housing and pull converter into crankshaft pilot. Align converter with flex plate and install screws. Rotate crankshaft to gain access to each screw hole.

(8) Install converter housing spacer cover. Install throttle valve bellcrank and manual linkage support. Connect throttle valve rod to bellcrank.

(9) Align exhaust system and install screws.

(10) Install and tighten upper converter housing screws.

(11) Install heat valve to right side exhaust manifold. Install front exhaust pipes, seals and nuts.

(12) Install starter motor and connect cable.

(13) Raise car, remove support stands and lower car to ground.

(14) Connect power steering hoses and fill reservoir, if removed.

(15) If equipped with air conditioning:

(a) Connect clutch feed wire.

(b) Connect service valves to proper ports, using replacement seals. Tighten nuts to 28 foot-pounds (38 Nm) torque, wet.

(c) Back-seat service valves and install covers.

(d) Purge compressor of air.

(16) Connect power brake vacuum check valve to booster.

(17) Install throttle cable housing bracket. Install throttle return spring.

(18) Install throttle cable housing in bracket. Connect cable.

(19) Connect heater and air conditioning vacuum hose to intake manifold.

(20) Connect flexible fuel line to steel fuel line and install clamp.

(21) Install vapor canister bracket, if equipped. Install canister and connect hoses.

(22) Install heater inlet hose to intake manifold and tighten clamp.

(23) Connect TCS solenoid control switch, if equipped.

(24) Connect TCS wire harness at vacuum solenoid valve and solenoid control switch, if equipped.

(25) Install heater outlet hose to heater core. Install clamp and tighten. Position hose in bracket at choke. Install clip to hold hoses together.

(26) Position ignition wire harness. Connect distributor sensor leads, throttle stop solenoid lead and temperature sender lead. Connect coil primary leads.

(27) Position alternator harness. Connect leads to alternator. Connect oil pressure sender lead.

(28) Connect return line to fuel filter and install clamp.

(29) Remove alignment screw from fan pulley and water pump. Install spacer and fan. Tighten screws.

(30) Position shroud over fan. Install radiator and attaching screws. Attach shroud to radiator.

(31) Install upper and lower radiator hoses and clamps.

(32) Connect transmission cooler tubes to radiator.

(33) Install coolant. Install radiator cap.

(34) Connect battery ground cable.

(35) Check engine oil level and correct as required.

(36) Start engine, inspect for leaks and check fluid levels. Correct fluid levels as required.

(37) Install TAC heat tube and air cleaner.

(38) Attach TAC vacuum line to manifold and attach canister purge hose and vacuum sensor hose to engine.

(39) Install and adjust hood. Connect underhood lamp if equipped.

VALVE TRAIN

General

The eight-cylinder engine has overhead valves operated by push rods and rocker arms. A chain-driven camshaft is mounted in the cylinder block. Hydraulic valve tappets provide automatic valve lash adjustment.

Rocker Arm Assembly

The intake and exhaust rocker arms of each cylinder pivot on a bridged pivot assembly which is secured to the cylinder head by two capscrews as shown in figure 1B-128. The bridged pivot maintains correct rocker arm-to-valve tip alignment. Each rocker arm is actuated by a hollow steel push rod with a hardened steel ball at each end. The hollow push rods channel oil to the rocker arm assemblies.

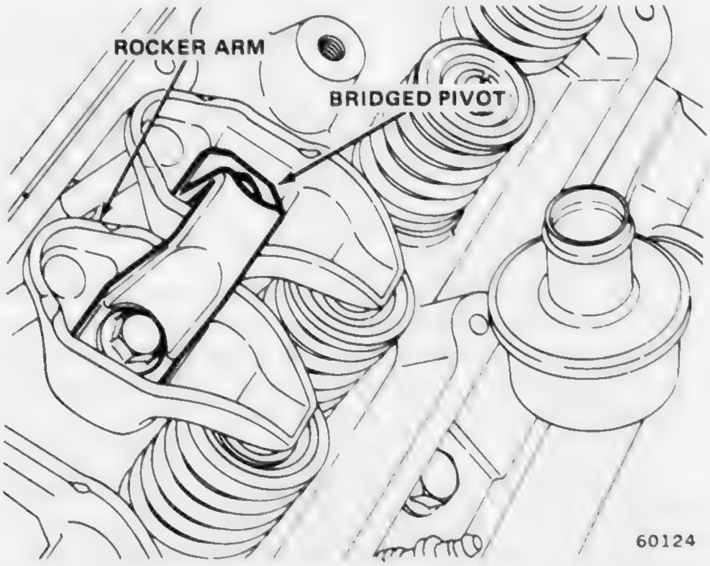


Fig. 1B-128 Rocker Arm Assembly

Removal

(1) Remove cylinder head cover.

(2) Remove capscrews at each bridged pivot. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove bridged pivots and corresponding pairs of rocker arms and place on bench in same order as removed.

(4) Remove push rods and place on bench in same order as removed.

Cleaning and Inspection

Clean all parts with cleaning solvent. Use compressed air to clean out the oil passages in the rocker arms and push rods.

Inspect the pivot surface of each rocker and pivot assembly. Replace parts which are scuffed, pitted or excessively worn. Inspect the valve stem contact surface of each rocker arm and replace if deeply pitted. Inspect each push rod end for scuffing or excessive wear. **If any push rod is excessively worn due to lack of oil, replace the push rod as well as the corresponding hydraulic valve tappet and rocker arm.**

It is not normal to find a pattern along the length of the push rod. Check the cylinder head for obstruction if this condition exists.

Installation

(1) Install push rods. **Make certain the bottom end of each rod is centered in the plunger cap of hydraulic valve tappet.**

(2) Install each bridged pivot and pair of rocker arms to cylinder from which they were removed.

(3) Loosely install two capscrews to each bridged pivot. Tighten capscrews alternately one turn at a time to avoid damaging bridge. Tighten to 19 foot-pounds (26 Nm) torque.

(4) Reseal and install cylinder head cover.

(5) Install retaining screws and washers. Tighten screws to 50 inch-pounds (5.7 Nm) torque.

Valves

The following procedures apply only after the cylinder head has been removed from the engine. If head has not been removed, refer to Cylinder Head for removal procedures.

Removal

(1) Compress each valve spring with C-clamp type spring compressor tool. Remove valve locks and retainers.

(2) Release compressor and remove valve spring.

(3) Remove valve stem oil deflectors.

(4) Remove valves one at a time and place in rack in same order as in cylinder head.

Cleaning and Inspection

Clean all carbon buildup from the combustion chambers, valve ports, valve stems and heads.

Remove all dirt and gasket cement from the cylinder head gasket mating surface.

Inspect for cracks in the combustion chambers and valve ports and in the gasket surface at each coolant passage.

Inspect for burned or cracked valve heads and scuffed valve stems. Replace any valve which is bent, warped or scuffed.

Valve Refacing

Use valve refacing machine to reface intake and exhaust valves to specified angle. After refacing, at least 1/32-inch margin must remain. If not, replace valve. Examples of correct and incorrect valve refacing are shown in figure 1B-129.

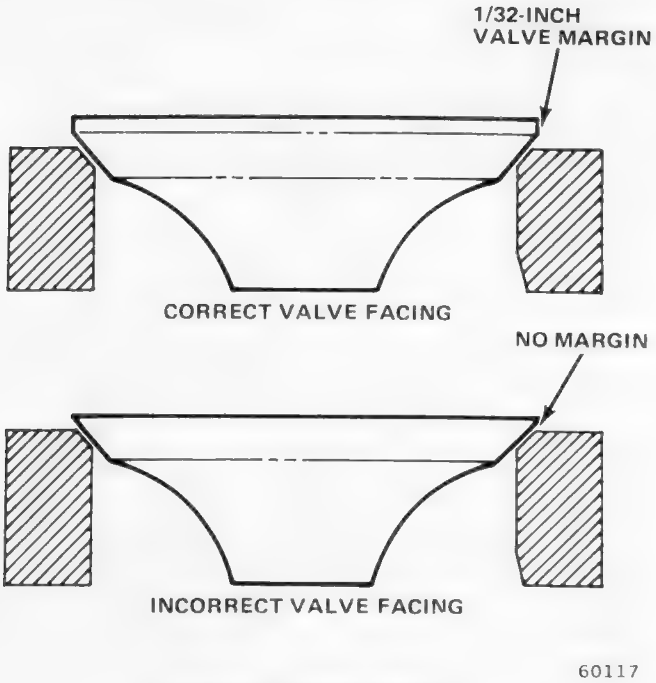


Fig. 1B-129 Valve Refacing

Resurface and rechamfer the valve stem tip when worn. **Never remove more than 0.020 inch.**

Valve Seat Refacing

Install a pilot of the correct size in the valve guide and reface the valve seat to the specified angle with a good dressing stone. Remove only enough metal to provide a smooth finish. This is especially important on exhaust valve seats. The seat hardness varies in depth. Use tapered stones to obtain the specified seat widths when required. Maximum seat runout is 0.0025 inch (fig. 1B-130).

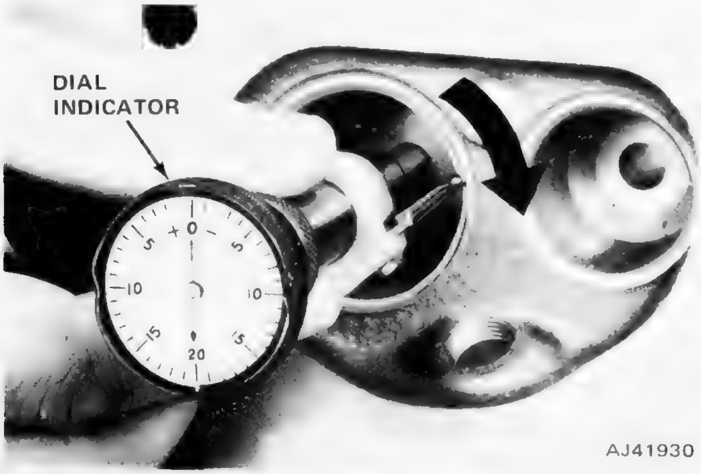


Fig. 1B-130 Valve Seat Runout

Valve Stem Oil Deflector Replacement

Nylon valve stem oil deflectors are installed on each valve stem to prevent the oil used for rocker arm lubrication from entering the combustion chamber through the valve guides. Replace oil deflectors whenever valve service is performed or if the deflectors become deteriorated.

Oil deflector replacement requires removal of valve springs. Refer to Valve Springs for procedure.

Valve Guides

The valve guides are an integral part of the cylinder head and are not replaceable. When the stem-to-guide clearance is excessive, ream the valve guides to the next larger size. Oversize service valves are available in 0.003 inch, 0.015 inch and 0.030 inch.

The following oversize valve guide reamers may be used:

Valve Guide Reamer Sizes

Reamer Tool Number	Size
J-6042-1	0.003 inch
J-6042-5	0.015 inch
J-6042-4	0.030 inch

60268

NOTE: *Ream guides in steps. Start with the 0.003-inch oversize reamer and progress to the size required.*

Valve Stem-to-Guide Clearance

Valve stem-to-guide clearance can be checked by two methods:

Preferred Method

(1) Remove valve from head and clean valve guide with solvent and bristle brush.

(2) Insert telescoping gauge into valve guide approximately 3/8 inch from valve spring side of head (fig. 1B-131) with contacts crosswise to head. Measure telescoping gauge with micrometer.

(3) Repeat measurement with contacts lengthwise to cylinder head.

(4) Compare lengthwise and crosswise readings to determine out-of-roundness. If measurements differ by more than 0.0025 inch, ream guide to accomodate oversize valve.

(5) Compare valve guide diameter with diameter listed in Specifications. If measurements differ by more than 0.003 inch, ream guide to accomodate oversize valve.

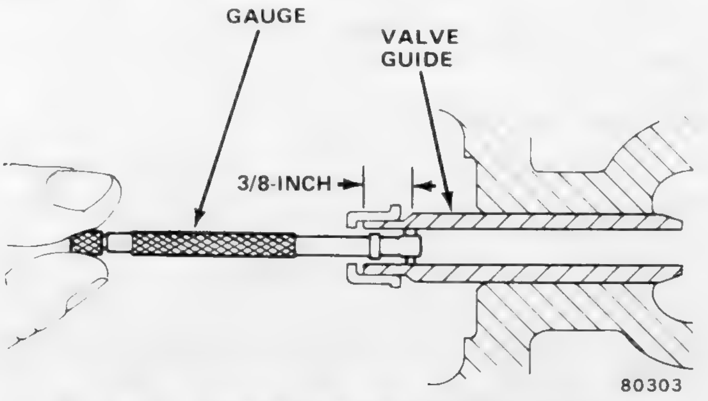


Fig. 1B-131 Measuring Valve Guide with Telescoping Gauge

Alternate Method

- Use dial indicator to measure lateral movement of valve stem with valve installed in its guide and just off valve seat (fig. 1B-132). Correct clearance is 0.001 to 0.003 inch.

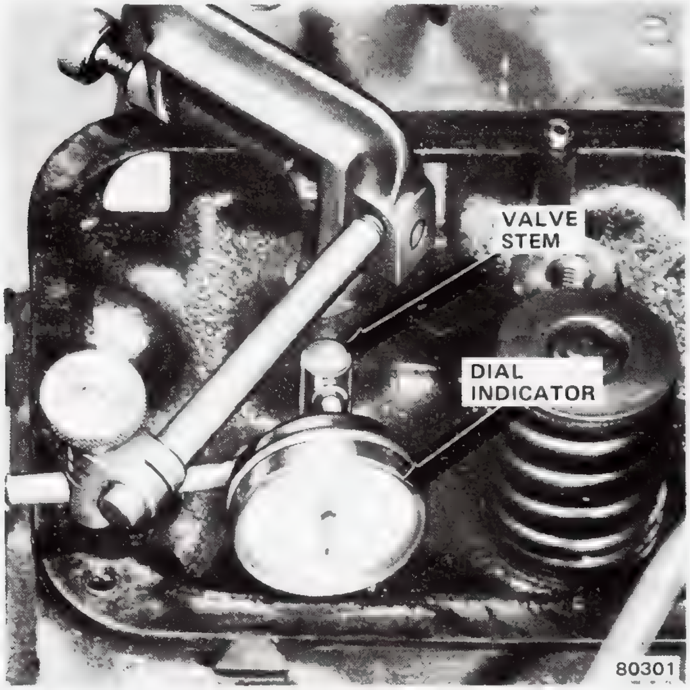


Fig. 1B-132 Valve Stem-to-Guide Clearance Measurement

Installation

(1) Thoroughly clean valve stems and valve guide bores.

(2) Lightly lubricate stem and install each valve in same valve guide from which it was removed.

(3) Install replacement valve stem oil deflector on valve stem.

(4) Position valve spring and retainer on cylinder head and compress valve spring with compressor tool. Install valve locks and release tool.

(5) Tap valve spring from side to side with light hammer to seat spring properly at cylinder head.

Valve Springs

Valve springs and oil deflectors can be removed without removing the cylinder head. Refer to Valves for removal procedure with the cylinder head removed.

Valve Spring and Oil Deflector Removal

The valve spring is held in place on the valve stem by a retainer and a set of valve locks. The locks can be removed only by compressing the valve spring.

(1) Remove cylinder head cover.

(2) Remove rocker arm assemblies. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove push rods.

NOTE: *Keep rocker arms, bridged pivots and push rods in the same order as removed.*

(4) Remove spark plug from cylinder which requires valve spring or oil deflector removal.

(5) Install 14-mm (thread size) air adapter in spark plug hole.

NOTE: *An adapter can be made by welding an air hose connection to the body of a spark plug from which the porcelain has been removed.*

(6) Connect air hose to adapter and maintain at least 90 psi in cylinder to hold valves against their seats.

(7) Use Valve Spring Remover and Installer Tools J-22534-1, J-22534-4, and J-22534-5 to compress valve spring. Remove valve locks (fig. 1B-133).

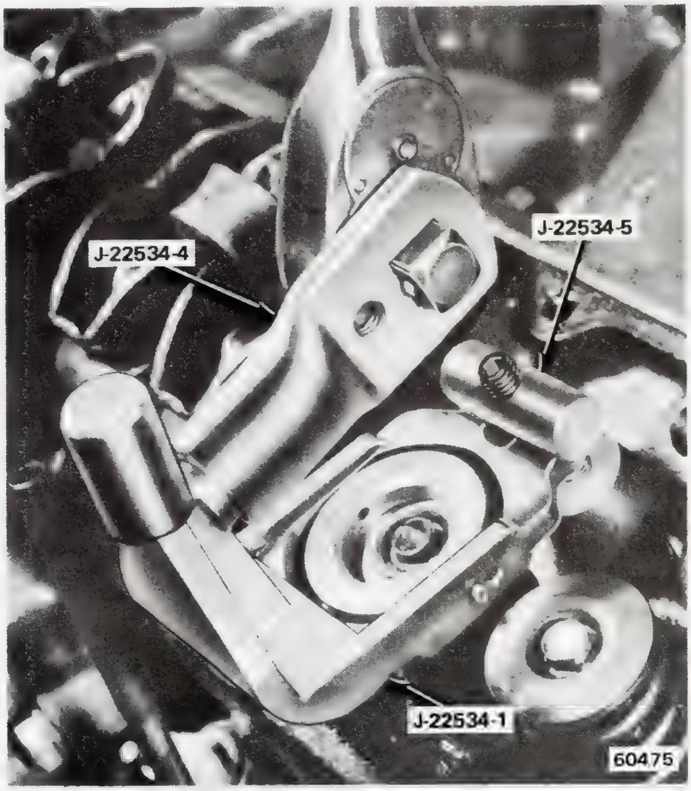


Fig. 1B-133 Valve Spring Removal

(8) Remove valve spring and retainer from cylinder head.

(9) Remove oil deflector.

Valve Spring Tension Test

Use Valve Spring Tester J-8056 to test each valve spring for the specified tension values (fig. 1B-134). Replace springs which are not within specifications. Replace springs that bind due to warpage.

Installation

(1) Use 7/16-inch deep socket and hammer to gently tap valve stem oil deflector onto valve stem.

(2) Install valve spring and retainer.

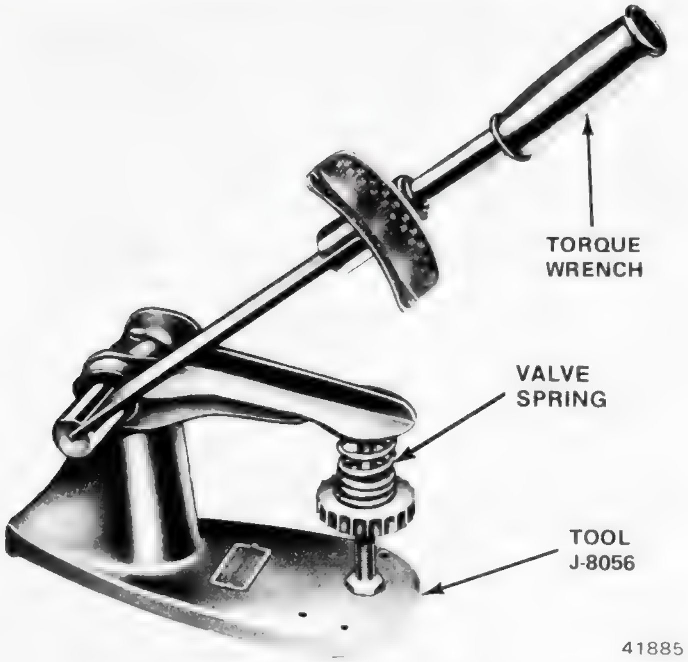


Fig. 1B-134 Valve Spring Tester

NOTE: *A close-coil valve spring is used on all valves. The close-coil end must face the cylinder head when installing the springs.*

(3) Compress valve spring with Valve Spring Remover and Installer Tools J-22534-1, J-22534-4, and J-22534-5. Insert valve locks. Release spring tension and remove tool.

(4) Tap valve spring from side to side with light hammer to be certain spring is seated properly at cylinder head.

(5) Disconnect air hose, remove air adapter from spark plug hole and install spark plug.

(6) Install push rods, making certain bottom end of each rod is centered in plunger cap of hydraulic valve tappet.

(7) Install rocker arms and bridged pivot. Alternately tighten capscrews one turn at a time to avoid damaging bridge. Tighten capscrews to 19 foot-pounds (26 Nm) torque.

(8) Reseal and install cylinder head cover.

(9) Install retaining screws and washers. Tighten screws to 50 inch-pounds (5.6 Nm) torque.

Camshaft and Bearings

General

The camshaft is supported by five steel-shelled, babbitt-lined bearings pressed into the block and line reamed. The camshaft journals are step bored, being larger at the front bearing than at the rear, to permit easy removal and installation of the camshaft. All camshaft bearings are lubricated under pressure.

NOTE: *Do not replace camshaft bearings unless special tools required for removing and installing are available.*

Camshaft end play is maintained by the load placed on the camshaft by the oil pump and distributor drive gear. The helical cut of the gear holds the camshaft sprocket thrust face against the cylinder block face to hold camshaft end play to zero during engine operation. The rear camshaft bearing journal has two holes drilled through it to relieve pressure that could develop between the journal and camshaft plug and force the camshaft forward.

Cam Lobe Lift Measurement

Cam lift may be checked with a dial indicator.

(1) Remove cylinder head covers and gaskets.

(2) Remove rocker arms and bridged pivot assemblies. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove spark plugs.

(4) Install dial indicator on end of push rod (fig. 1B-135). Use piece of rubber tubing to secure dial indicator plunger to push rod.

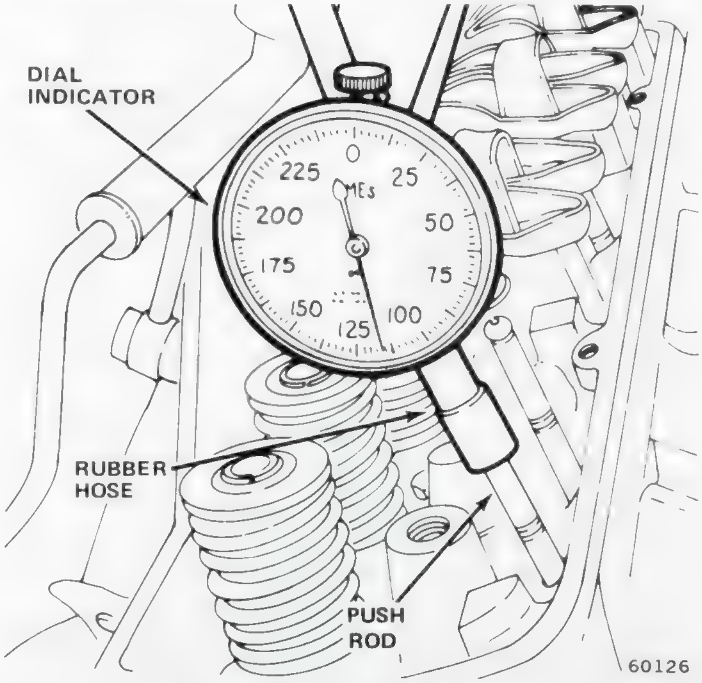


Fig. 1B-135 Cam Lobe Lift Measurement

(5) Rotate crankshaft until cam lobe base circle (push rod down) is under valve tappet.

(6) Set dial indicator to zero.

(7) Rotate crankshaft until point of maximum push rod upward movement occurs.

(8) Read travel at dial indicator. Correct lift is 0.260 to 0.270 inch.

NOTE: *Rocker arm ratio is 1.6:1. Multiply cam lift by 1.6 to determine valve lift.*

Valve Timing

(1) Remove spark plugs.

(2) Remove cylinder head covers and gaskets.

(3) Remove rocker arms and bridged pivot assemblies from No. 1 cylinder.

(4) Rotate crankshaft until No. 6 piston is at Top Dead Center (TDC) on compression stroke. This places No. 1 piston at TDC on the exhaust stroke in valve overlap position.

(5) Rotate crankshaft counterclockwise 90° as viewed from front.

(6) Install dial indicator on No. 1 intake valve push rod end.

(7) Set dial indicator to zero.

(8) Crank engine slowly in direction of rotation (clockwise viewed from front) until dial indicator indicates 0.020 inch.

(9) This should place milled timing mark on vibration damper in line with TDC marking on timing case cover. If more than 1/2-inch variation exists in either direction, remove timing case cover and inspect timing chain installation.

Camshaft Removal

(1) Drain radiator and cylinder block.

(2) Remove radiator assembly.

(3) If equipped with air conditioning, remove condenser and receiver assembly as charged unit.

(4) Remove cylinder head covers and gaskets.

(5) Remove rocker arms and bridged pivot assemblies. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(6) Remove push rods.

NOTE: *Keep push rods, rocker arm assemblies and tappets in the same order as removed.*

(7) Remove intake manifold assembly.

(8) Remove drive belts.

(9) Remove fan and hub assembly.

(10) Remove distributor.

(11) Remove damper pulley and vibration damper.

(12) Remove timing case cover.

(13) Install crankshaft screw with two or more flat washers to provide means of rotating crankshaft.

(14) Rotate crankshaft until timing mark on crankshaft sprocket is closest to and on centerline with timing mark on camshaft sprocket. Refer to Figure 1B-144.

(15) Remove retaining screw from camshaft. Remove retaining screw from crankshaft.

(16) Remove distributor drive gear and fuel pump eccentric from the camshaft (fig. 1B-136).

(17) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

(18) Remove hood latch support bracket upper retaining screws and move bracket, as required, to allow removal of camshaft.

(19) Remove front bumper or grille, as required, and remove camshaft.

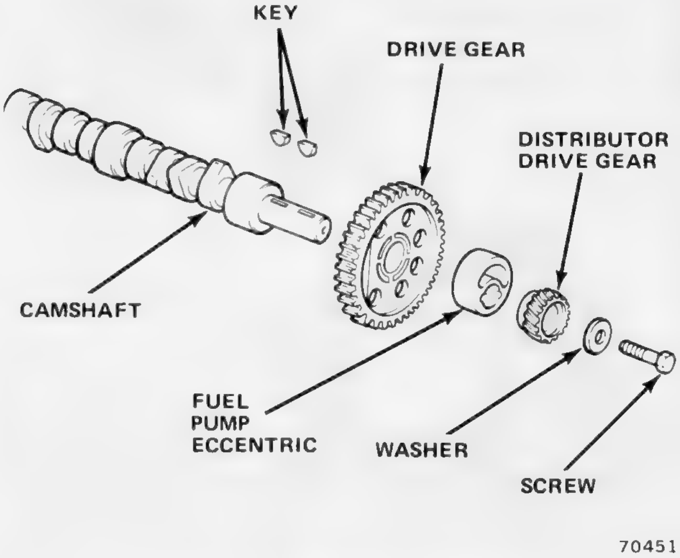


Fig. 1B-136 Camshaft Drive Gear

Camshaft Inspection

Inspect the camshaft bearing journals for an uneven wear pattern or rough finish. Replace camshaft if either condition exists.

Inspect the distributor drive gear for damage or excessive wear.

Inspect fuel pump eccentric for excessive wear.

Inspect each cam lobe and the matching hydraulic valve tappet for wear. If the face of the tappet(s) is worn concave and the matching camshaft lobe(s) is also worn, replace both camshaft and tappet(s).

Camshaft Installation

(1) Lubricate entire camshaft generously with AMC Engine Oil Supplement (EOS), or equivalent.

(2) Carefully install camshaft into engine block.

(3) Assemble timing chain, crankshaft sprocket and camshaft sprocket with timing marks aligned. Refer to Timing Chain Installation.

(4) Install oil slinger on crankshaft.

(5) Install fuel pump eccentric and distributor drive gear to camshaft (fig. 1B-136). Tighten retaining screw to 30 foot-pounds (41 Nm) torque.

NOTE: *The fuel pump eccentric has the word "REAR" stamped on it to indicate proper installed position. The camshaft screw washer fits into a recess in the distributor drive gear.*

(6) Install replacement timing case cover gasket.

(7) Install timing case cover.

(8) Install replacement oil seal. Apply light film of engine oil to lips of seal.

(9) Install vibration damper.

(10) Install damper pulley and retaining screws. Tighten screws to 30 foot-pounds (41 Nm) torque.

(11) Install hydraulic valve tappets lubricated with AMC Engine Oil Supplement, or equivalent.

NOTE: *Do not drain the EOS from the engine for at least 1,000 miles or until the next scheduled oil change.*

(12) Install intake manifold assembly.

(13) Install push rods.

(14) Install rocker arms and bridged pivot assemblies. Alternately tighten capscrews one turn at a time to avoid damaging bridge. Tighten capscrews to 19 foot-pounds (26 Nm) torque.

(15) Reseal and install cylinder head covers.

(16) Install fuel pump.

(17) Rotate crankshaft until No. 1 piston is at TDC position on compression stroke.

NOTE: *After No. 1 intake valve has closed, TDC can be reached by rotating the crank clockwise as viewed from the front until the timing mark or the damper aligns with TDC on the timing case cover.*

(18) Install distributor so that rotor is aligned with No. 1 terminal of cap when fully seated on block.

(19) Install distributor cap.

(20) Install ignition wires.

(21) If removed, install air conditioning condenser and receiver assembly.

CAUTION: *Both service valves must be open before the air conditioning system is operated.*

(22) Install hood latch support bracket retaining screws and tighten securely.

(23) If removed, install front bumper or grille.

(24) Install radiator.

(25) Fill cooling system to specified level.

(26) Install and tighten drive belts to proper tension. Refer to Chapter 1C—Cooling.

Hydraulic Valve Tappets

The hydraulic valve tappet consists of a tappet body, plunger, plunger return spring, check valve assembly, metering disc, plunger cap and lockring (fig. 1B-137).

The tappet operates in a guide bore which has an oil passage drilled into the adjoining oil gallery.

The operating mode of the hydraulic tappet begins when the tappet is on the heel of the cam lobe (engine valve closed). A groove in the tappet body aligns with the tappet oil gallery, admitting pressurized oil into the tappet (fig. 1B-138). A hole and groove arrangement admits the oil to the inside of the plunger. Oil is forced past the plunger check valve and fills the chamber between the plunger and tappet body. When the chamber is full, additional oil in the plunger body unseats the metering disc, and a spurt of oil flows up the pushrod to lubricate the rocker assembly. These events all take place while the tappet is on the heel of the cam lobe. As the cam turns, the lobe begins exerting force on the tappet body. This force is transmitted by the trapped oil in the tappet chamber to the plunger and finally to the push-rod and rocker assembly. The engine valve opens. While the valve is open, the trapped oil is subjected to considerable pressure and some of it escapes between the plunger and the tappet body (leak-down). The cycle is completed as the cam lobe rotates back to the starting position and another charging cycle begins. In this way, zero valve lash is maintained.

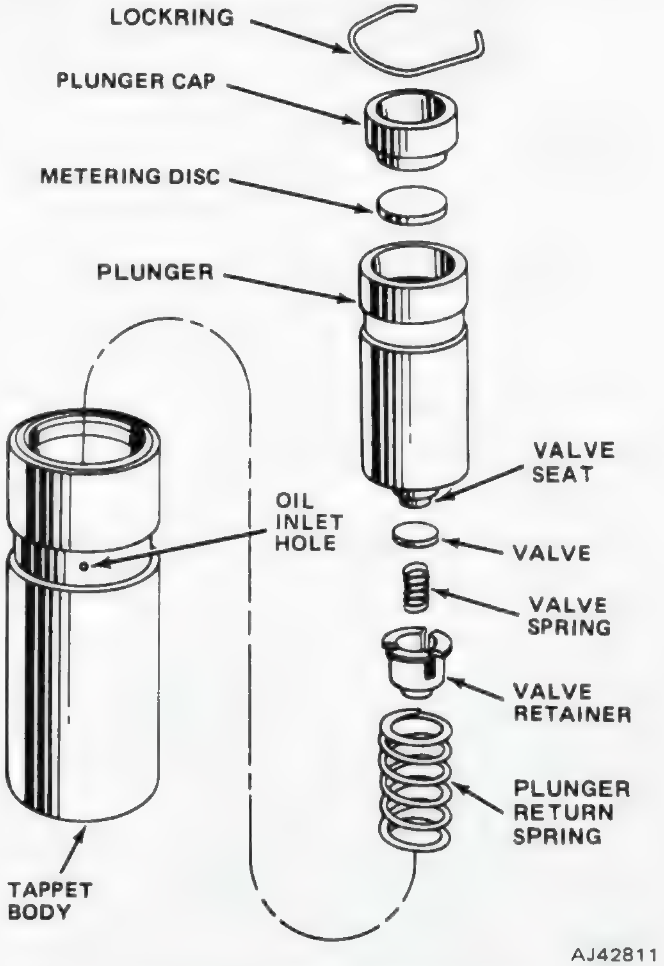


Fig. 1B-137 Hydraulic Tappet Assembly

Removal

(1) Remove cylinder head cover.

(2) Remove rocker arms and bridged pivot assemblies. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(3) Remove push rods.

NOTE: *Keep rocker arm assemblies and push rods in the same order as removed.*

(4) Remove intake manifold.

(5) Remove tappet from guide bore in engine block.

Cleaning and Inspection

(1) Release lockring.

(2) Remove plunger cap, metering disc, plunger assembly, and plunger return spring from tappet body.

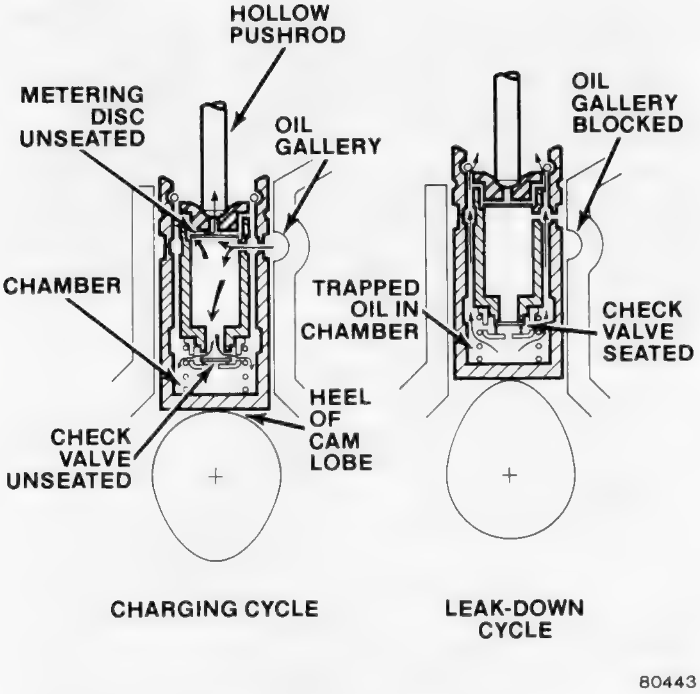


Fig. 1B-138 Hydraulic Tappet Operation

NOTE: *Keep the tappets and all components in the same order as removed.*

(3) Clean all components of hydraulic tappet assembly in cleaning solvent to remove all varnish or gum deposits.

(4) Visually inspect each tappet assembly for signs of scuffing on the barrel and face of the tappet. Inspect tappet face for wear using straightedge across tappet face. If tappet face is concave, corresponding lobe on camshaft is worn and replacement of the camshaft and tappets is necessary.

(5) Replace entire tappet assembly if any component shows evidence of wear or damage.

(6) Install plunger return spring, plunger, metering disc, and plunger cap in tappet body.

(7) Use push rod on plunger cap to compress plunger assembly and install lockring.

Hydraulic Tappet Leak-Down Test

After cleaning and inspection use tool J-5790 to test the tappet for leak-down to ensure its zero-lash operating ability (fig. 1B-139).

(1) Swing weighted arm of tester away from ram of tester.

(2) Place 0.312- to 0.313-diameter ball bearing on plunger cap of tappet.

(3) Lift ram and place tappet with ball bearing inside tester cup.

(4) Lower ram, then adjust nose of ram until it contacts ball bearing.

(5) Fill tester cup with valve tappet test oil J-5268 until tappet is completely covered.

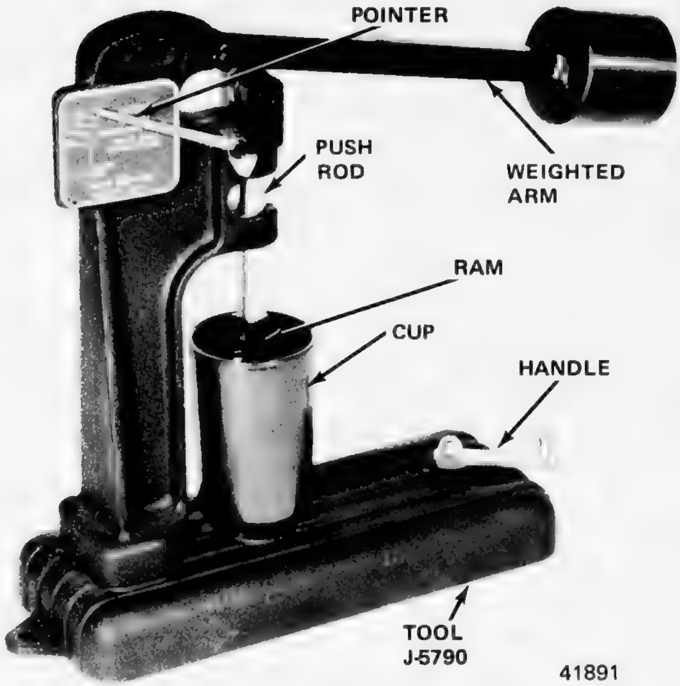


Fig. 1B-139 Hydraulic Tappet Leak-Down Tester J-5790

(6) Swing weighted arm onto ram and pump up and down on tappet to remove air. When air bubbles cease, swing weighted arm away and allow plunger to rise to normal position.

(7) Adjust nose of ram to align pointer with SET mark on scale of tester and tighten hex nut.

(8) Slowly swing weighted arm onto ram. Rotate cup by turning handle at base of tester clockwise one revolution every two seconds.

(9) Time leak-down from instant pointer aligns with START mark on scale until pointer aligns with 0.125 mark.

(10) An acceptable tappet will take 20 to 110 seconds to leak-down. Replace tappets outside this range.

NOTE: *Do not charge the tappet assemblies with engine oil as they will charge themselves within three to eight minutes of engine operation.*

Installation

(1) Dip each tappet assembly in AMC Engine Oil Supplement (EOS), or equivalent. Install tappet in same bore from which it was removed.

(2) Install push rods in same order as removed.

(3) Install rocker arm and bridged pivot assemblies. Alternately tighten capscrews one turn at a time to avoid damaging bridge. Tighten to 19 foot-pounds (26 Nm) torque.

(4) Pour remaining EOS over entire valve train mechanism.

NOTE: *Do not drain the EOS from the engine for at least 1,000 miles or until the next scheduled oil change.*

(5) Reseal and install cylinder head cover. Tighten retaining screws to 50 inch-pounds (5.6 Nm) torque.

(6) Install intake manifold using replacement gasket and end seals. Tighten manifold retaining bolts to 43 foot-pounds (58 Nm) torque.

(7) Install all lines, hoses, linkage and wires disconnected from intake manifold.

Timing Case Cover

The timing case cover is die-cast aluminum with a crankshaft oil seal to prevent oil leakage at the vibration damper hub (fig. 1B-140). The oil seal may be installed from either side of the timing case cover. It is not necessary to remove the cover whenever oil seal replacement is required.

A graduated scale cast in the cover is used for ignition timing. A hole is provided for checking ignition timing with a magnetic timing probe.

The engine oil pump, oil passages and coolant passages are incorporated within the timing case cover casting. The timing case cover casting is used to mount the fuel pump, distributor and water pump.

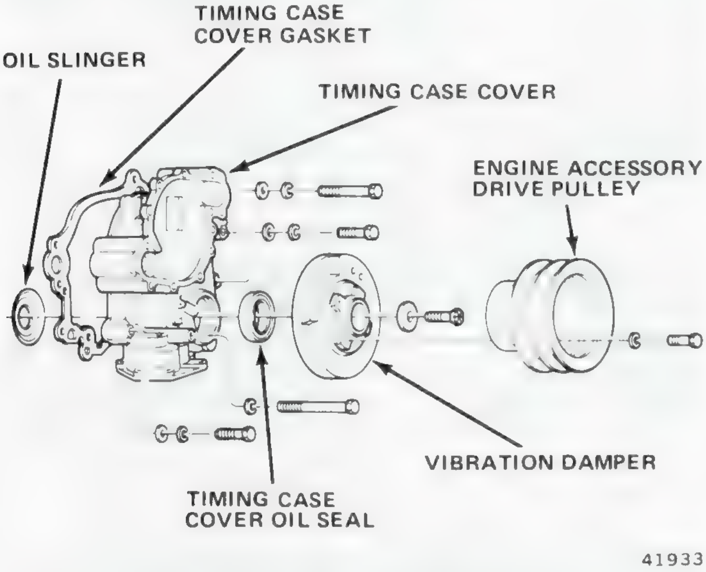


Fig. 1B-140 Timing Case Cover Assembly

Removal

(1) Drain cooling system and cylinder block.

(2) Disconnect radiator hoses and bypass hose.

(3) Remove all drive belts.

(4) Remove fan and hub assembly.

(5) If equipped with air conditioning, remove compressor and bracket assembly from engine and move aside. Do not disconnect air conditioning hoses.

(6) Remove alternator, alternator mounting bracket and back idler pulley.

(7) Disconnect heater hose at water pump.

(8) Remove power steering pump and bracket assembly, if equipped. Remove air pump and mounting bracket as an assembly. Do not disconnect power steering hoses.

(9) Remove distributor cap. Note rotor and housing position.

(10) Remove distributor.

(11) Remove fuel pump.

(12) Remove vibration damper pulley and retaining screws.

(13) Remove vibration damper using tool J-21791.

(14) Remove two front oil pan screws.

(15) Remove screws which secure timing case cover to engine block.

NOTE: *The cover retaining screws are of various lengths and must be installed in the same location as removed.*

(16) Remove cover by pulling forward until free of locating dowel pins.

(17) Clean gasket surface of cover.

(18) Remove oil seal.

NOTE: *Always replace the oil seal whenever the timing case cover is removed. Refer to Oil Seal Replacement.*

Installation

(1) Remove lower locating dowel pin from engine block.

NOTE: *The dowel pin is required for correct cover alignment. Install dowel after the cover is in position.*

(2) Use sharp knife or razor blade to cut both sides of oil pan gasket flush with engine block (fig. 1B-141).

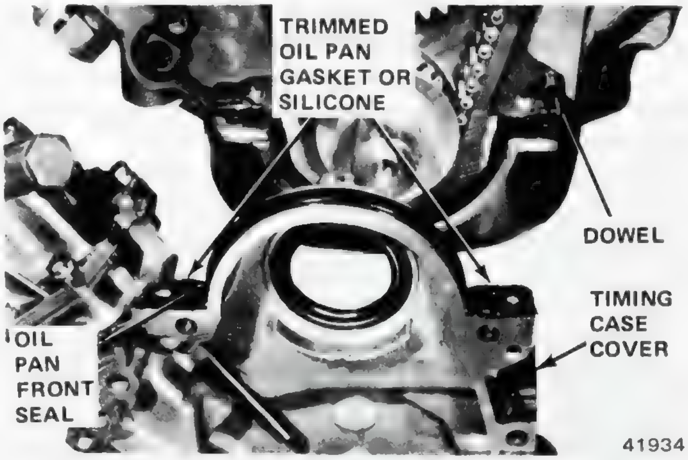


Fig. 1B-141 Oil Pan Front Seal Installation

(3) Apply Permatex No. 2, or equivalent, to both sides of replacement timing case cover gasket. Install gasket on timing case cover.

(4) Install replacement front oil pan seal to bottom of timing case cover.

NOTE: *There are two methods of sealing timing case cover to oil pan where oil pan gaskets were cut off. If replacement oil pan gaskets are used, perform step (5). If room temperature vulcanizing (RTV) silicone is used, perform step (6).*

(5) If oil pan gaskets are used:

(a) Using original gasket pieces as guide, trim replacement gaskets to correspond to amount cut off in step (2).

(b) Align tongues of replacement oil pan gasket pieces with oil pan seal and cement into place on timing case cover (fig. 1B-141).

(c) Apply Permatex No. 2, or equivalent, to cut-off edges of original oil pan gaskets.

(d) Place timing case cover into position and install front oil pan screws.

(e) Tighten screws slowly and evenly until cover aligns with upper locating dowel.

(f) Install lower dowel through cover and drive into corresponding hole in engine block.

(g) Install each cover retaining screw in same location as removed. Tighten to 25 foot-pounds (34 Nm) torque.

(h) Proceed to step (7).

(6) If RTV is used:

(a) Apply coating of RTV 1/8-inch thick on timing case cover flanges. Use AMC Gasket-in-a-Tube, or equivalent. Flanges must be clean and dry.

(b) Place cover into position. Align with top dowel.

(c) Loosely install cover retaining screws in same locations as removed, *excluding* oil pan screws.

(d) Install lower dowel through cover and drive into corresponding hole in engine block.

(e) Tighten cover retaining screws to 25 foot-pounds (34 Nm) torque.

(f) Apply small bead of RTV to joint between pan and cover and force into place with finger.

(g) Apply drop of Loctite, or equivalent, to oil pan screws and install until snug. *Do not torque-tighten* as oil pan would be distorted.

(h) Proceed to step (7).

(7) Install vibration damper. Tighten retaining screw to 90 foot-pounds (122 Nm) torque (lubricated).

(8) Install damper pulley and retaining screws.

(9) Install fuel pump.

(10) Install distributor with rotor and housing in same position as it was prior to removal.

(11) Install distributor cap and connect heater hose.

(12) Install power steering pump and air pump and mounting bracket, if removed.

(13) Install alternator, alternator mounting bracket and back idler pulley assembly.

(14) Install air conditioning compressor and bracket assembly, if removed.

(15) Install fan and hub assembly.

(16) Install all drive belts and tighten to specified tension. Refer to Chapter 1C—Cooling.

(17) Connect radiator hoses and bypass hose.

(18) Fill cooling system to specified level.

(19) Start engine and check for oil or coolant leaks.

(20) Adjust initial ignition timing to specified setting. Refer to Chapter 1A—General Service and Diagnosis.

Oil Seal Replacement

(1) Loosen all drive belts.

(2) Remove vibration damper pulley.

(3) Remove vibration damper, screw and washer.

(4) Install damper screw to crankshaft to prevent damper puller from damaging crankshaft threads.

(5) Remove vibration damper with tool J-21791. Remove damper screw.

(6) Use Remover J-2956 to remove oil seal (fig. 1B-142).

(7) Wipe crankshaft sealing area clean.

(8) Apply Permatex No. 2, or equivalent, to outer metal surface of replacement seal.

(9) Install seal using Installer J-26562 (fig. 1B-143).

(10) Apply light coating of engine oil to sealing surface of damper.

(11) Install damper, flat washer and screw. Tighten screw to 90 foot-pounds (122 Nm) torque.

(12) Install pulley and belts. Tighten belts to specifications. Refer to Chapter —Cooling.

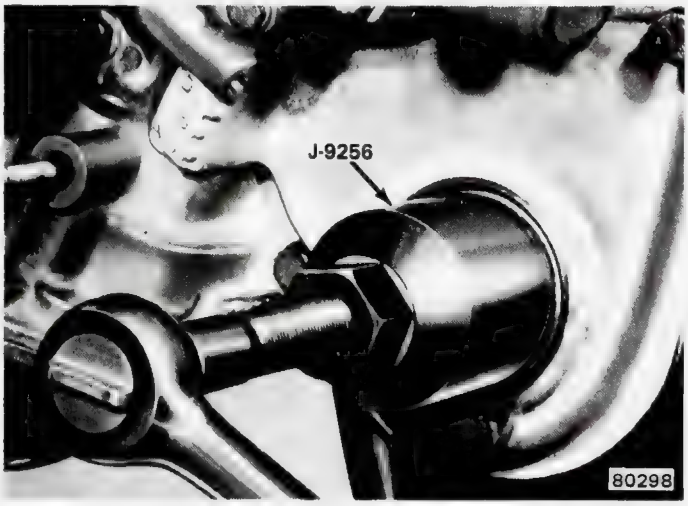


Fig. 1B-142 Removing Timing Case Cover Oil Seal

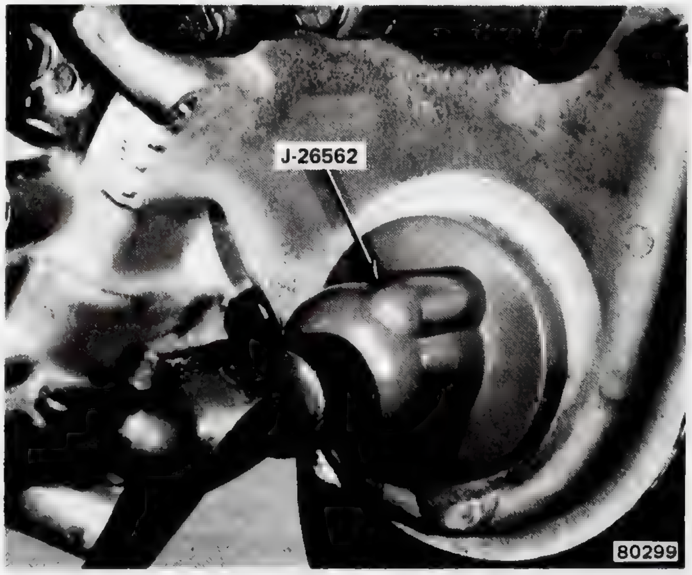


Fig. 1B-143 Installing Timing Case Cover Oil Seal

Timing Chain

The timing chain consists of 62 links joined by 62 pins. It is a single-row design.

To ensure correct valve timing, install the timing chain with the timing marks of the crankshaft and camshaft sprockets properly aligned. A worn timing chain will adversely affect valve timing. If the timing chain deflects more than 1/2 inch, it should be replaced.

Removal

(1) Remove timing case cover and gasket (fig. 1B-140).

(2) Remove crankshaft oil slinger.

(3) Remove camshaft sprocket retaining screw and washer.

(4) Remove distributor drive gear and fuel pump eccentric.

(5) Rotate crankshaft until zero timing mark on crankshaft sprocket is closest to and on centerline with zero timing mark on camshaft sprocket (fig. 1B-144).

(6) Remove crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

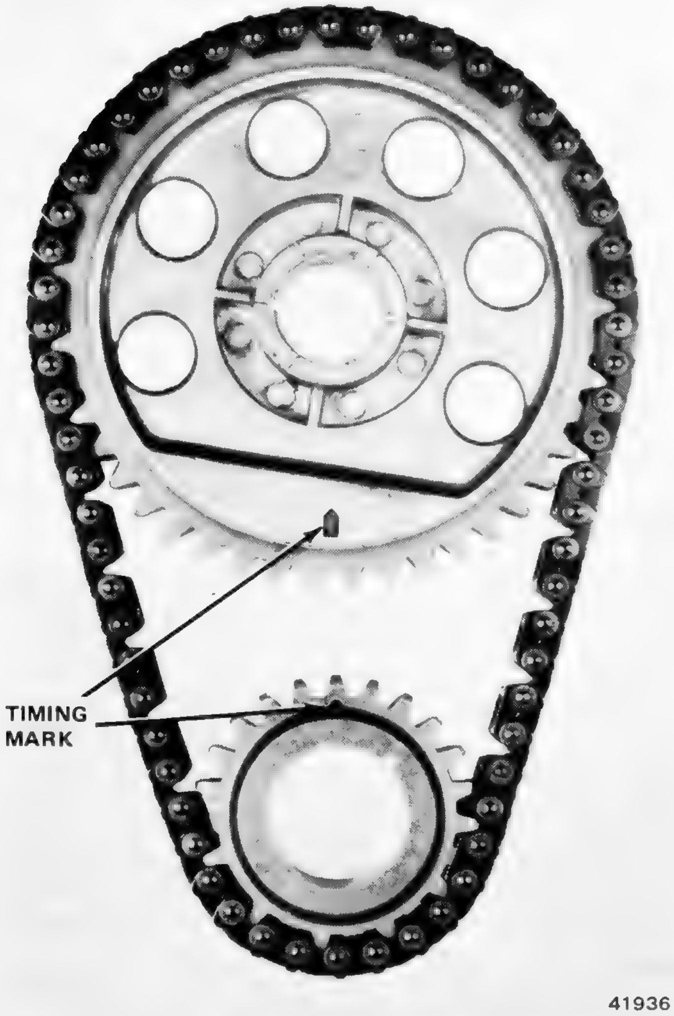


Fig. 1B-144 Timing Chain and Sprocket Alignment

Installation

(1) Assemble timing chain, crankshaft sprocket and camshaft sprocket with timing marks aligned (fig. 1B-144).

(2) Install chain and sprocket assembly to crankshaft and camshaft.

(3) Install fuel pump eccentric and distributor drive gear.

(4) Install camshaft sprocket, washer and retaining screw. Tighten screw to 30 foot-pounds (41 Nm) torque.

NOTE: *Install the fuel pump eccentric with the stamped word REAR facing the camshaft sprocket.*

(5) To verify correct installation of timing chain:

(a) Rotate crankshaft until timing mark on camshaft sprocket is on horizontal line at 3 o'clock position.

(b) Beginning with pin directly adjacent to camshaft sprocket timing mark, count number of pins downward to timing mark on crankshaft sprocket.

(c) There must be 20 pins between these two points. **The crankshaft sprocket timing mark must be between pins 20 and 21 (fig. 1B-145).**

(6) Install crankshaft oil slinger.

(7) Remove original oil seal from timing case cover.

(8) Install replacement oil seal in timing case cover.

(9) Install timing case cover using replacement gasket. Tighten retaining screws to 25 foot-pounds (34 Nm) torque.

INTAKE AND EXHAUST MANIFOLDS

Intake Manifold

The cast iron intake manifold is designed to enclose and seal the tappet area between the cylinder heads. A one-piece metal gasket, used to seal the intake manifold to the cylinder heads and block, also serves as an oil splash baffle.

The intake manifold contains coolant passages, a crankcase ventilator passage, and an exhaust crossover passage. Passages are also incorporated within the intake manifold for the Exhaust Gas Recirculation (EGR) system.

Induction system passages distribute a uniform fuel and air mixture to the combustion chamber of each cylinder. The left bore of the carburetor supplies fuel-air mixture through passages in the intake manifold to numbers 1, 7, 4 and 6 cylinder intake ports. The right bore supplies 3, 5, 2, and 8.

Removal

(1) Drain coolant from radiator and cylinder block.

(2) Remove air cleaner assembly.

(3) Disconnect ignition wires.

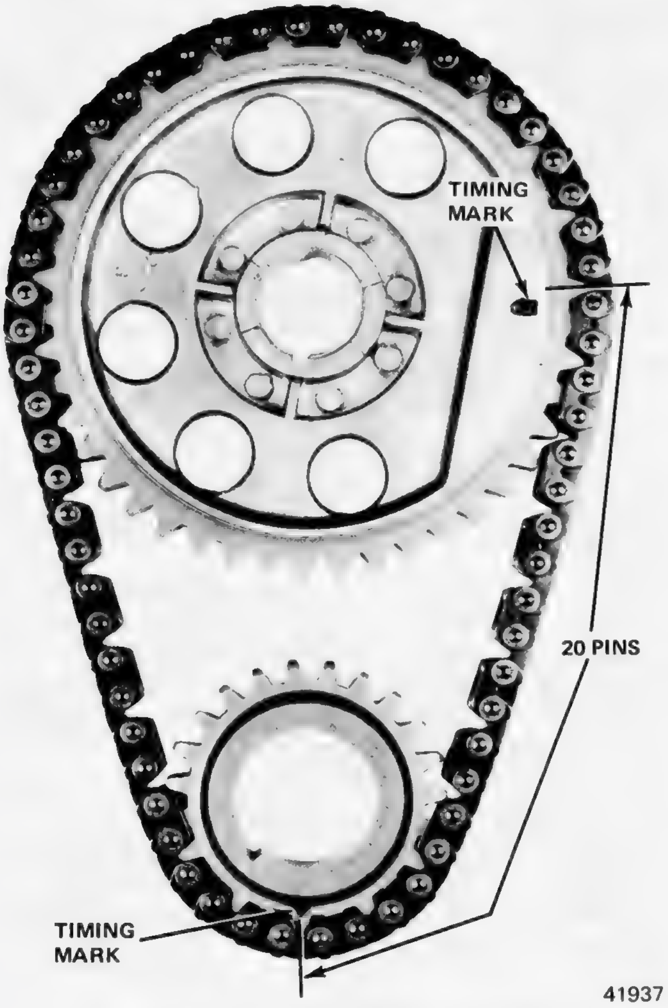


Fig. 1B-145 Correct Timing Chain Installation

(4) Remove ignition wire plastic separators from cylinder head cover brackets.

(5) Disconnect radiator upper hose and bypass hose from intake manifold.

(6) Disconnect and move aside wire from temperature gauge sending unit.

(7) Remove air conditioning bracket, if equipped.

(8) Disconnect ignition coil bracket and move coil and bracket assembly aside.

(9) Remove TCS solenoid vacuum valve and solenoid control switch, if equipped, from right side cylinder head cover.

(10) Disconnect heater hose from rear of manifold.

(11) Disconnect all hoses, lines and wires from carburetor.

(12) Disconnect accelerator linkage and throttle valve linkage from carburetor and intake manifold.

(13) Disconnect air delivery hoses at air injection manifold.

(14) Disconnect diverter valve from air pump output hose and move valve and delivery hoses aside.

(15) Remove carburetor.

(16) Remove intake manifold, metal gasket and end seals.

(17) Clean mating surfaces of engine block, cylinder head and intake manifold.

Installation

NOTE: *When installing replacement intake manifold, transfer all components such as EGR valve and back-pressure sensor, EGR CTO, thermostat/housing and temperature gauge sending unit from original manifold. Clean and tighten as required.*

(1) Apply a non-hardening sealer or silicone sealer such as AMC Gasket-in-a-Tube, or equivalent, to both sides of replacement manifold gasket.

(2) Position gasket by aligning locators at rear of cylinder head. While holding rear in place, align front locators.

(3) Install two end seals. Apply Permatex No. 2, AMC Gasket-in-a-Tube, or equivalent, to seal ends.

(4) Install intake manifold and retaining screws. Make sure all screws are properly started before tightening. Tighten to 43 foot-pounds (58 Nm) torque.

(5) Install diverter valve and connect air pump output hose.

(6) Connect air delivery hoses to air injection manifolds.

(7) Connect all disconnected hoses, lines, linkages and wires to intake manifold and carburetor.

(8) Install TCS solenoid vacuum valve and solenoid control switch, if equipped, to right side rocker arm cover.

(9) Install air conditioning bracket, if equipped.

(10) Install ignition coil and bracket assembly.

(11) Connect radiator upper hose and bypass hose.

(12) Install ignition wire plastic separators to cylinder head cover brackets.

(13) Connect ignition wires.

(14) Install air cleaner assembly.

(15) Add coolant as necessary.

Exhaust Manifold

The swept-flow design of the cast iron manifold provides efficient removal of exhaust gases and minimizes cylinder back-pressure. The mating surface of the exhaust manifold and the cylinder head are machined smooth to eliminate the need for a gasket.

All eight-cylinder engines are equipped with an Air Guard system and have air injection manifolds attached at number 1, 3, and 5 exhaust ports on the left exhaust manifold and numbers 2, 4, 6, and 8 on the right exhaust manifold. Refer to Chapter 1K—Exhaust Systems for description of the Air Guard system.

Removal

(1) Disconnect ignition wires.

(2) Disconnect air delivery hose at injection manifold.

(3) Disconnect exhaust pipe at exhaust manifold.

(4) To remove right side manifold on Concord only:

(a) Remove transmission filler tube attaching screw.

(b) Remove filler tube from transmission.

(5) Remove exhaust manifold retaining screws.

(6) Separate exhaust manifold from cylinder head.

(7) Remove air injection manifold, attaching screws and washers.

Installation

(1) Clean mating surfaces of exhaust manifold and cylinder head. **Do not nick or scratch.**

(2) Install air injection manifold, attaching screws and washers.

(3) Install exhaust manifold and retaining screws. Tighten screws to 25 foot-pounds (34 Nm) torque.

(4) After installing right side manifold on Concord:

(a) Install filler tube to transmission, using replacement O-ring.

(b) Install screw to secure filler tube.

(5) Connect exhaust pipe using replacement seal, if required. Tighten nuts to 20 foot-pounds (27 Nm) torque.

(6) Connect air delivery hose to air injection manifold.

(7) Connect ignition wires.

CYLINDER HEAD AND COVER

Cylinder Head Cover

All eight-cylinder engines use a formed-in-place RTV (room temperature vulcanizing) silicone gasket.

Removal

(1) Remove air cleaner assembly.

(2) Disconnect air delivery hose at air injection manifold.

(3) Left side:

(a) Disconnect power brake vacuum hose at intake manifold, if equipped.

(b) Disconnect throttle stop solenoid wire.

(4) Right side:

(a) Remove thermostatically controlled air cleaner (TAC) hot air hose.

(b) Remove heater hose from choke cover clamp.

(5) Disconnect ignition wires and remove plastic wire separator from cylinder head cover bracket.

(6) Remove retaining screws and washers. Separate cylinder head cover and gasket from cylinder head.

Installation

(1) Inspect for bent or cracked cover and repair as required.

(2) Clean cylinder head cover and cylinder head gasket surface of original gasket material.

(3) Apply a bead of AMC Gasket-in-a-Tube, or equivalent, to cylinder head and cylinder head cover gasket surface.

NOTE: *If silicone gasket has not been badly damaged during removal, it is not necessary to clean and reseal cover completely. Use AMC Gasket-in-a-Tube, or equivalent, to repair small gaps in silicone gasket.*

(4) Position cylinder head cover on engine.

(5) Install retaining screws and tighten to 50 inch pounds (5.6 Nm) torque.

(6) Connect ignition wires and install plastic wire separator to cylinder head cover bracket.

(7) Right side:

(a) Install heater hose to choke cover clamp.

(b) Install TAC hot air hose.

(8) Left side:

(a) Connect power brake vacuum hose at intake manifold.

(b) Connect throttle stop solenoid wire.

(9) Connect air delivery hose to air injection manifold.

(10) Install air cleaner assembly.

Cylinder Head

Removal

(1) Drain cooling system and cylinder block.

(2) Remove cylinder head cover and gasket.

(3) Remove rocker arm assemblies. Remove two capscrews at each bridged pivot. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(4) Remove push rods.

NOTE: *Keep rocker arm assemblies and push rods in the same order as removed.*

(5) Remove ignition wires and spark plugs.

(6) Remove intake manifold.

(7) Remove exhaust manifold(s). It is not necessary to remove manifold from exhaust pipe.

(8) Loosen all drive belts.

(9) Right side:

(a) If equipped with air conditioning, remove compressor mounting bracket and battery negative cable from cylinder head.

(b) Disconnect alternator support brace from cylinder head.

(10) Left side: Disconnect air pump and power steering mounting bracket, if equipped, from cylinder head.

(11) Remove cylinder head retaining screws.

(12) Remove cylinder head and gasket.

Cleaning and Inspection

Thoroughly clean the gasket surfaces of the cylinder head and block to remove all dirt and gasket cement.

Remove the carbon deposits from the combustion chambers and the top of each piston.

Use a straightedge and feeler gauge to check the flatness of the cylinder head and block mating surfaces. Refer to Specifications for flatness tolerances.

If the cylinder head is to be replaced and the original valves reused, remove the valves and measure the stem diameter.

NOTE: *Service replacement heads have standard-size valve guides. If oversize valves from original head are to be installed in replacement head, ream valve guides to appropriate oversize.*

If the original valves are used, remove all carbon buildup and reface the valves as outlined under Valve Refacing. Install the valves in the cylinder head using replacement valve stem oil deflectors. If oversize valves are used, oversize deflectors are required. Transfer all attached components from the original head which are not included with the replacement head.

Installation

NOTE: *The 304 CID engine utilizes an aluminum coated embossed steel gasket and the 360 CID engine utilizes an aluminum coated laminated steel and asbestos gasket. Retightening is not necessary with either gasket.*

(1) Apply even coat of non-hardening sealing compound to both sides of replacement head gasket.

NOTE: *Do not apply sealing compound to head and block surfaces. Do not allow sealer to enter cylinder bores.*

(2) Position gasket on block with stamped word TOP facing upward.

(3) Install cylinder head and gaskets.

NOTE: *Wire brush the threads of screws prior to installation. Dirt will affect the torque readings. Blow coolant from screw holes to prevent trapping coolant.*

(4) Tighten cylinder head capscrews evenly to 80 foot-pounds (108 Nm) torque following the sequence outlined in figure 1B-146. Then follow the sequence again and tighten screws to 110 foot-pounds (149 Nm) torque.

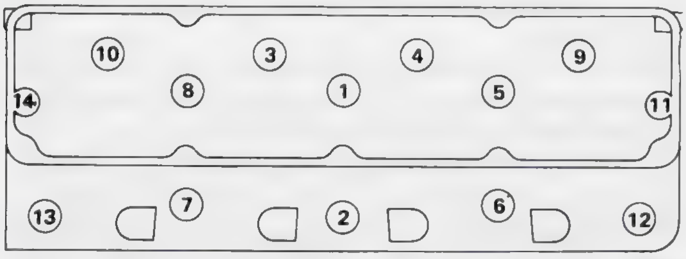


Fig. 1B-146 Cylinder Head Torque Sequence

(5) Left side: connect air pump mounting bracket to cylinder head and power steering pump, if removed.

(6) Right side:

(a) Connect alternator support bracket to cylinder head.

(b) Install air conditioning compressor mounting bracket, if removed, and battery negative cable to cylinder head.

(7) Adjust all drive belts to specified tension. Refer to Chapter 1C—Cooling.

(8) Install exhaust manifold and tighten retaining screws to 25 foot-pounds (34 Nm) torque.

(9) Install intake manifold. Tighten manifold retaining screws to 43 foot-pounds (58 Nm) torque.

(10) Install all disconnected lines, hoses, linkage and wires.

(11) Install rocker arm assemblies and push rods in the same order as removed. Loosely install capscrews to bridged pivots. At each bridge, altenately tighten capscrews one turn at a time to avoid damaging or breaking bridge. Tighten capscrews to 19 foot-pounds (26 Nm) torque.

(12) Reseal and install cylinder head cover. Tighten retaining screws to 50 inch-pounds (5.6 Nm) torque.

(13) Install spark plugs and connect ignition wires.

(14) Fill cooling system to specified level.

LUBRICATION SYSTEM

Oil is drawn from the sump of the oil pan through a tube and screen assembly to a horizontal oil gallery located at the lower right side of the engine block (fig. 1B-147). A passage in the timing case cover channels oil into the oil pump. Pressure is developed when oil is driven between the gears and pump body.

The oil is forced from the pump through a passage in the oil pump cover to the oil filter (fig. 1B-148).

The oil passes through the filtering elements and on to an outlet passage in the oil pump cover. From the oil pump cover passage, the oil enters an adjoining passage in the timing case cover and is channeled into a gallery which extends up the left front of the cylinder block. This gallery channels oil directly to the right main oil gallery which intersects with a short passage that channels oil to the left main oil gallery.

The left and right main oil galleries extend the length of the cylinder block. The left oil gallery channels oil to each hydraulic tappet on the left bank. The right oil gallery channels oil to each hydraulic tappet on the right bank. In addition, passages extend down from the right oil gallery to the five camshaft bearings and on to the five upper main bearing inserts. The crankshaft is drilled to allow oil to flow from each main journal to adjacent connecting rod journals. A squirt hole in each connecting rod bearing cap distributes oil to the cylinder walls, pistons and piston pins as the crankshaft rotates.

A small passage within the front camshaft bearing journal channels oil through the camshaft sprocket to

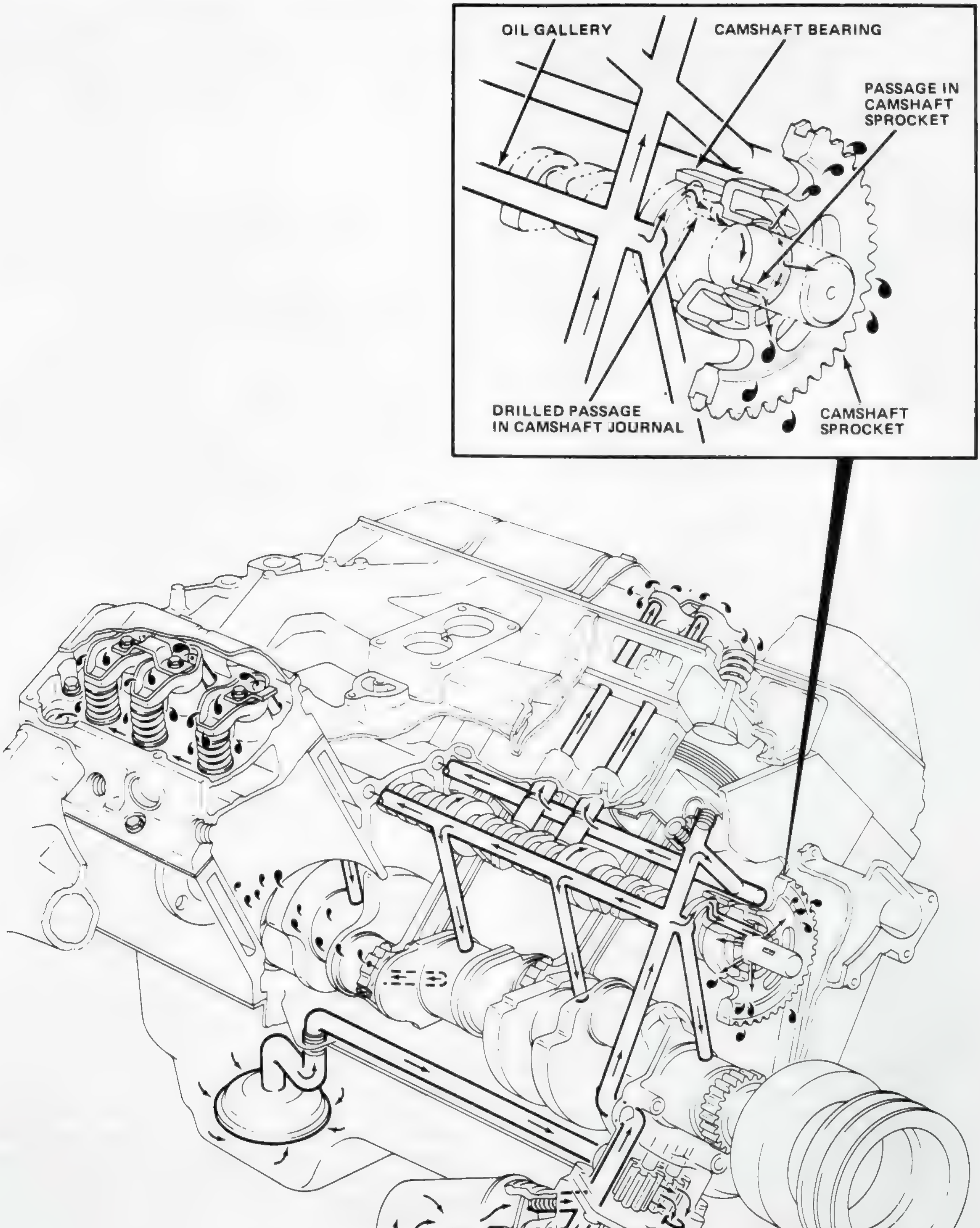


Fig 1B-147 Lubrication System

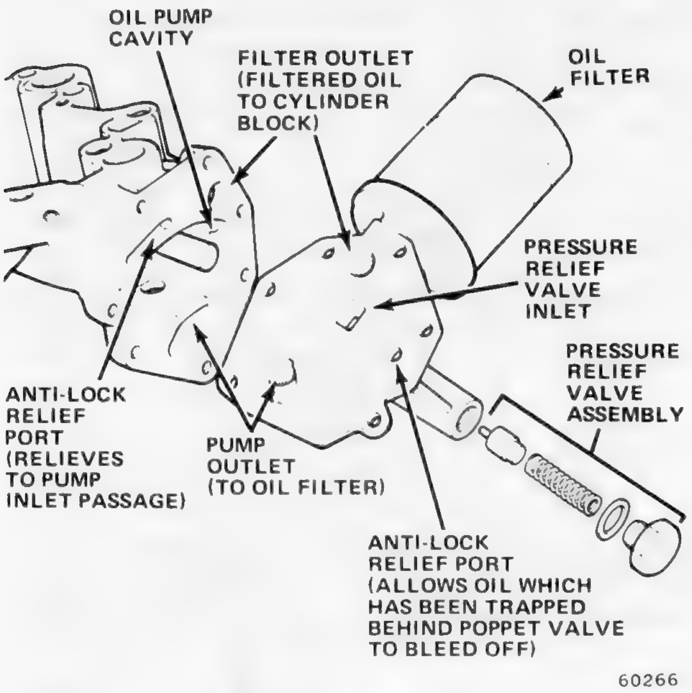


Fig. 1B-148 Oil Pump Cover

the timing case cover area where the case and sprockets throw off oil to lubricate the distributor gears and fuel pump eccentric (see insert, fig. 1B-147). This oil returns to the oil pan by passing under the front main bearing cap.

The oil supply for rocker arm assemblies is metered through the hydraulic valve tappets and routed through hollow push rods to a hole in the push rod end of the corresponding rocker arm. This oil lubricates the valve train, then returns to the oil pan through channels at both ends of the cylinder head.

Oil Filter

A full flow oil filter mounted on the oil pump at the lower right-hand side of the engine is accessible from below the chassis.

A bypass valve, incorporated in the filter mounting base, provides a safety factor in the event the filter becomes inoperative as a result of dirt or sludge accumulation (fig. 1B-149). Oil Filter Remover Tool J-22700 will facilitate removal.

Before installation, apply a thin film of oil to the filter gasket. **Do not use grease.** Install filter until gasket contacts the seat of the oil pump cover. Tighten by hand only, following instructions on replacement filter. Operate engine at fast idle and check for leaks.

Oil Pump

The positive-displacement gear-type oil pump is driven by the distributor shaft, which is driven by a gear on the camshaft (fig. 1B-149). The pump is incorporated in the timing case cover. A cavity in the cover forms the body of the pump. A pressure relief valve regulates maximum pressure.

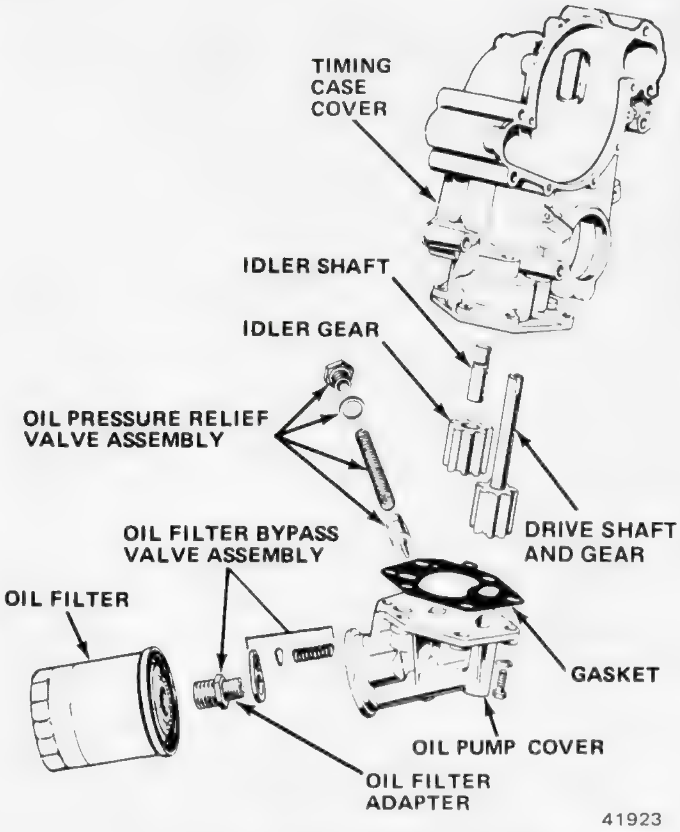


Fig. 1B-149 Oil Pump and Filter Assembly

Oil pump removal or replacement will not affect distributor timing. The distributor drive gear remains in mesh with the camshaft gear.

Oil Pressure Relief Valve

The oil pressure relief valve is not adjustable. A setting of 75 pounds maximum pressure is built into the tension of the spring.

In the relief position, the valve permits oil to bypass through a passage in the pump cover to the inlet side of the pump (fig. 1B-148).

Removal

(1) Remove retaining screws and separate oil pump cover, gasket and oil filter as an assembly from pump body (timing case cover).

(2) Remove drive gear and shaft, and idler gear by sliding them out of body.

(3) Remove oil pressure relief valve from pump cover for cleaning by removing retaining cap and spring. Clean cover thoroughly. Check operation of relief valve by inserting poppet valve and checking to see that it slides back and forth freely. If not, replace pump cover and poppet valve.

Gear End Clearance Measurement

This check indicates the distance between the end of the pump gear and the pump cover. The ideal clearance is as close as possible without binding gears. The pump cover gasket is 0.008 inch to 0.010 inch thick (0.007 inch minimum, compressed). Symptoms of excessive pump clearance are fair to good pressure when cold, low or no pressure after a hot engine start-up.

Preferred Method:

(1) Place strip of Plastigage across full width of each gear (fig. 1B-150).

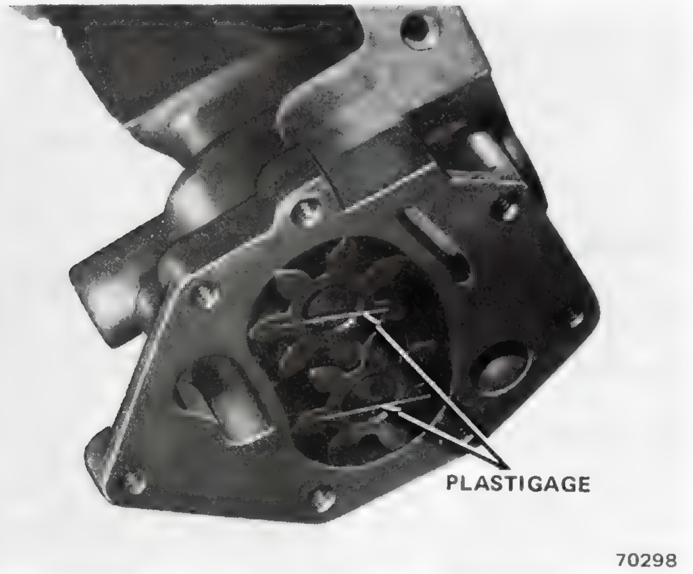


Fig. 1B-150 Oil Pump Gear End Clearance Measurement—Plastigage Method

(2) Install pump cover and gasket. Tighten screws to 55 inch-pounds (6.2 Nm) torque.

(3) Remove pump cover and determine amount of clearance by measuring width of compressed Plastigage with the scale on the Plastigage envelope. Correct clearance by this method is 0.0005 to 0.006 inch (0.002 preferred).

Alternate Method:

(1) Place straightedge across gears and pump body.

(2) Select feeler gauge which will fit snugly but freely between straightedge and pump body (fig. 1B-151). Correct clearance by this method is 0.004 to 0.0065 inch (0.0065 inch preferred).

NOTE: *Make certain gears are up into body as far as possible.*

If gear end clearance is excessive, measure gear length. If gear length is correct, install thinner gasket. If gear length is incorrect, replace gears.

Gear-to-Body Clearance

(1) Insert feeler gauge between gear tooth and pump body inner wall directly opposite the point of gear mesh. Select feeler gauge which fits snugly but freely (fig. 1B-152).

(2) Rotate gears to check each tooth in this manner. Correct clearance is 0.0005 to 0.0025 inch (0.0005 inch preferred).

(3) If gear-to-body clearance is more than specified, measure gear diameter with a micrometer. If gear diameter is correct, check gear end clearance and correct. If gear clearance is acceptable and relief valve is functioning properly, replace timing case cover. If gear diameter is incorrect, replace gears.

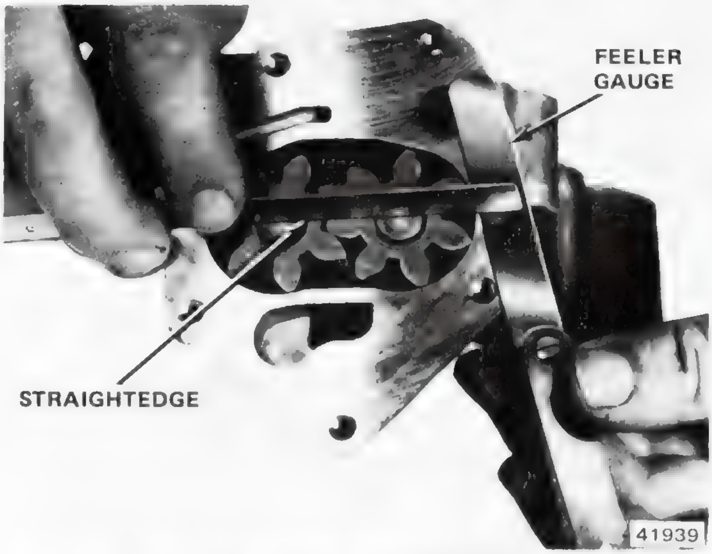


Fig. 1B-151 Gear End Clearance Measurement—Feeler Gauge Method

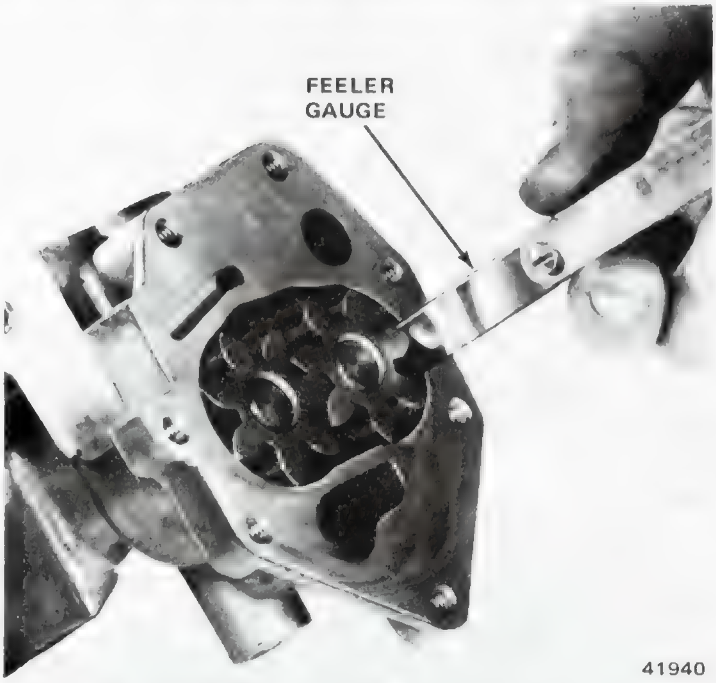


Fig. 1B-152 Gear-to-Body Clearance Measurement

NOTE: *If oil pump shaft or distributor drive shaft has broken, inspect for loose oil pump gear-to-shaft fit or worn front cover. Oversize pump shafts are not available.*

Installation

(1) Install oil pressure relief valve in pump cover with spring and retaining cap.

(2) Install idler shaft, idler gear and drive gear assembly.

NOTE: *To ensure self-priming of the oil pump, fill pump with petroleum jelly prior to the installation of the oil pump cover.* **Do not use grease of any type.**

(3) Install pump cover and oil filter assembly with a replacement gasket. Tighten retaining screws to 55 inch-pounds.

Oil Pan

Removal

(1) Disconnect battery negative cable.
(2) Support engine with a holding fixture, as shown in figure 1B-127.
(3) Raise car and support at frame side sills with support stands.
(4) Drain engine oil.
(5) Disconnect steering idler arm at side sill.
(6) Disconnect sway bar brackets at side sills.
(7) Disconnect strut rods at lower control arms.
(8) Disconnect engine-to-body ground cable.
(9) Disconnect engine front support cushions at crossmember.
(10) Remove crossmember-to-side sill bolts and nuts. Pull crossmember down.
(11) Remove starter.
(12) Remove oil pan attaching screws. Remove oil pan.
(13) Remove oil pan front and rear neoprene oil seals.
(14) Thoroughly clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan sump.

Installation

(1) Install replacement oil pan front seal to timing case cover. Apply generous amount of AMC Gasket-in-a-Tube (RTV silicone), or equivalent, to end tabs.
(2) Coat inside curved surface of replacement oil pan rear seal with soap. Apply a generous amount of AMC Gasket-in-a-Tube (RTV silicone), or equivalent, to gasket contacting surface of seal end tabs.
(3) Install seal in recess of rear main bearing cap, making certain it is fully seated.
(4) Apply engine oil to oil pan contacting surface of front and rear oil pan seals.
(5) Cement replacement oil pan side gaskets into position on engine block. Apply a generous amount of AMC Gasket-in-a-Tube (RTV silicone), or equivalent, to gasket ends.
(6) Install oil pan. Tighten 1/4-20 oil pan screws to 7 foot-pounds (9 Nm) torque and 5/16-18 oil pan screws to 11 foot-pounds (15 Nm) torque.
(7) Tighten drain plug securely.
(8) Install starter.
(9) Push up on crossmember. Install retaining screws and nuts and tighten to 65 foot-pounds (88 Nm) torque.
(10) Install engine front support cushion-to-crossmember retaining nuts and tighten to 37 foot-pounds (50 Nm) torque.
(11) Connect engine-to-body ground cable.
(12) Install strut rods to lower control arms. Tighten retaining screws to 75 foot-pounds (102 Nm) torque.
(13) Install sway bar brackets to side sills. Tighten retaining screws to 25 foot-pounds (34 Nm) torque.
(14) Install steering idler arm to side sill. Tighten retaining screws to 50 foot-pounds (68 Nm) torque.
(15) Lower car and remove engine holding fixture.
(16) Fill crankcase to specified level with clean oil.
(17) Connect battery negative cable.

Oil Pressure Indicator

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and replacement of the oil pressure indicator lamp.

Oil Pressure Gauge

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and replacement of the oil pressure indicator gauge.

CONNECTING ROD AND PISTON ASSEMBLY

Use these procedures to service connecting rods and pistons with the engine in the car.

Removal

(1) Remove cylinder head cover(s).
(2) Remove rocker arms and bridged pivot assemblies. Alternately loosen each capscrew one turn at a time to avoid damaging bridge.
(3) Remove push rods.
(4) Remove intake manifold assembly.
(5) Remove exhaust manifold(s). It is not necessary to disconnect manifold from exhaust pipe.
(6) Remove cylinder head and gasket.
(7) Position pistons, one at a time, near bottom of stroke. Use ridge reamer to remove any ridge from top end of cylinder walls.
(8) Drain engine oil.
(9) Remove oil pan.
(10) Remove connecting rod bearing caps and inserts. Keep in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(11) Remove connecting rod and piston assemblies through top of cylinder bores. Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls. Short pieces of rubber hose slipped onto the rod bolts will provide protection during disassembly.

Installation

(1) Thoroughly clean cylinder bores. Apply a light film of clean engine oil to bores with clean, lint-free cloth.

(2) Install piston rings. Refer to Piston Rings for sequence.

(3) Lubricate piston and ring surfaces with clean engine oil.

(4) Use piston ring compressor tool to install connecting rod and piston assemblies through top of cylinder bores. Be careful that connecting rod bolts do not scratch connecting rod journals or cylinder walls. Short lengths of rubber hose slipped over connecting rod screws will provide protection during installation.

(5) Install connecting rod bearing caps and inserts in same order as removed. Tighten retaining nuts to 33 foot-pounds (45 Nm) torque.

NOTE: *Squirt holes in connecting rods must face inward (fig. 1B-153).*

(6) Install engine oil pan using replacement gaskets and seals.

(7) Install cylinder heads and replacement gaskets.

(8) Install push rods.

(9) Install rocker arms and bridged pivot assemblies. Loosely install capscrews to each bridged pivot. At each bridged pivot, alternately tighten capscrews one turn at a time to avoid damaging bridge. Tighten capscrews to 19 foot-pounds (26 Nm) torque.

(10) Install intake manifold gasket and manifold assembly.

(11) Reseal and install cylinder head cover(s).

(12) Fill crankcase with clean oil to specified level.

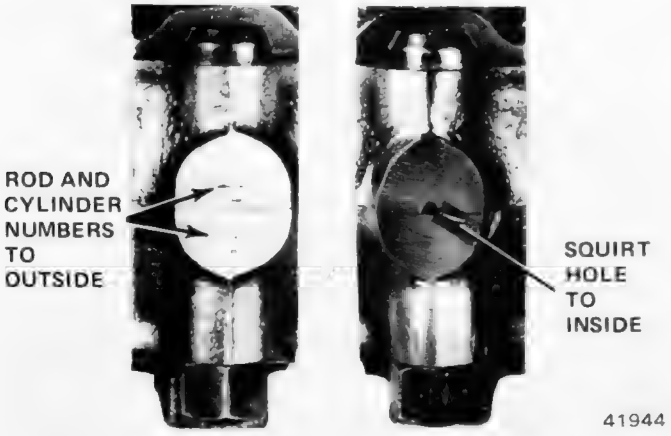


Fig. 1B-153 Rod Number and Squirt Hole Location

CONNECTING RODS

The connecting rods are malleable iron and are independently balanced. The crankshaft end of the connecting rod incorporates a two-piece bearing insert. The number stamped onto the removeable bearing cap and onto the adjacent machined surface of the rod corresponds to the cylinder in which the rod was assembled (fig. 1B-153). The piston end of the rod is a 2000-pound press-fit to the piston pin.

Have the connecting rod alignment checked by a competent machine shop whenever engine wear patterns or damage indicates probable rod misalignment. Always replace bent connecting rods.

Connecting Rod Side Clearance Measurement

(1) Rotate crankshaft to position connecting rod journal at bottom of stroke.

(2) Insert snug fitting feeler gauge between connecting rods (fig. 1B-154).

(3) Compare feeler gauge measurement to clearance specified. Replace rods not to specifications.

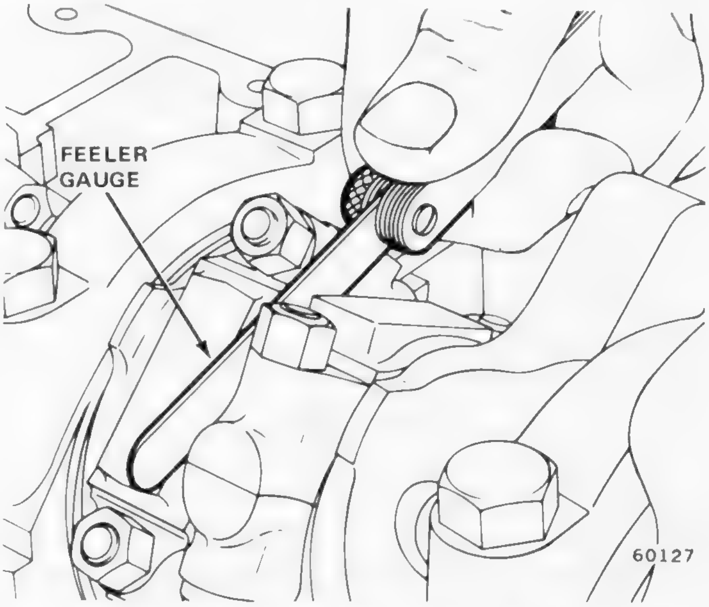


Fig. 1B-154 Connecting Rod Side Clearance Measurement

Connecting Rod Bearings

The connecting rod bearings are precision-type steel-backed aluminum alloy. The connecting rod bearings are selectively fitted to their respective journals to obtain the desired operating clearance. **In production**, the select fit is obtained by using various sized color coded bearing inserts as shown in the bearing fitting chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on production inserts.*

The rod journal size is identified **in production** by a color coded paint mark on the adjacent cheek or counterweight toward the flanged (rear) end of the crankshaft. Use color codes shown in the bearing fitting chart to identify journal size and select the correct bearing inserts to obtain proper clearances.

When required, different sized upper and lower bearing inserts may be used as a pair. A standard size insert is sometimes used in combination with a 0.001-inch undersize insert to reduce clearance by 0.0005 inch (1/2 thousandth of an inch).

Connecting Rod Bearing Fitting Chart

Crankshaft Connecting Rod Journal Color Code and Diameter	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
304 — 360 CID Engines		
Yellow —2.0955 to 2.0948 (Standard)	Yellow — Standard	Yellow — Standard
Orange —2.0948 to 2.0941 (0.0007 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black —2.0941 to 2.0934 (0.0014 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Red —2.0855 to 2.0848 (0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize

60270

CAUTION: *Never use a pair of bearing inserts with greater than 0.001-inch difference in size.*

Example:

Correct	Incorrect
Upper—Standard Lower—0.001-inch undersize	Standard 0.002-inch undersize

70242

Service replacement bearing inserts are available in pairs in the following sizes: standard, 0.001-inch undersize, 0.002-inch undersize, 0.010-inch undersize, and 0.012-inch undersize. The size is stamped on the back of service replacement inserts.

NOTE: *The 0.002-inch and 0.012-inch undersize inserts are not used in production.*

Removal

Use this procedure to service connecting rod bearings with the engine in the car.

(1) Drain engine oil.

(2) Remove oil pan.

(3) Rotate crankshaft as required to position two connecting rods at a time at bottom of their stroke.

(4) Remove bearing caps and lower inserts.

(5) Remove upper insert by rotating insert out of connecting rod.

NOTE: *Do not mix bearing caps. Connecting rod and matching cap are stamped with the cylinder number (fig. 1B-153). The numbers are located on a machined surface opposite the squirt holes.*

Inspection

(1) Clean inserts

(2) Inspect linings and backs of inserts for irregular wear pattern. Note any scraping, stress cracks or distortion (fig. 1B-155). If bearing has spun in rod, replace bearing and connecting rod and inspect crankshaft journal for scoring.

(3) Inspect for material imbedded in linings which may indicate piston, timing gear, distributor gear or oil pump gear problems. Figures 1B-156 and 1B-157 show common score problems.

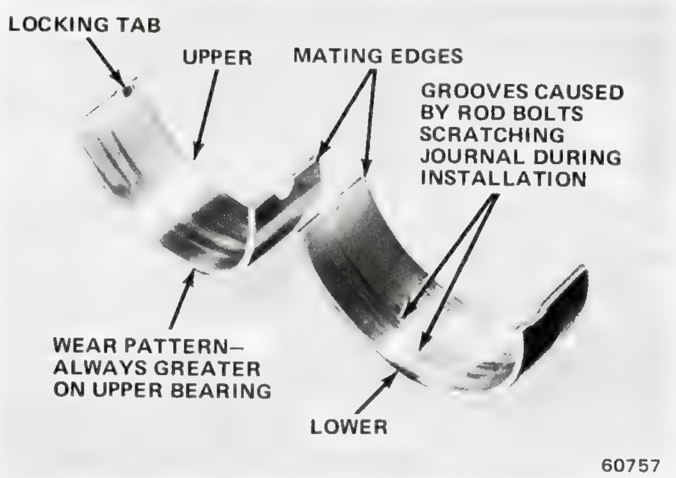


Fig. 1B-155 Connecting Rod Bearing Inspection

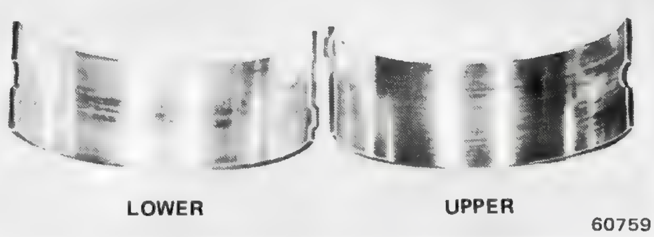


Fig. 1B-156 Scoring Caused by Insufficient Lubrication

(4) Inspect fit of bearing locking tab in rod cap. If inspection indicates that insert may have been caught between rod and rod cap, replace upper and lower bearing inserts.

(5) Inspect insert area of locking tab. Abnormal wear indicates bent tabs or improper installation of inserts (fig. 1B-158).

(6) Replace bearing inserts that are damaged or worn.

Measuring Bearing Clearance with Plastigage

(1) Wipe bearing inserts and rod journal clean.

(2) Lubricate upper insert and install in rod.

(3) Place strip of Plastigage across full width of lower insert at center of bearing cap.

(4) Install bearing cap to connecting rod and tighten retaining nuts to 33 foot-pounds (45 Nm) torque.

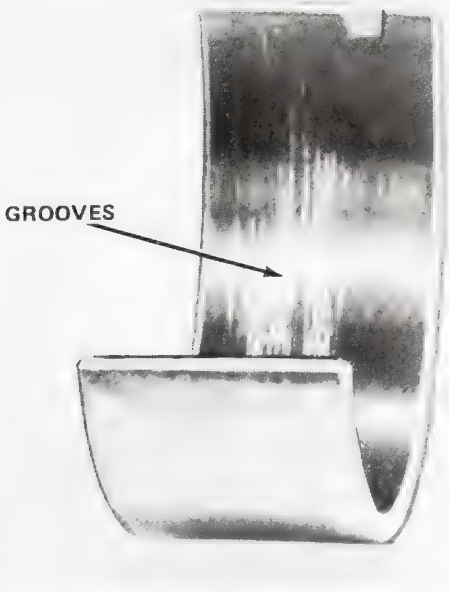


Fig. 1B-157 Scoring Caused by Dirt

Fig. 1B-158 Locking Tab Inspection

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading. Plastigage must not crumble. If brittle, obtain fresh stock.*

(5) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope (fig. 1B-159).

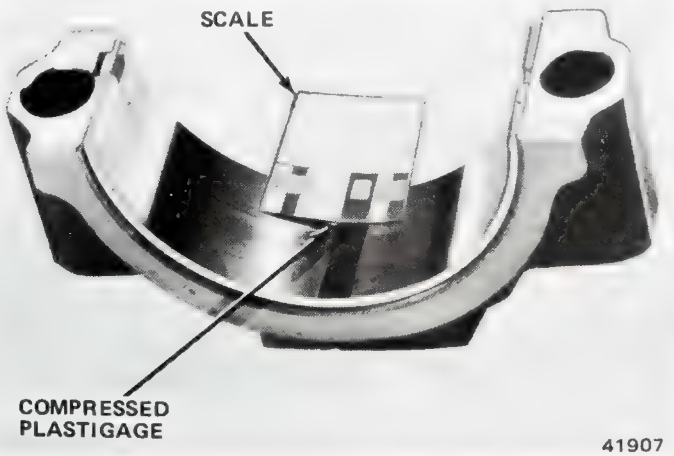


Fig. 1B-159 Connecting Rod Bearing Clearance Measurement with Plastigage

NOTE: *Plastigage should maintain the same width across the entire width of the insert. If size varies, it may indicate a tapered journal, bent connecting rod or dirt trapped between the insert and rod.*

(6) If correct clearance is indicated, bearing fitting is not necessary. Remove Plastigage from crankshaft and bearing and proceed to Installation.

NOTE: *Plastigage remaining on bearing will not cause damage. It will dissolve in hot oil when engine is running.*

(7) If oil clearance exceeds specification, install 0.001-inch undersize bearing inserts and check clearance as described in steps (1) through (5).

The clearance indicated with 0.001-inch undersize inserts installed will determine if 0.001-inch undersize inserts or some other combination are needed to provide correct clearance. For example, if the initial clearance was 0.003 inch, 0.001 inch undersize inserts would reduce clearance by 0.001 inch. Oil clearance would be 0.002 inch and within specification. An 0.002-inch undersize insert and a 0.001-inch undersize insert would reduce this clearance an additional 0.0005 inch. Oil clearance would then be 0.0015 inch.

CAUTION: *Never use inserts which differ more than one bearing size as a pair. For example, do not use a standard upper and 0.002-inch lower.*

(8) If oil clearance exceeds specification when 0.002-inch undersize inserts are installed, measure connecting rod journal with micrometer. If journal size is correct, inside diameter of connecting rod is incorrect and rod must be replaced.

NOTE: *Journal may have been ground 0.010-inch undersize.*

If journal size is incorrect, replace crankshaft or grind journal to accept a suitable undersized bearing.

Measuring Connecting Rod Journal with Micrometer

(1) Wipe connecting rod journals clean.

(2) Use micrometer to measure journal diameter at two points 90° apart at each end of journal. Note difference between maximum and minimum diameters.

(3) Refer to Specifications for maximum allowable taper and out-of-round. If any rod journal is outside specifications, replace crankshaft or recondition crankshaft and fit with undersize bearing inserts.

(4) Compare maximum reading obtained with journal diameters listed in bearing fitting chart.

(5) Select inserts required to obtain specified bearing clearance.

NOTE: *Always check clearance with Plastigage after installing replacement bearings. Check clearance of each journal when installing crankshaft kit (crankshaft supplied with bearings).*

Installation

(1) Rotate crankshaft to position connecting rod journal at bottom of stroke.

(2) Lubricate bearing surface of each insert with clean engine oil.

(3) Install bearing inserts, cap and retaining nuts. Tighten to 33 foot-pounds (45 Nm) torque.

CAUTION: *Be careful when rotating the crankshaft with bearing caps removed. Be sure the connecting rod screws do not accidentally come in contact with the rod journals and scratch the finish, which can cause bearing failure. Short pieces of rubber hose slipped over rod screws will provide protection during installations.*

(4) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(5) Fill crankcase to specified level with clean oil.

PISTONS

Aluminum alloy Autothermic pistons, steel reinforced for strength and controlled expansion, are used.

The pistons are cam-ground and are not perfectly round. The ring belt area contains three piston rings, two compression rings, and one oil control ring above the piston pin.

The piston pin boss is offset from the piston centerline to place it nearer the thrust side of the piston, minimizing piston slap.

To ensure correct installation of the pistons in the bore, two notches are cast in the top perimeter of the piston. The notches must face forward (fig. 1B-160).

Piston Fitting

Micrometer Method

(1) Using an inside micrometer, measure cylinder bore inside diameter at a point 2 5/16 inch below top of bore crosswise to block.

(2) Measure outside diameter of piston.

NOTE: *Pistons are cam ground and must be measured at right angle to piston pin at centerline of pin (fig. 1B-161).*

(3) Difference between cylinder bore diameter and piston diameter dimension is the piston-to-bore clearance.

Feeler Gauge Method

(1) Remove rings from piston.

(2) Insert long 0.001-inch feeler gauge into bore.

(3) Insert piston (top first) into bore alongside feeler gauge. With entire piston inserted in bore, piston should not bind against feeler gauge.

(4) Repeat steps (2) and (3) with long 0.002-inch feeler gauge. Piston should bind.

If piston binds on the 0.001-inch gauge, piston is too large or bore is too small. If piston does not bind on the 0.002-inch gauge, piston is too small for bore. Enlarge piston by knurling or shot-peening. Replace pistons that are 0.004-inch or more undersize.

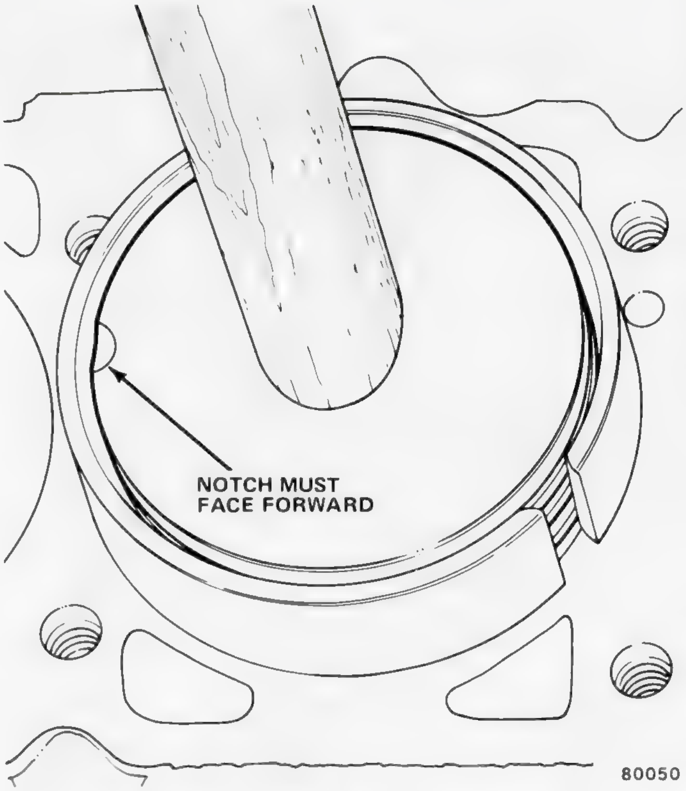


Fig. 1B-160 Installing Piston Assembly into Bore

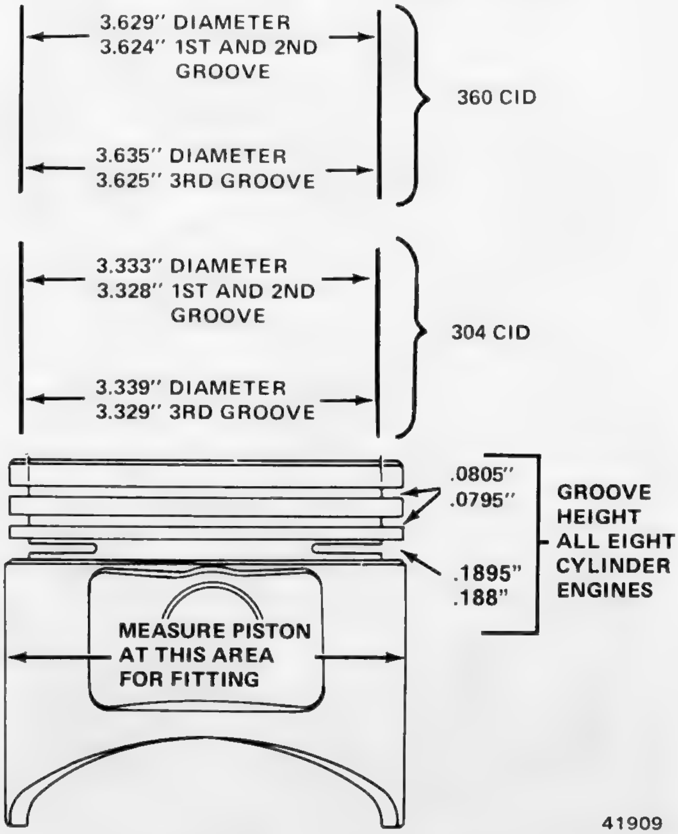


Fig. 1B-161 Piston Measurements

Piston Rings

The top compression ring is made of moly-filled iron. The second compression ring is made of cast-iron. The oil control is a three-piece steel design.

Ring Fitting

(1) Clean carbon from all ring grooves. Oil drain openings in oil ring grooves and pin boss must be open.

CAUTION: *Do not remove metal from grooves or lands. This will change ring groove clearances and will damage ring-to-land seating.*

(2) Check ring side clearance with feeler gauge fitted snugly between ring land and ring. Roll ring around groove in which it is to operate. It must fit freely at all points (fig. 1B-162). Refer to Specifications for correct ring side clearance.

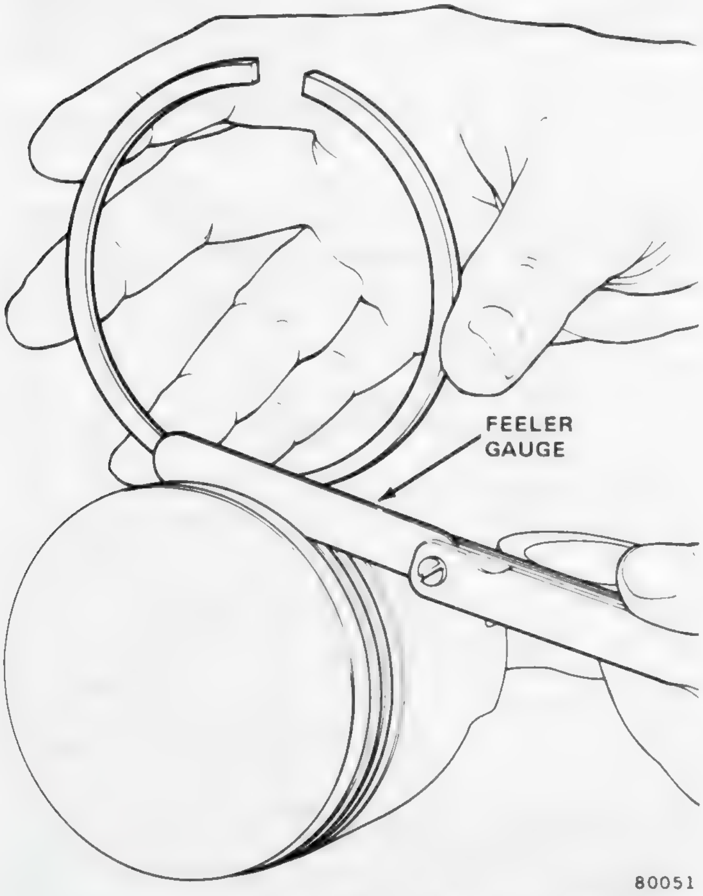


Fig. 1B-162 Ring Side Clearance Measurement

(3) Place ring in bore. With an inverted piston, push ring down near lower end of ring travel area. Measure ring gap or joint clearances with feeler gauge fitted snugly in ring opening (fig. 1B-163).

NOTE: *Fit every ring except oil control ring in its respective bore and check end gap.*

Installation

Refer to figure 1B-164 for position of ring gaps when installing rings.

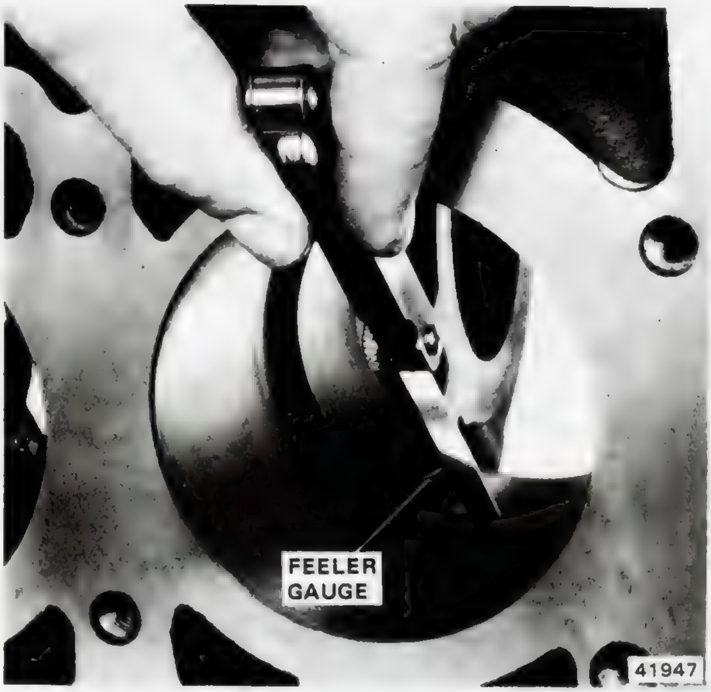


Fig. 1B-163 Ring Gap Measurement

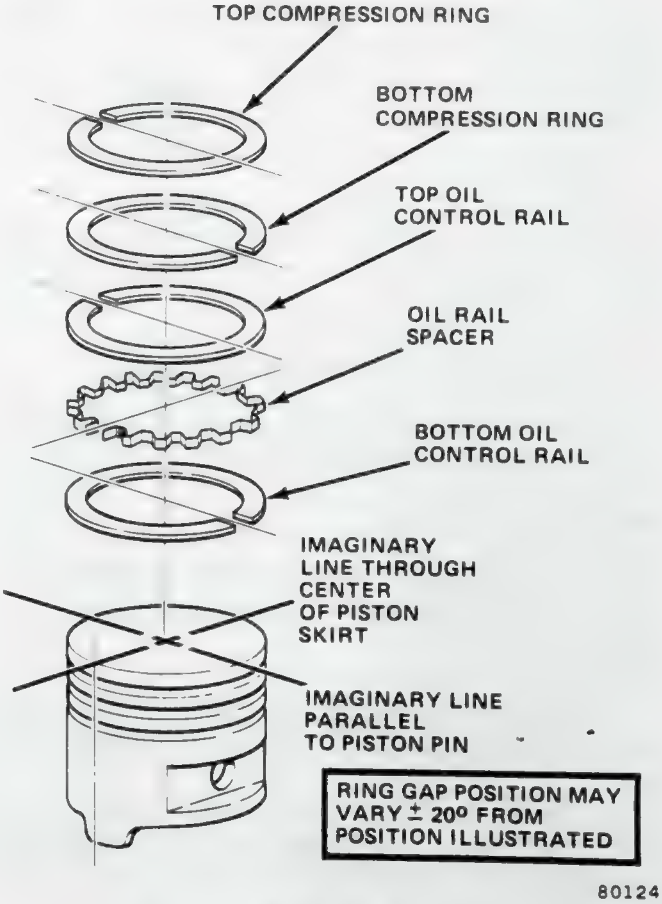


Fig. 1B-164 Piston Ring Gap Position

(1) Install oil control rings as indicated by instructions in package. It is not necessary to use a tool to install upper and lower rails. They are rolled into place (fig. 1B-165).

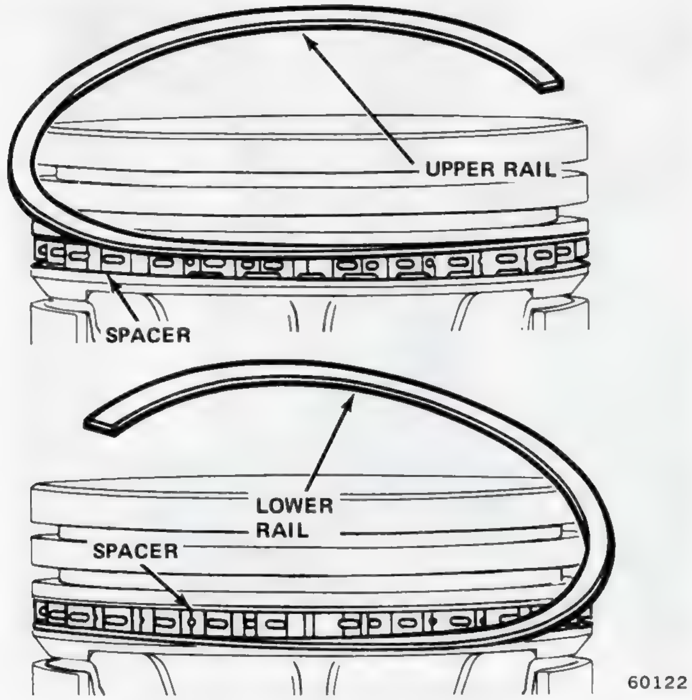


Fig. 1B-165 Installing Upper and Lower Rails

(2) Install lower compression ring. Use ring installer to expand ring around piston.

NOTE: *Be sure upper and lower compression rings are installed right side up. Figure 1B-166 shows typical ring markings to indicate the top side of the ring.*

Fig. 1B-166 Typical Piston Ring Markings

(3) Install upper compression ring using ring installer to expand ring around piston (fig. 1B-167).

Piston Pins

The piston pins are press-fit into the rods at 2000 pounds pressure and require no locking device.

Removal

(1) Using Piston Pin Remover J-21872 and an arbor press, place piston on Remover Support J-21872 (fig. 1B-168).

(2) Use Piloted Driver J-21872-3 to press pin completely out of piston. Note position of pin through gauge window of remover support.

Inspection

(1) Inspect pin and pin bore for nicks and burrs. Replace as necessary.

NOTE: *Never reuse piston pin after it has been installed in and removed from a connecting rod.*

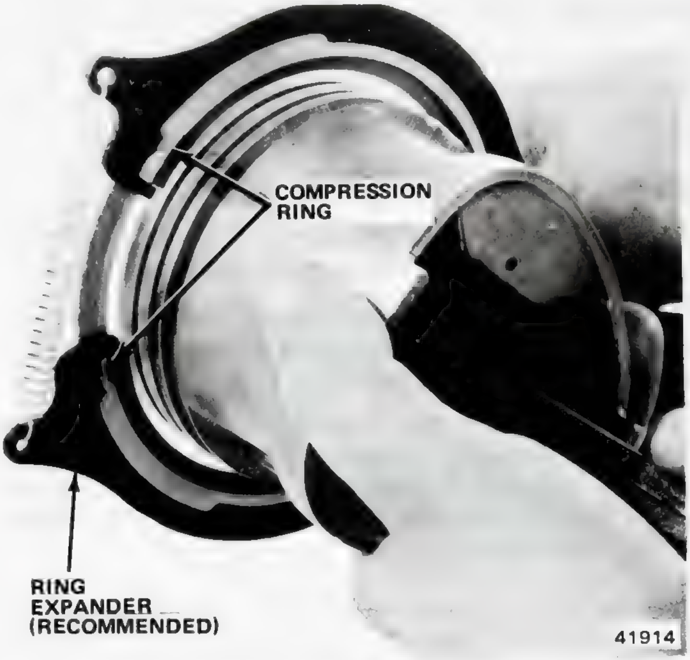


Fig. 1B-167 Compression Ring Installation

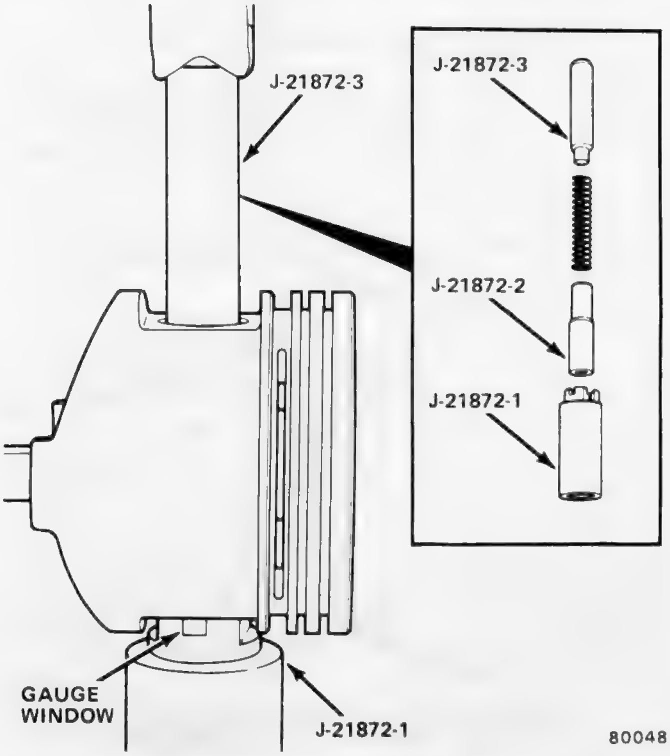


Fig. 1B-168 Piston Pin Removal and Installation

(2) With pin removed from piston, clean and dry piston pin bore and piston pin.

(3) Position piston so that pin bore is in vertical position. Insert pin in bore. At room temperature, pin should slide completely through pin bore without pushing.

(4) Replace piston and pin if pin jams in bore.

Installation

(1) Position piston and connecting rod so that piston notch will face forward and rod squirt hole will face inward when assembly is installed in engine.

(2) Place Pin Pilot J-21872-2 through piston and connecting rod pin bores (fig. 1B-168).

(3) Place pin pilot, piston, and connecting rod on Support J-21872-1.

(4) Place piston pin through upper piston pin bore and into connecting rod pin bore.

(5) Place Piloted Driver J-21872-3 inside piston pin.

(6) Using arbor press, press piston pin through connecting rod and piston until pin pilot indexes with mark on support.

NOTE: *The piston pin requires 2000 pounds pressure for installation. If little effort is required to install piston pin in connecting rod, or if rod moves along pin, replace connecting rod.*

(7) Remove piston and connecting rod assembly from press. Pin should be centered in rod ±1/32 inch.

CRANKSHAFT

The crankshaft is counterweighted and balanced independently. The component parts of the crankshaft assembly are individually balanced, then the complete assembly is balanced as a unit. Service replacement dampers, crankshafts, flywheels, and torque converters may be replaced without rebalancing the assembly.

There are five main bearings and four connecting rod journals. The end thrust is controlled by No. 3 main bearing.

The rear main bearing oil seal is protected from excessive oil by a slinger which is a machined part of the crankshaft.

NOTE: *The torque converter and converter flexplate. Marked before removal. Install in the same position upon assembly.*

Removal or Replacement

If the crankshaft is damaged beyond reconditioning, it must be replaced. Use the procedures outlined under Cylinder Block to remove or replace the crankshaft.

Crankshaft End Play Measurement

Crankshaft end play is controlled at the No. 3 main bearing which is flanged for this purpose.

(1) Attach dial indicator to crankcase adjacent to No. 3 main bearing.

(2) Set dial indicator push rod on face of adjacent counterweight (fig. 1B-169).

(3) Pry crankshaft fore and aft.

(4) Read dial indicator. End play is the difference between high and low readings.

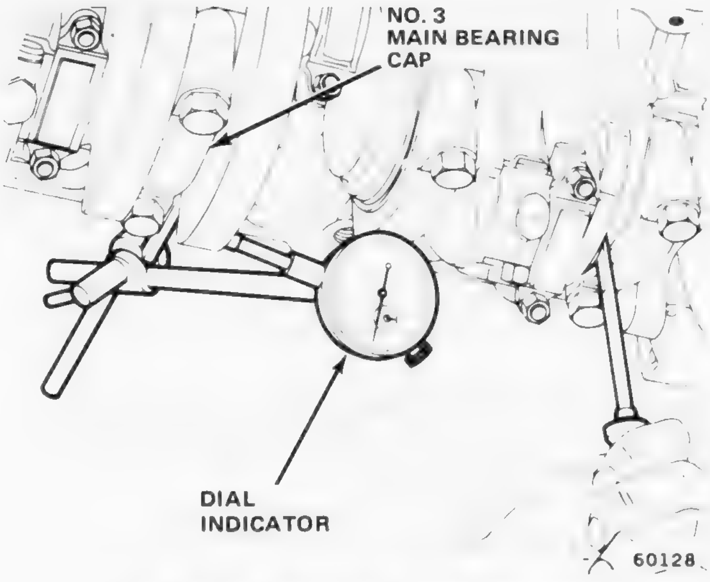


Fig. 1B-169 Crankshaft End Play Measurement

(5) If end play is outside of specifications, inspect crankshaft thrust faces for wear. If no wear is apparent, replace thrust bearing and check end play. If end play is still outside of specifications, replace crankshaft.

NOTE: *When replacing the thrust bearings, pry the crankshaft fore and aft to align the thrust faces of the bearings before final torque tightening.*

Crankshaft Main Bearings

The main bearings are steel-backed aluminum-tin with overplated copper-lead as an optional lining. The main bearing caps are numbered 1 through 5, front to rear, with an arrow to indicate forward position. The upper main bearing inserts are grooved, and the lower insert surfaces are smooth.

Each bearing is select fitted to its respective journal to obtain the desired operating clearance. **In production,** the select fit is obtained by using various-sized color-coded bearing inserts as shown in the Main Bearing Fitting Chart. The bearing color code appears on the edge of the insert.

NOTE: *Bearing size is not stamped on production inserts.*

The main bearing journal size is identified **in production** by a color-coded paint mark on the adjacent cheek toward the flanged (rear) end of the crankshaft except for the rear main journal. The paint mark for the rear main journal is on the crankshaft rear flange.

Use the Bearing Fitting Chart to select proper bearing inserts to obtain the specified bearing clearance. The correct clearance is 0.0015 to 0.0020 inch on No. 1 through No. 4 main bearings and 0.0023 to 0.0027 inch for the rear main bearing.

When required, different sized upper and lower bearing inserts may be used as a pair. A standard size upper

Main Bearing Fitting Chart

Crankshaft Main Bearing Journal Color Code and Diameter in Inches (Journal Size)	Bearing Color Code	
	Upper Insert Size	Lower Insert Size
Yellow —2.7489 to 2.7484 (Standard)	Yellow — Standard	Yellow — Standard
Orange —2.7484 to 2.7479 (0.0005 Undersize)	Yellow — Standard	Black — .001-inch Undersize
Black —2.7479 to 2.7474 (0.001 Undersize)	Black — .001-inch Undersize	Black — .001-inch Undersize
Green —2.7474 to 2.7469 (0.0015 Undersize)	Black — .001-inch Undersize	Green — .002-inch Undersize
Red —2.7389 to 2.7384 (0.010 Undersize)	Red — .010-inch Undersize	Red — .010-inch Undersize

60273

insert may be used in combination with a 0.001-inch undersize lower insert to reduce clearance by 0.0005 inch (1/2 thousandth of an inch).

Example:

Correct	Incorrect
Upper—Standard Lower—0.001-inch undersize	Standard 0.002-inch undersize

70242

NOTE: *When servicing upper and lower inserts of different sizes, install undersize inserts together either all on the top (upper) or all on the bottom (lower). Never use bearing inserts with greater than 0.001-inch difference in pairs.*

Service replacement bearing inserts are available as pairs in the following sizes: standard, 0.001-inch undersize, 0.002-inch undersize, 0.010-inch undersize, and 0.012-inch undersize. The bearing size is stamped on the back of service replacement inserts.

NOTE: *The 0.012-inch undersize insert is not used in production.*

Removal

This procedure may be used with engine in car.

(1) Drain engine oil and remove pan.

(2) Remove main bearing cap and insert.

(3) Remove lower insert from bearing cap.

(4) Remove upper insert by loosening all other bearing caps and inserting cotter pin about 1/2-inch long in crankshaft oil hole. Bend cotter pin as shown in figure 1B-170.

(5) With pin in place, rotate shaft so that upper bearing insert is rotated in direction of its locking tab.

(6) Remove and inspect remaining bearings in same manner.

Inspection

(1) Wipe lower insert clean and inspect for abnormal wear pattern and for dirt or metal imbedded in lining. A normal main bearing wear pattern is shown in figure 1B-171.

NOTE: *If the crankshaft journal is scored, remove the engine for crankshaft repair.*

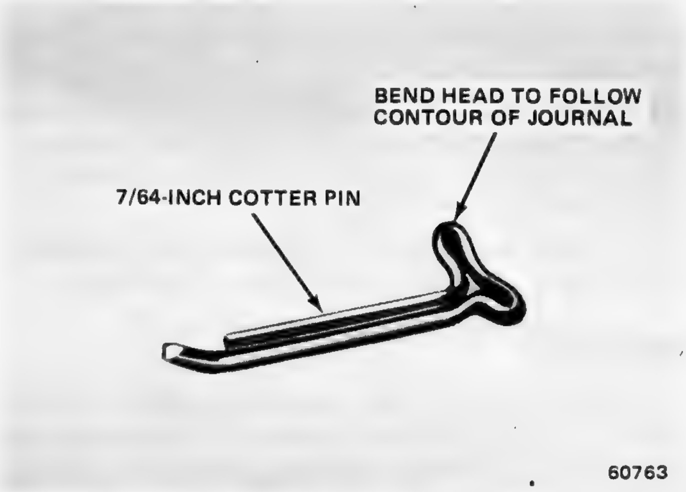


Fig. 1B-170 Upper Main Bearing Removal Tool

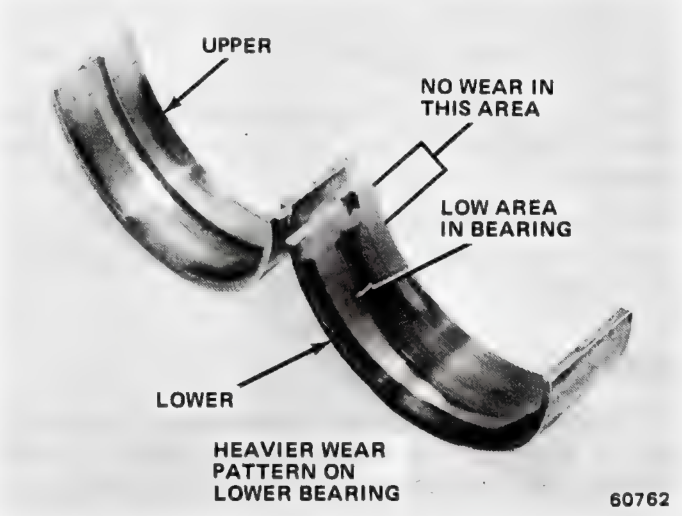


Fig. 1B-171 Normal Main Bearing Wear Pattern

(2) Inspect back of insert for fractures, scrapings or irregular wear pattern.

(3) Inspect locking tab for damage.

(4) Replace bearing inserts that are damaged or worn.

Measuring Main Bearing Clearance with Plastigage (Crankshaft Installed)

(1) Support weight of crankshaft with jack placed under counterweight adjacent to main bearing being checked.

NOTE: *Check clearance of one bearing at a time. ALL other bearings must remain tightened.*

(2) Remove main bearing cap and insert.

(3) Wipe insert and exposed portion of crankshaft journal clean.

(4) Place strip of Plastigage across full width of bearing insert.

NOTE: *Plastigage must not crumble. If brittle, obtain fresh stock.*

(5) Install bearing cap and tighten retaining bolts to 100 foot-pounds torque.

NOTE: *Do not rotate crankshaft. Plastigage will shift, resulting in inaccurate reading.*

(6) Remove bearing cap and determine amount of clearance by measuring width of compressed Plastigage with scale on Plastigage envelope. Correct clearance is 0.0017 to 0.0020 inch on No. 1 through No. 4 main bearings and 0.0025 to 0.003 inch for the rear main bearing (fig. 1B-172).

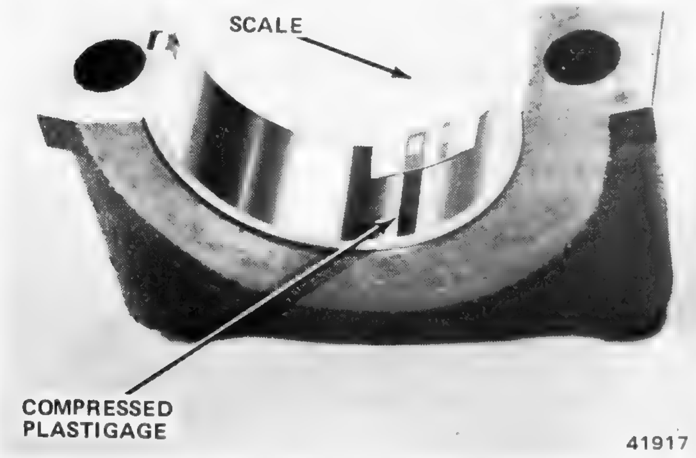


Fig. 1B-172 Checking Main Bearing Clearance with Plastigage

NOTE: *The Plastigage should maintain the same size across the entire width of the insert. If size varies, this may indicate a tapered journal or dirt trapped behind the insert.*

(7) If correct clearance is indicated, bearing fitting is not necessary. Remove Plastigage from crankshaft and bearing. Proceed to Installation.

NOTE: *Small pieces of Plastigage may remain on bearing surface. They will dissolve in engine oil after assembly.*

(8) If oil clearance exceeds specification, install a pair of 0.001-inch undersize bearing inserts and check clearance as described in steps 3 through 6.

(9) The clearance indicated with the 0.001-inch undersize bearing installed will determine if the 0.001-inch undersize inserts or some other combination will provide correct clearance. For example, if the clearance was 0.0035 inch originally, a pair of 0.001-inch undersize inserts would reduce clearance by 0.001 inch. Oil clearance would be 0.0025 inch and within specification. A 0.002-inch undersize insert half and a 0.001-inch undersize half would reduce this clearance an additional 0.0005 inch and oil clearance would be 0.002 inch.

CAUTION: *Never use a pair of inserts which differ more than one bearing size as a pair. For example, do not use a standard upper and 0.002 inch undersize lower.*

(10) If oil clearance exceeds specification using 0.002-inch undersize bearings, measure crankshaft journal with micrometer. If the journal size is correct, the crankshaft bore of the cylinder block may be misaligned which requires cylinder block replacement. If journal size is incorrect, the crankshaft must be replaced or ground to a standard undersize.

Measuring Main Bearing Journal with Micrometer (Crankshaft Removed)

(1) Wipe main bearing journal clean.

(2) Measure journal diameter with micrometer. Note difference between maximum and minimum diameters.

(3) Refer to Specifications for maximum allowable taper and out-of-round.

(4) Compare maximum reading obtained with journal diameters listed in Main Bearing Fitting Chart.

(5) Select inserts required to obtain specified bearing clearance. Correct clearance is 0.0015 to 0.0020 inch on No. 1 through No. 4 main bearings and 0.0023 to 0.0027 inch for the rear main bearing.

Installation

(1) Lubricate bearing surface of each insert with clean engine oil.

(2) Loosen all main bearing caps.

(3) Install main bearing upper insert(s).

(4) Install main bearing cap(s) and lower insert(s). Tighten retaining screws evenly to 100 foot-pounds (136 Nm) torque in steps of 30, 60, 90 and 100 foot-pounds (41, 82, 122, and 135 Nm) torque. Turn crankshaft at each step to determine if crank rotates freely. If crank does not rotate freely, check inserts for proper installation and size.

(5) After installation, turn crankshaft to check for free operation.

(6) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.

(7) Fill crankcase to specified level with clean oil.

Rear Main Bearing Oil Seal

The rear main bearing oil seal consists of a two-piece neoprene single lip seal. Correct installation of the seal is required for leak-free engine operation.

Removal

(1) Drain engine oil.
(2) Remove starter motor.
(3) Remove oil pan.
(4) Remove oil pan front and rear neoprene oil seals.
(5) Remove oil pan side gaskets.
(6) Thoroughly clean gasket surfaces of oil pan and engine block. Remove all sludge and dirt from oil pan sump.
(7) Remove rear main bearing cap.
(8) Remove and discard lower seal.

NOTE: *To ensure leak-free operation, replace the upper and lower seal halves in pairs.*

(9) Clean main bearing cap thoroughly to remove all sealer.
(10) Loosen all remaining main bearing capscrews.
(11) Use brass drift and hammer to tap upper seal until sufficient seal is protruding to permit pulling seal out completely.

Installation

(1) Wipe crankshaft seal surface clean. Oil lightly.
(2) Coat block contacting surface of replacement upper seal with soap and lip of seal with engine oil (fig. 1B-173).

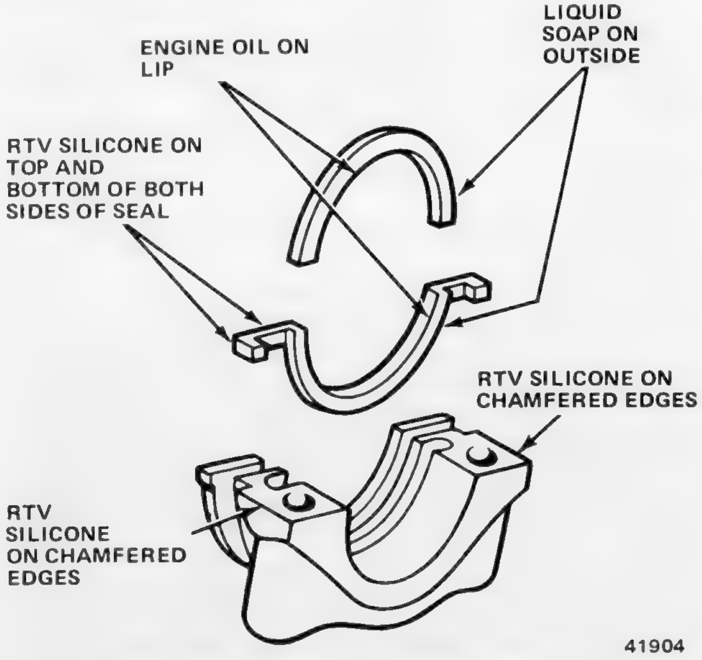


Fig. 1B-173 Rear Main Oil Seal Installation

(3) Install upper seal into engine block.

NOTE: *The lip of the seal must face to the front of the engine.*

(4) Coat both sides of replacement lower seal end tabs with AMC Gasket-in-a-Tube, or equivalent. Be careful to not apply sealer to lip of seal.
(5) Coat outer curved surface of lower seal with soap and lip of seal with engine oil.
(6) Install seal into cap recess and seat firmly.
(7) Apply AMC Gasket-in-a-Tube, or equivalent, on both chamfered edges of rear main bearing cap.

CAUTION: *Do not apply sealer to the cylinder block mating surface of the rear main cap as bearing clearance could be affected.*

(8) Tighten all main bearing capscrews to 100 foot-pounds torque.
(9) Install oil pan using replacement gaskets and seals. Tighten drain plug securely.
(10) Install starter motor.
(11) Fill crankcase to specified level with clean oil.

Vibration Damper

The vibration damper is balanced independently and then rebalanced as part of the complete crankshaft assembly.

Do not attempt to duplicate original damper balance holes when installing a service replacement. The vibration damper is not repairable and is serviced only as a complete assembly.

Removal

(1) Loosen damper retaining screw.
(2) Loosen alternator drive belt.
(3) Loosen air conditioning drive belt, if equipped, and move aside.
(4) Loosen power steering drive belt, if equipped, and move aside.
(5) Remove damper drive pulley retaining screws. Remove damper pulley from vibration damper.
(6) Remove damper retaining screw and washer.
(7) Use Vibration Damper Removal Tool J-21791 to remove damper from crankshaft (fig. 1B-174).

Installation

(1) Polish damper hub with crocus cloth to prevent seal damage.
(2) Apply light film of engine oil to seal contacting surface of vibration damper.
(3) Align key slot of vibration damper with crankshaft.
(4) Position damper onto crankshaft.
(5) Lubricate screw threads and washer with engine oil.
(6) Install damper retaining screw and washer and tighten to 90 foot-pounds (122 Nm) torque.

NOTE: *If crankshaft turns before torque is reached, proceed with belt installation. With belts installed, tighten damper retaining screw to 90 foot-pounds (122 Nm) torque.*

(7) Install damper pulley and retaining screws. Tighten screws to 30 foot-pounds (41 Nm) torque.

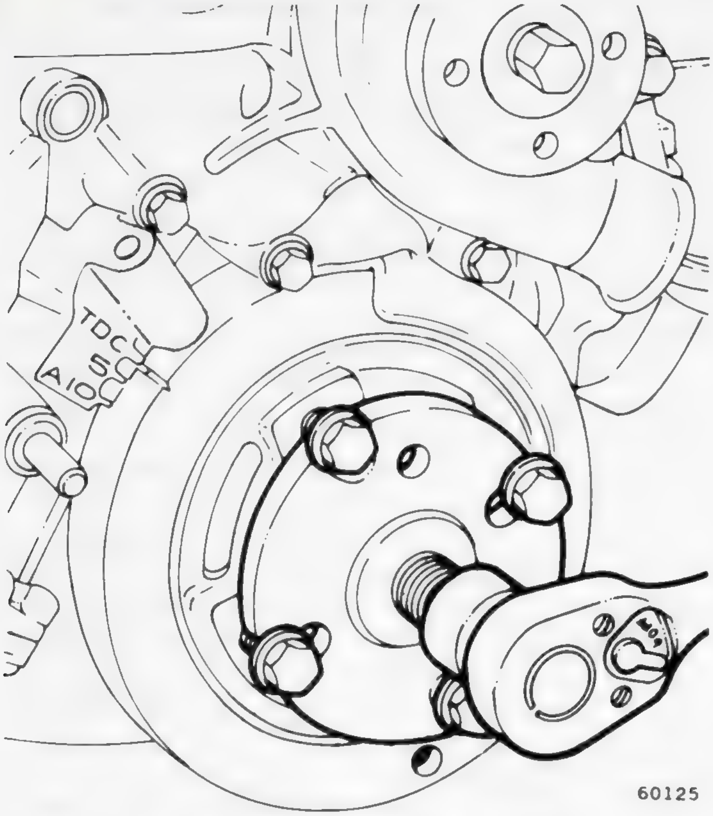


Fig. 1B-174 Vibration Damper Removal

(8) Install drive belts and tighten to specified tension. Refer to Chapter 1C—Cooling.

Flywheel and Starter Ring Gear Assembly

The starter ring gear is welded to and balanced as part of the torque converter drive plate and is not removeable separately.

CYLINDER BLOCK

Disassembly

(1) Drain engine oil.

(2) Remove engine assembly as outlined in Engine Removal.

(3) Use engine stand to support engine assembly.

(4) Remove distributor.

(5) Remove cylinder head covers and gaskets.

(6) Remove rocker arms and bridged pivot assemblies. Alternately loosen capscrews one turn at a time to avoid damaging bridge.

(7) Remove push rods.

(8) Remove intake manifold assembly.

(9) Remove valve tappets.

(10) Remove cylinder heads and gaskets.

(11) Position pistons, one at a time, near bottom of their stroke. Use ridge reamer to remove any ridge from top end of cylinder walls.

(12) Loosen all drive belts. Remove power steering pump, air pump and air conditioning compressor, if equipped.

(13) Remove damper pulley and vibration damper.

(14) Remove timing case cover.

(15) Remove oil pan.

(16) Remove camshaft.

(17) Remove connecting rod bearing caps and inserts and keep in same order as removed.

NOTE: *Connecting rods and caps are stamped with the number of the cylinder to which they were assembled.*

(18) Remove connecting rod and piston assemblies through top of cylinder bores. Be careful that connecting rod screws do not scratch connecting rod journals or cylinder walls. Short pieces of rubber hose slipped over rod screws will provide protection during removal.

(19) Remove oil pickup tube and screen assembly.

(20) Remove main bearing caps and inserts.

(21) Remove crankshaft.

Cylinder Bore Reconditioning

Measuring Cylinder Bore

Use a bore gauge to measure the cylinder bore (fig. 1B-175). If a bore gauge is not available, use an inside micrometer.

(1) Measure cylinder bore crosswise to block near top of bore. Repeat measurement at bottom of bore.

(2) Determine taper by subtracting smaller dimension from larger dimension.

(3) Turn measuring device 120° and repeat step (1). Then turn another 120° and repeat again.

(4) Determine out-of-roundness by comparing difference between readings taken 120° apart.

If cylinder taper does not exceed 0.005 inch and out-of-round does not exceed 0.003 inch, the cylinder bore may be trued by honing. If the cylinder taper or out-of-round condition exceeds these limits, the cylinder must be bored and then honed for an oversize piston.

Resurfacing Cylinder Bore

CAUTION: *Do not use rigid type hones to remove cylinder glaze. A slight amount of taper always exists in cylinder walls after the engine has been in service.*

(1) Use expanding hone to true cylinder bore and to remove glaze for faster ring seating. Move hone up and down at sufficient speed to produce uniform 60° angle crosshatch pattern on cylinder walls. Do not use more than ten strokes per cylinder. A stroke is one down-and-up motion.

CAUTION: *Protect engine bearings and lubrication system from abrasives.*

(2) Scrub cylinder bores clean with hot water and detergent solution.

(3) Immediately apply light engine oil to cylinder walls. Wipe with clean, lint-free cloth.

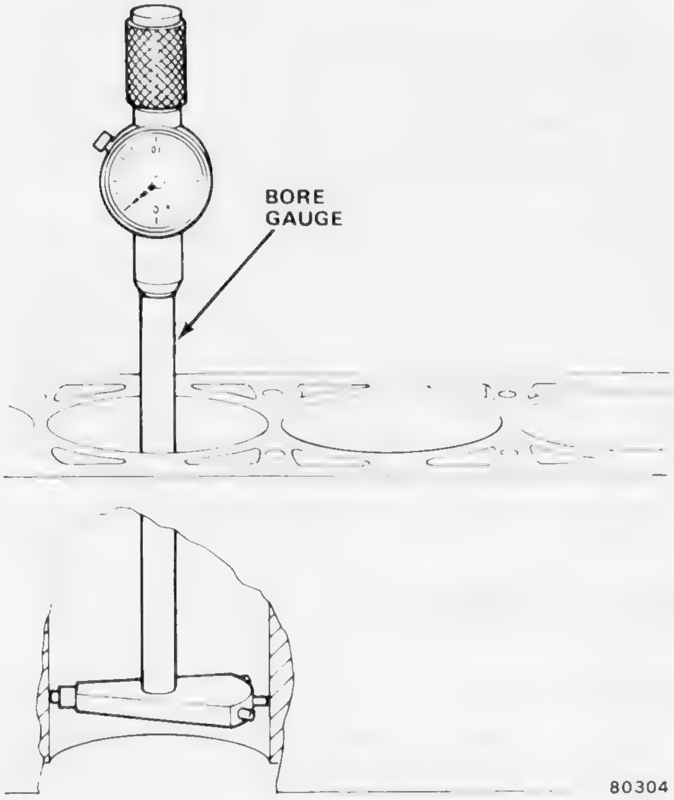


Fig. 1B-175 Measuring Cylinder Bore with Bore Gauge

NOTE: *If crankshaft remains in block, cover connecting rod journals with clean cloths during cleaning operation.*

Assembly

(1) Install and lubricate upper main bearing inserts and rear main upper seal. Lubricate seal lip.

(2) Install crankshaft.

(3) Install main bearing caps and inserts. If replacement bearings are installed, Plastigage each bearing.

(4) Install replacement oil pickup tube and screen assembly. Do not attempt to install original pickup tube. Be sure plastic button is inserted in bottom of replacement screen.

(5) Install camshaft.

(6) Position piston rings on pistons. Refer to figure 1B-164 for proper ring gap spacing.

(7) Lubricate piston and ring surfaces with clean engine oil.

(8) Use piston ring compressor tool to install connecting rod and piston assemblies through top of cylinder bores.

NOTE: *Be careful that connecting rod screws do not scratch connecting rod journals or cylinder walls. Short lengths of rubber hose slipped over connecting rod screws will provide protection during installation.*

(9) Install connecting rod bearing caps and inserts in same order as removed. Tighten nuts to 33 foot-pounds (45 Nm) torque.

(10) Install camshaft and timing chain.

(11) Install timing case cover and gaskets. Refer to Timing Case Cover.

(12) Install engine oil pan using replacement gaskets and seals. Tighten drain plug securely.

(13) Install vibration damper and damper pulley.

(14) Install cylinder head and replacement gaskets.

(15) Install valve tappets.

(16) Install intake manifold and replacement gaskets.

(17) Install push rods.

(18) Install rocker arms and bridged pivot assemblies. Loosely install capscrews to each bridged pivot. At each bridge, alternately tightening capscrews one turn at a time to avoid damaging. Tighten capscrews to 19 foot-pounds (26 Nm) torque.

(19) Turn crankshaft to bring No. 1 cylinder to TDC on compression stroke.

(20) Reseal and install cylinder head covers.

(21) Install power steering pump, air pump and air conditioning compressor.

(22) Install distributor.

(a) Point rotor to No. 1 spark plug wire position.

(b) Turn oil pump shaft with long screw driver to allow distributor shaft to engage oil pump.

(c) With rotor pointing to No. 1 spark plug wire position, rotate housing counterclockwise until leading edge of trigger wheel segment is aligned with center of sensor. Tighten distributor clamp.

(d) When engine is installed and running, check ignition timing as outlined in Chapter 1A.

(23) Remove engine from stand.

(24) Install engine assembly as outlined in Engine Installation.

SPECIFICATIONS

Eight-Cylinder Engine Specifications

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Bore		
304	3.75	95.25
360	4.08	103.63
Stroke		
304	3.44	87.38
360	3.44	87.38
Displacement		
304	304 cu.in.	772 cu.cm.
360	360 cu.in.	914 cu.cm.
Compression Ratio		
304	8.40:1	
360	8.25:1	
Compression Pressure		
304	140 psi (min)	965 kPa (min)
360	140 psi (min)	965 kPa (min)
Maximum Variation Between Cylinders	20 psi	138 kPa (min)
Taxable Horsepower		
304	45.00	33.56 kW
360	53.27	39.72 kW
Fuel	unleaded	
Camshaft		
Fuel Pump Eccentric Diameter	2.182-2.192	55.423-55.677
Tappet Clearance	Zero lash (hydraulic tappets)	
End Play	Zero (engine operating)	
Bearing Clearance	0.001-0.003 (0.0017-0.0020 preferred)	0.0254-0.0762 (0.0432-0.0508 preferred)
Bearing Journal Diameter		
No. 1	2.1195-2.1205	53.835-53.861
No. 2	2.0895-2.0905	53.073-53.099
No. 3	2.0595-2.0605	52.311-52.337
No. 4	2.0295-2.0305	51.549-51.575
No. 5	1.9995-2.0005	50.787-50.813
Maximum Base Circle Runout	0.001	0.0254
Cam Lobe Lift		
304/360	0.266	6.7564
Intake Valve Timing		
Opens 304/360	14.75° BTDC	
Closes 304/360	68.75° BTDC	
Exhaust Valve Timing		
Opens 304/360	56.75° BBDC	
Closes 304/360	26.75° ATDC	
Valve Overlap		
304/360	41.50°	
Intake Duration		
304/360	263.50°	
Exhaust Duration		
304/360	263.50°	
Connecting Rods		
Total Weight (Less Bearings)		
304/360	681-689 grams	
Total Length (Center-to-Center)		
304/360	5.873-5.877	149.17-149.28
Bearing Clearance	0.001-0.003 (0.0020-0.0025 preferred)	0.03-0.08 (0.051-0.064 preferred)
Side Clearance	0.006-0.018	0.15-0.46
Maximum Twist	0.0005 per inch	0.013 per 25.4 mm
Maximum Bend	0.001 per inch	0.03 per 25.4 mm

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Crankshaft		
End Play	0.003-0.008	0.08-0.20
Main Bearing Journal Diameter		
No. 1, 2, 3, 4	2.7474-2.7489	69.784-69.822
Rear Main	2.7464-2.7479	69.759-69.797
Main Bearing Journal Width		
304/360		
No. 1	1.2635-1.2695	32.093-32.25
No. 2	1.246-1.248	31.65-31.70
No. 3	1.273-1.275	32.33-32.39
No. 4	1.246-1.248	31.65-31.70
No. 5	1.215-1.217	30.86-30.91
Main Bearing Clearance		
No. 1, 2, 3, 4	0.001-0.003 (0.0017-0.0020 preferred)	0.03-0.08 (0.04-0.05 preferred)
Rear Main		
No. 5	0.002-0.004 (0.0025-0.003 preferred)	0.05-0.10 (0.06-0.08 preferred)
Connecting Rod Journal Diameter		
304/360	2.0934-2.0955	53.172-53.266
Connecting Rod Journal Width		
304/360	1.998-2.004	50.75-50.90
Connecting Rod Bearing		
Clearance	0.001-0.003 (0.0020-0.0025 preferred)	0.03-0.08 (0.051-0.064 preferred)
Maximum Taper (All Journals)	0.0005	0.013
Maximum Out-of-Round (All Journals)	0.0005	0.013
Cylinder Block		
Deck Height	9.205-9.211	233.81-233.96
Deck Clearance		
304/360	0.0145 (below block)	0.368 (below block)
Maximum Cylinder Taper	0.005	0.13
Maximum Cylinder Out-of-Round	0.003	0.08
Tappet Bore Diameter	0.9055-0.9065	22.999-23.025
Cylinder Block Flatness	0.001/1- 0.002/6 0.008 (max)	0.03/25- 0.05/152 0.20 (max)
Cylinder Head		
Combustion Chamber Volume		
304	57.42-60.42 cc	
360	58.62-61.62 cc	
Valve Arrangement	EI-IE-EI-IE	
Valve Guide ID (Integral)	0.3735-0.3745	9.487-9.512
Valve Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Seat Angle	30°	
Exhaust Valve Seat Angle	44.5°	
Valve Seat Width	0.040-0.060	1.02-1.52
Valve Seat Runout	0.0025 (max)	0.064 (max)
Cylinder Head Flatness	0.001/1- 0.002/6 0.008 (max)	0.03/25- 0.05/152 0.20 (max)
Lubrication System		
Engine Oil Capacity	4 quarts (add 1 quart with filter change)	3.8 liters (add 0.9 liters with filter change)

60271A

Eight-Cylinder Engine Specifications (Continued)

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Normal Operating Pressure	13 psi at 600 rpm 37-75 psi at 1600+ rpm	90 kPa at 600 rpm 255-517 kPa at 1600+ rpm
Oil Pressure Relief	75 psi (max)	517 kPa (max)
Gear-to-Body Clearance	0.0005-0.0025 (0.0005 preferred)	0.013-0.064 (0.013 preferred)
Gear End Clearance	0.0005-0.006 (0.002 preferred)	0.051-0.152 (0.051 preferred)
Pistons		
Weight (Less Pin)		
304	506-510 grams	
360	601-605 grams	
Piston Pin Bore CL-to Piston Top		
304/360	1.599-1.603	40.62-40.72
Piston-to-Bore Clearance		
304	0.0010-0.0018 (0.0014 preferred)	0.025-0.46 (0.035 preferred)
360	0.0012-0.0020 (0.0016 preferred)	0.030-0.051 (0.041 preferred)
Piston Ring Gap Clearance		
No. 1 and No. 2	0.010-0.020 (0.010-0.012 preferred)	0.25-0.51 (0.25-0.305 preferred)
Oil Control Steel Rail		
304	0.010-0.025	0.25-0.64
360	0.015-0.045 (0.010-0.020 preferred)	0.38-1.14 (0.25-0.51 preferred)
Piston Ring Side Clearance		
340		
No. 1	0.0015-0.0035 (0.0015 preferred)	0.038-0.089 (0.038 preferred)
No. 2	0.0015-0.003 (0.0015 preferred)	0.038-0.076 (0.038 preferred)
Oil Control	0.0011 -0.008	0.028 -0.203
360		
No. 1	0.0015-0.003 (0.0015 preferred)	0.038-0.076 (0.038 preferred)
No. 2	0.0015-0.0035 (0.0015 preferred)	0.038-0.089 (0.038 preferred)
Oil Control	0.000-0.007	0.000-0.18

	(USA) Inches Unless Otherwise Specified	(METRIC) Millimeters Unless Otherwise Specified
Piston Ring Groove Height		
No. 1 and No. 2	0.0795-0.0805	2.019-2.045
Oil Control	0.1880-0.1895	4.775-4.813
Piston Ring Groove Diameter		
304		
No. 1 and No. 2	3.328-3.333	84.53-84.66
Oil Control	3.329-3.339	84.56-84.81
360		
No. 1 and No. 2	3.624-3.629	92.05-92.18
Oil Control	3.624-3.635	92.05-92.33
Piston Pin Diameter		
304/360	0.9308-0.9313	23.649-23.655
Piston Pin Bore Diameter		
304/360	0.9288-0.9298	23.592-23.617
Piston-to-Pin Clearance	0.0003-0.0005 (0.005 preferred) loose	0.008-0.013 (0.013 preferred) loose
Rocker Arms, Push Rods, and Tappets		
Rocker Arm Ratio	1.6:1	
Push Rod Length	7.790-7.810	197.87-198.37
Push Rod Diameter	0.312-0.315	7.93-8.00
Hydraulic Tappet Diameter	0.9040-0.9045	22.962-22.974
Tappet-to-Bore Clearance	0.001-0.0025	0.025-0.064
Valves		
Valve Length (Tip-to-Gauge Dim. Line)	4.7895-4.8045	121.653-122.034
Valve Stem Diameter	0.3715-0.3725	9.436-9.462
Stem-to-Guide Clearance	0.001-0.003	0.03-0.08
Intake Valve Head Diameter		
304	1.782-1.792	45.26-45.52
360	2.020-2.030	51.31-51.56
Intake Valve Face Angle	29°	
Exhaust Valve Head Diameter		
304	1.401-1.411	35.59-35.84
360	1.675-1.685	42.55-42.80
Exhaust Valve Face Angle	44°	
Valve Springs		
Free Length	1.99	50.55
Spring Tension		
Valve Closed	64-72 lbs. at 1.786	29.0-32.7 kg. at 45.36
Valve Open	202-220 lbs. at 1.356	91.6-99.8 kg. at 34.44
Inside Diameter (All)	0.948-0.968	24.08-24.59

60271B

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	**Service In-Use Recheck Torque**	**Service Set-To Torque**	**Service In-Use Recheck Torque**
Air Injection Tube-to-Manifold	52	41-61	38	30-45
Air Pump-to-Bracket Pivot Screw	27	20-30	20	15-22
Air Pump Brackets-to-Engine—AC Compressor or Pedestals	34	24-38	25	18-28
Air Pump Adjusting Strap-to-Pump	27	20-30	20	15-22
Alternator Pivot Bolt or Nut	38	27-47	28	20-35
Alternator Adjusting Bolt	24	20-27	18	15-20
Alternator Mounting Bracket Bolt-to-Engine	38	31-41	28	23-30
Alternator Pivot Mounting Bolt-to-Head	45	41-47	33	30-35
Block Heater Nut, T-Screw Type	2	2-3	20 in.lbs.	17-25 in.lbs.
Camshaft Gear Retainer Screw	41	34-47	30	25-35
Carburetor Adapter-to-Manifold Screws—2V	19	16-20	14	12-15
Carburetor Holddown Nuts	19	16-20	14	12-15
Connecting Rod Bolt Nuts	45	41-47	33	30-35
Crankshaft Pulley-to-Damper	31	24-38	23	18-28
Cylinder Head Capscrews	149	136-163	110	100-120
Cylinder Head Cover Screws	6	5-7	50 in.lbs.	42-58 in.lbs.
Distributor Clamp Screw	18	14-24	13	10-18
Drive Plate-to-Converter Screw	30	27-34	22	20-25
EGR Valve-to-Manifold	18	12-24	13	9-18
Exhaust Manifold Bolts	34	27-41	25	20-30
Exhaust Pipe-to-Manifold Nuts	27	20-34	20	15-25
Fan and Hub Assembly Bolts	24	16-34	18	12-25
Flywheel or Drive Plate-to-Crankshaft	142	129-156	105	95-115
Front Crossmember-to-Sill Bolt and Stud	88	75 (min)	65	55 (min)
Front Support Cushion Bracket-to-Block Screw	47	34-54	35	25-40
Front Support Cushion-to-Bracket	45	37-52	33	27-38
Front Support Cushion-to-Crossmember	50	41-61	37	30-45
Fuel Pump Screws	22	18-26	16	13-19
Idler Pulley Bearing Shaft-to-Bracket Nut	45	38-52	33	28-38
Idler Pulley Bracket-to-Front Cover Nut	9	5-12	7	4-9
Intake Manifold Screws	58	50-64	43	37-47
Main Bearing Capscrews	136	122-142	100	90-105
Oil Pump Cover Screws	6	5-7	55 in.lbs.	45-65 in.lbs.
Oil Pan Screws				
1/4 inch - 20	9	7-12	7	5-9
5/16 inch - 18	15	12-18	11	9-13
Oil Relief Valve Cap	38	30-47	28	22-35
Power Steering Pump Adapter Screw	31	24-38	23	18-28
Power Steering Pump Bracket Screw	58	50-64	43	37-47
Power Steering Pump Mounting Screw	38	34-47	28	25-35
Rear Crossmember-to-Side Sill Nut	41	27-47	30	20-35
Rear Insulator Bracket-to-Trans. Screw	45	37-52	33	27-38
Rear Support Insulator-to-Bracket Nut	65	54-75	48	40-55
Rear Support Cushion-to-Crossmember Screw Nut	24	16-34	18	12-25
Rocker Arm Capscrew	26	22-35	19	16-26
Spark Plugs	38	30-45	28	22-33
Starter Motor to Converter Housing Screws	24	18-34	18	13-25
Thermostat Housing Screw	18	14-24	13	10-18
Throttle Valve Rod Adjusting Screw	5	3-6	40 in.lbs.	30-50 in.lbs.
Timing Case Cover-to-Block	34	24-45	25	18-33
Vibration Damper Screw (Lubricated)	122	108-136	90	80-100
Water Pump Screws	5	5-6	48 in.lbs.	40-55 in.lbs.

All Torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.
Refer to the Standard Torque Specifications and Capscrew Markings Chart in Chapter A of this manual for any torque specifications not listed above.

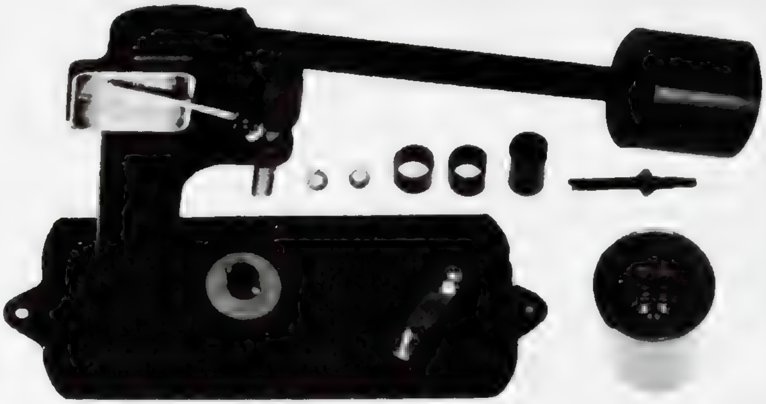
Special Tools

TOOL J-22534-1
VALVE SPRING REMOVER
AND INSTALLATION TOOL

TOOL
J-22534-4

TOOL
J-22534-5

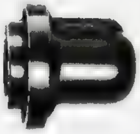
J-22534 VALVE SPRING REMOVER AND INSTALLATION TOOL



J-5790
HYDRAULIC VALVE
LIFTER TESTER

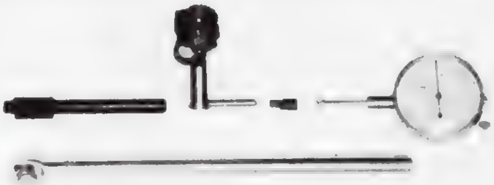
J-22533
TIMING CASE COVER
OIL SEAL INSTALLER

J-9256
TIMING CASE COVER
OIL SEAL REMOVER

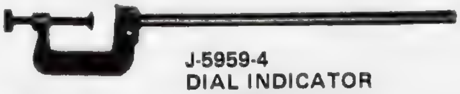


J-26562
OIL SEAL
INSTALLER

J-21791
VIBRATION DAMPER
REMOVER



J-8520
DIAL INDICATOR SET
(0-1 INCH-.001 INCH GRADUATION)

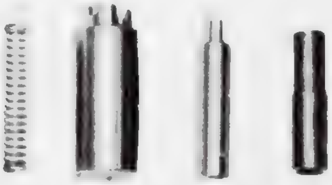


J-5959-4
DIAL INDICATOR
CLAMP AND ROD

J-6042-1, 4, 5
VALVE GUIDE REAMERS

J-22700
OIL FILTER WRENCH

J-8056
VALVE AND CLUTCH
SPRING TESTER



J-21872—304-360 CID
PISTON PIN REMOVER AND INSTALLER

41951

COOLING SYSTEM 1C

SECTION INDEX

GENERAL

The cooling system regulates engine operating temperature by allowing the engine to reach normal operating temperature as quickly as possible, maintaining normal operating temperature and preventing overheating (fig. 1C-1, 1C-2 and 1C-3). The cooling system also provides a means of heating the passenger compartment and cooling the automatic transmission fluid.

The cooling system is pressurized and uses a centrifugal water pump to circulate coolant through the system.

COMPONENTS

Coolant

The coolant is a mixture of low mineral content water and ethylene glycol-based antifreeze. The addition of antifreeze to water alters several physical characteristics of water that are important to cooling system performance. The freezing point is lowered, the boiling point is raised and tendencies for corrosion and foaming are reduced. The lowered freezing point protects the engine and cooling system components from damage caused by the expansion of water as it freezes. The raised boiling point contributes to more efficient heat transfer. Reduced corrosion and reduced foaming permit unobstructed coolant flow for more efficient cooling. During heat-soak conditions after engine shutdown, the higher boiling point helps prevent coolant loss due to boilover. The higher boiling point also helps minimize damage caused by cavitation.

NOTE: *Cavitation is the formation of a partial vacuum by moving a solid body (pump impeller) swiftly through a liquid (coolant). The vacuum reduces the boiling point of the liquid and allows the formation of vapor bubbles, which burst when contacting a hard surface. If enough bubbles do this in a localized area, metal can be eroded, causing leakage.*

Cars built at Kenosha have an antifreeze concentration which protects against freezing to -20°F (-28.9° C). Brampton-built cars have a concentration which protects to -34°F (-36.6° C).

Water Pump

A centrifugal water pump circulates the coolant through the water jackets, passages, radiator core and hoses of the system. The pump is driven by the engine crankshaft, through a v-type belt. The water pump impeller is pressed onto the rear of the shaft which rides in bearings pressed into the housing. The housing has a small hole to allow seepage to escape. The water pump seals are lubricated by the antifreeze. No additional lubrication is necessary.

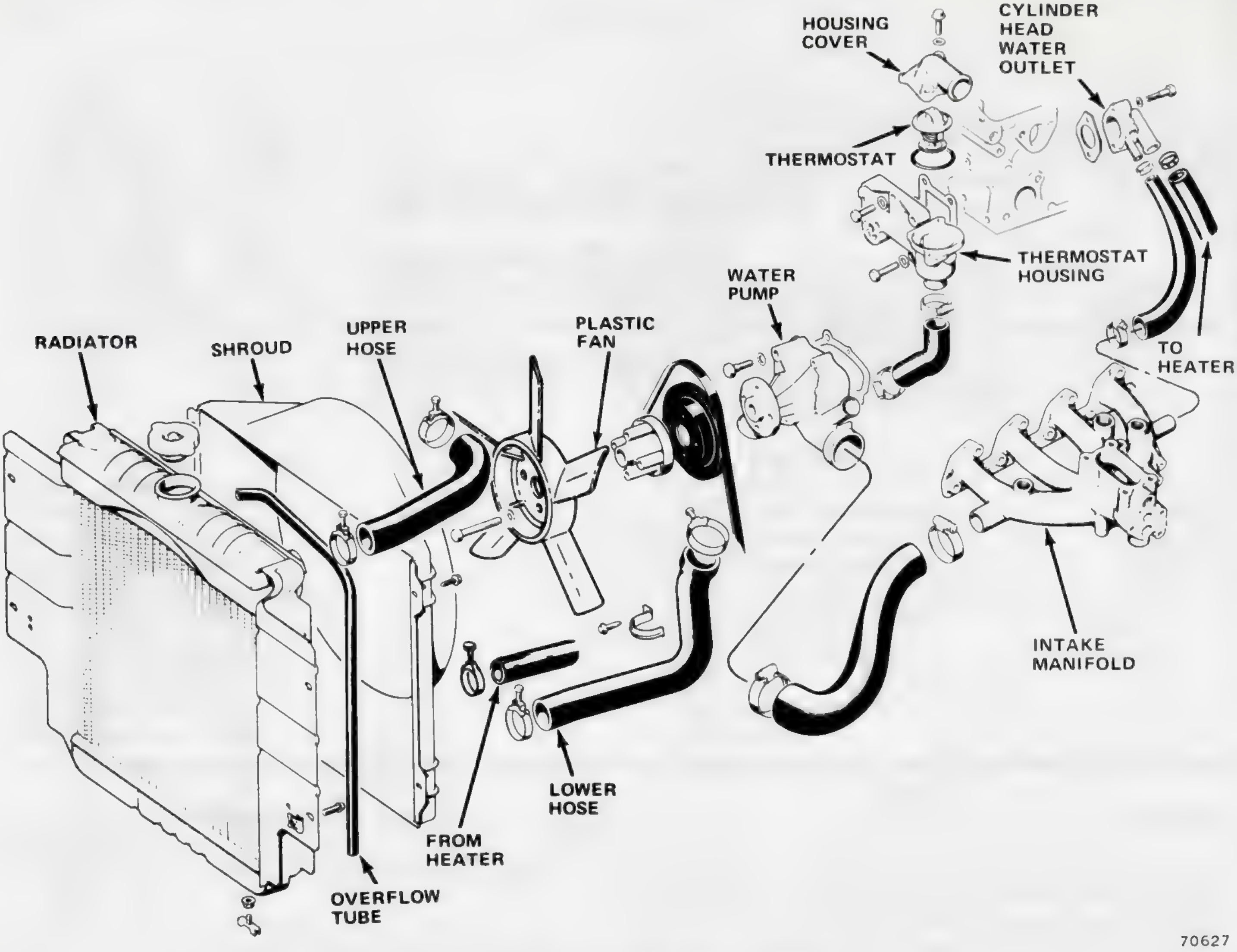


Fig. 1C-1 Four-Cylinder Cooling System Components

Hoses

Rubber hoses route coolant to the heater core and radiator. A coolant control valve is installed in the heater core inlet hose to shut off coolant flow to the heater core. On cars with eight-cylinder engines, the heater core return hose is routed through a bracket attached to the carburetor choke housing, except those equipped with electric choke.

The lower radiator hose on all six- and eight-cylinder engines is spring-reinforced to prevent collapsing caused by water pump suction.

Thermostat

A pellet-type thermostat controls operating temperature of the coolant by controlling coolant flow to the radiator. On four-cylinder engines, the temperature-sensitive pellet keeps the water control valve closed below 87°C (189°F), causing coolant to be recirculated within the engine. On six- and eight-cylinder engines, the thermostat is closed below 90°C (195°F). Above these temperatures, coolant is allowed to flow to the radiator. This provides quick warmup and overall temperature control. An arrow or the words TO RAD are stamped on the thermostat to indicate the proper installed position. The same thermostat is used for winter and summer. Engines should not be operated without a thermostat, except for servicing or testing. Operating without a thermostat causes longer engine warmup time, poor warmup performance and crankcase condensation which can lead to sludge formation.

Radiator

The radiator, a tube and spacer type, is composed of two tanks soldered to the cooling tubes. The filler neck has an overflow tube that routes overboil to the road or to the coolant recovery bottle.

The six-cylinder Pacer radiator is of the crossflow type. Two side-mounted tanks are soldered to the horizontal cooling tubes. The inlet tank on the right is fitted

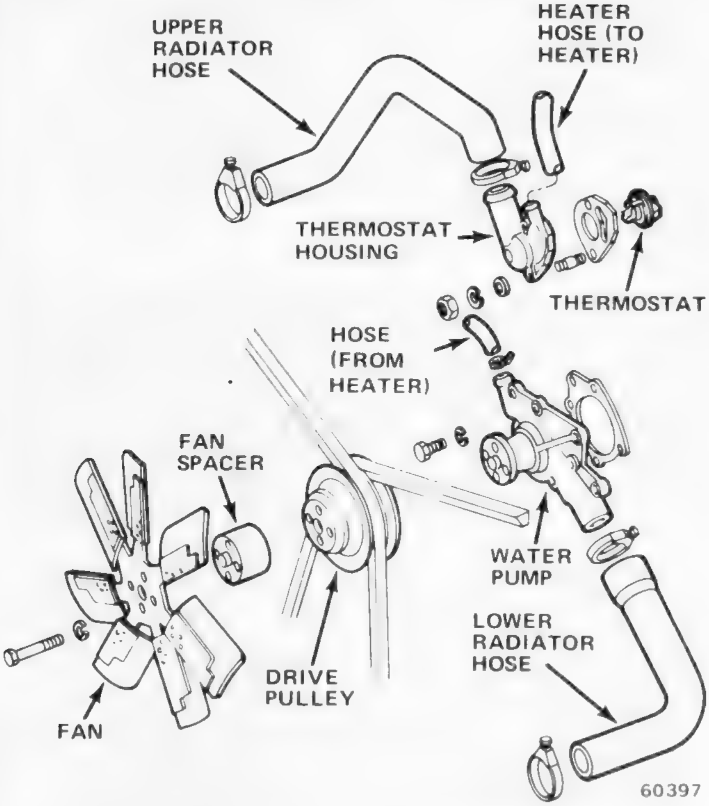


Fig. 1C-2 Six-Cylinder Cooling System Components

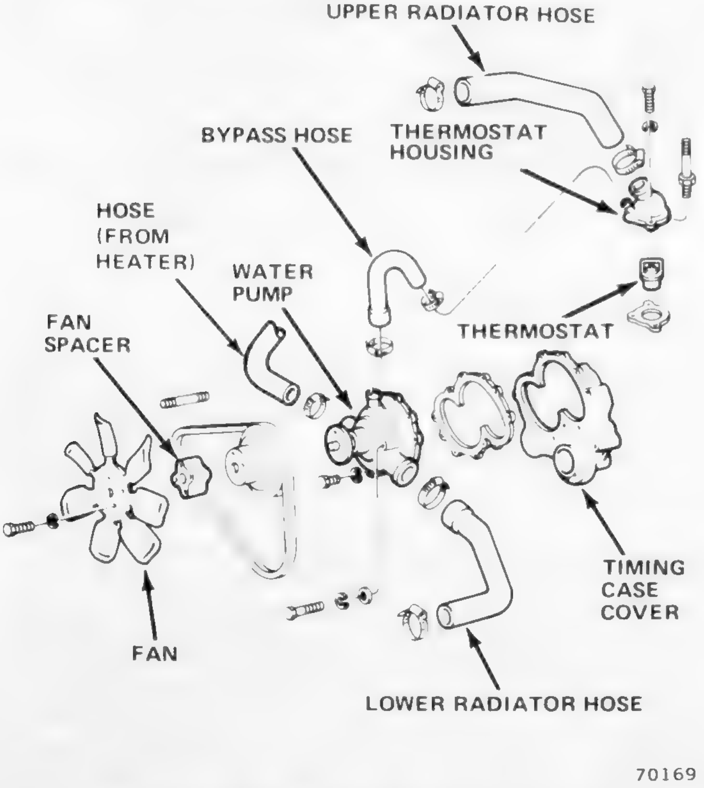


Fig. 1C-3 Eight-Cylinder Cooling System Components

with a drain cock. The outlet tank on the left contains the oil cooler on cars with automatic transmission. The radiator cap and filler neck are also located on the outlet tank.

Gremlin, Concord and Matador models have downflow radiators. A top tank and a bottom tank are soldered to vertical cooling tubes. The radiator cap and filler neck are located on the inlet tank. The bottom, or outlet, tank contains the drain cock. It also contains the oil cooler on cars with automatic transmission.

Some radiators have a plastic shroud attached to funnel air more directly through the radiator for improved cooling at idle and low road speeds.

Some cars are equipped with an air seal between the radiator top tank and crossmember. This prevents air from flowing forward over the radiator and recirculating through the core.

Radiator Pressure Cap

The radiator cap consists of a pressure valve and a vacuum valve. The cap performs several functions:

- Prevents coolant loss when car is in motion.
- Keeps impurities out of the system to minimize corrosion.
- Allows atmospheric pressure to equalize the vacuum that occurs in the system during cooldown.
- Seals cooling system pressure up to 14 psi, which raises the coolant boiling point approximately 2-1/2°F per pound of pressure.

Fan

Refer to the Cooling System Components chart for specific applications.

Rigid plastic fans are used on all four-cylinder engines, regardless of cooling package. The lightweight material provides the necessary strength for proper operation and contributes to vehicle weight reduction.

Six- and eight-cylinder engines use metal fans of several types. Most engines with standard cooling use a rigid fan. Several engines for 1978 are fitted with standard-equipment flexible fans for noise reduction. Air-conditioned cars have either a flexible fan or a viscous (Tempatrol) fan. The Tempatrol fan is new for 1978.

Rigid fans have four blades. Flexible fans have 5 or 7 flexible blades which automatically change pitch relative to engine rpm. As rpm increases, blade pitch decreases, saving power and decreasing noise level. At slow speed, the pitch increases and the airflow rate increases to effectively cool the engine.

The Tempatrol fan drive is a torque- and temperature-sensitive clutch unit which automatically increases or decreases fan speed to provide proper cooling (fig. 1C-4). A bimetal coil in the clutch unit reacts to changes in radiator air temperature and regulates the flow of silicone fluid into the drive chamber. The amount of fluid regulates fan speed in proportion to the cooling requirements of the engine.

Rigid and flexible fan blades are riveted to the fan hub and balanced within 0.25 in.-oz. The fan is mounted on an aluminum spacer or viscous fan drive to maintain the proper distance between the fan and radiator.

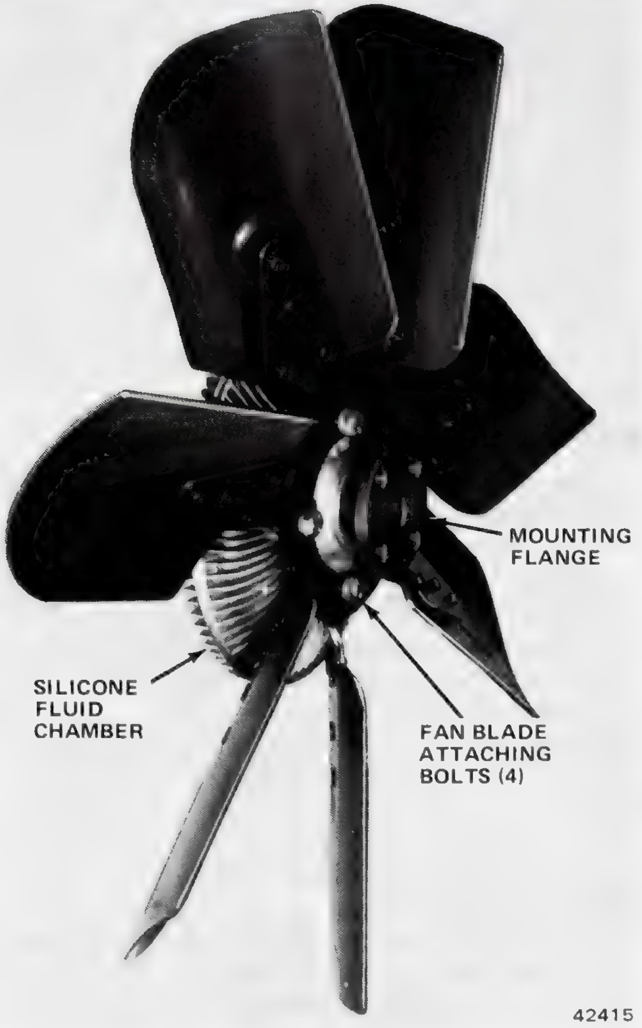


Fig. 1C-4 Tempatrol Fan

Coolant Recovery System

A coolant recovery system is used on an increased number of cars for 1978. Refer to the Cooling System Components chart for specific applications. The coolant recovery system consists of a special pressure radiator cap, an overflow hose and a plastic coolant recovery bottle (fig. 1C-5).

The radiator cap used with the recovery system has a gasket to prevent air leakage at the filler neck. The cap has no finger grips to discourage unnecessary removal and has a mark on top which aligns with the overflow hose to indicate proper installed position. The rubber overflow hose fits into the top of the plastic bottle and protrudes to the bottom. The overflow hose must always be submerged in coolant. The bottle has a molded-in tube for overflow. This same tube allows atmospheric pressure to enter the bottle during recovery operation. The bottle is fitted with a plain plastic cap.

Temperature Gauge

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and repair of the temperature gauge system.

Temperature Indicator Lamp

Refer to Chapter 1L—Power Plant Instrumentation for operation, diagnosis and repair of the temperature indicator lamp system.

Fig. 1C-5 Coolant Recovery System—Typical

Engine Block Heater

A factory-installed engine block heater is optional. It consists of a 600W, 120V heater element fitted into a core plug hole in the block, a power cord and nylon straps which are placed in the glove box for later installation.

COOLING SYSTEM OPERATION

With the engine running, the belt-driven water pump circulates coolant throughout the system. On four-cylinder engines, coolant is forced into the front of the cylinder block. Water jackets carry the coolant around all cylinders. Coolant then passes upward through holes in the cylinder head gasket and into the head. After flowing through passages in the head, coolant flows toward the front of the head and toward the rear. An adapter at the front of the head directs coolant into the thermostat housing. Below 87°C (189°F), this coolant is bypassed into the inlet of the water pump. And adapter on the back of the head divides coolant flow into two hoses. One

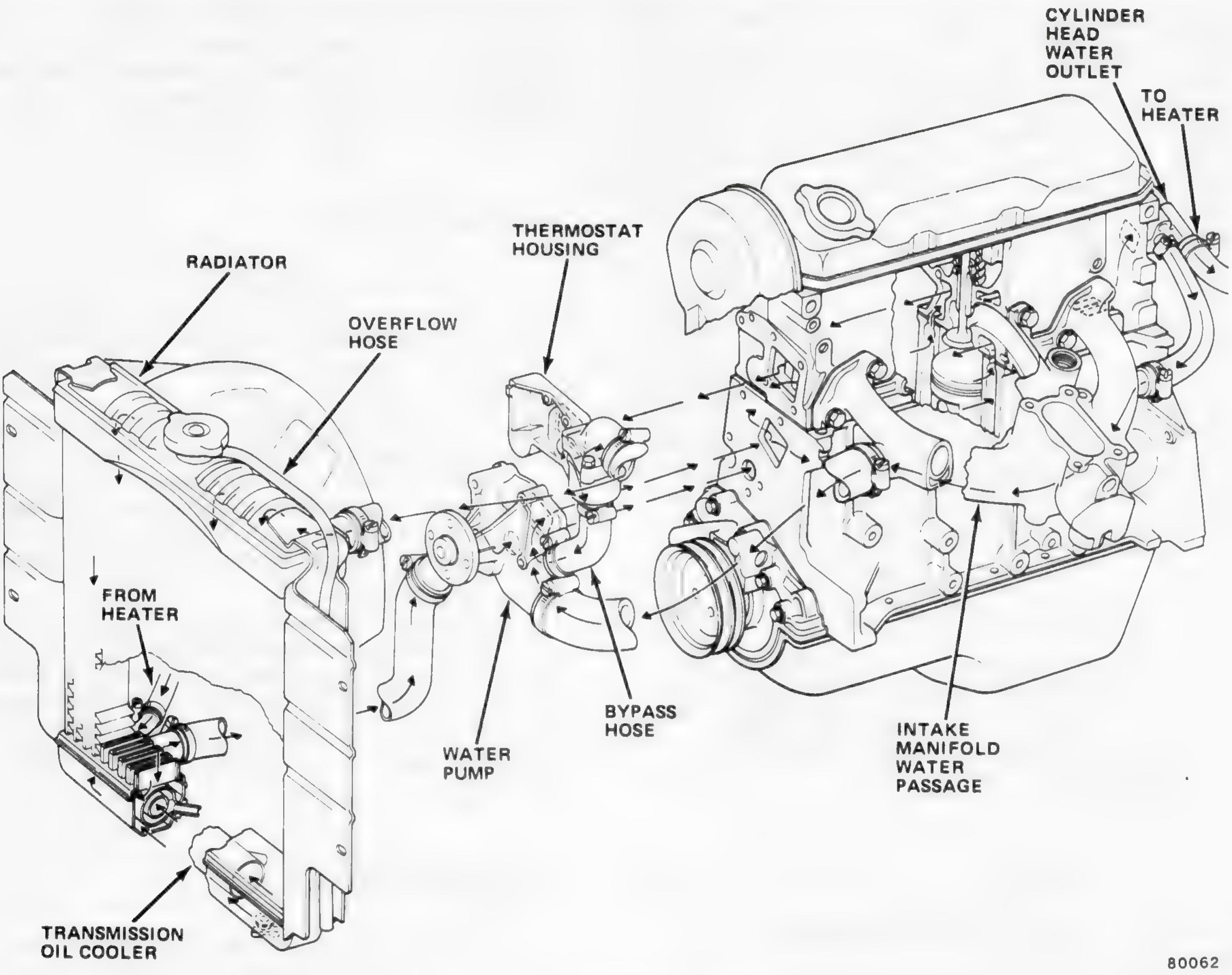


Fig. 1C-6 Four-Cylinder Coolant Flow

hose carries coolant throught the heater core and back to an inlet in the radiator lower tank adjacent to the radiator outlet. The second hose carries coolant from the head to an inlet fitting at the rear of the intake manifold. Coolant flows forward through the intake manifold. Heat from the coolant is used to warm the intake manifold to prevent fuel condensation. Also the EGR CTO switch and ignition CTO switch are located in the intake manifold coolant passage. Coolant leaves the intake manifold through a hose which is attached to the inlet side of the water pump.

On six-cylinder engines, coolant is forced directly into the cylinder block water jackets surrounding the cylinders. It travels up through passages in the head gasket and cylinder head, around the combustion chambers and valves, and forward to the front of the cylinder head. Below 90°C (195°F), the thermostat is closed and coolant flows through the bypass port in the cylinder head, down through the block and back to the water pump where it is recirculated. A bypass port in the thermostat housing allows coolant flow to the heater core.

On eight-cylinder engines, coolant is forced from the center of the engine timing case cover through side outlets into both banks of the cylinder block. It flows through the water jackets around all cylinders and up through holes in the block and head gaskets into the cylinder heads to cool the combustion chambers and valves. Coolant then flows through the heads to passages at the front of the heads and through the intake manifold to the thermostat. In the right head, coolant is forced into an intake manifold passage at the rear corner and out to the heater core, through the heater core, and back to the water pump. Below 90°C, (195°F), the thermostat is closed and coolant flows out the bypass port through the hose to the water pump, where it is recirculated.

On all engines, the recirculation cycle continues until coolant temperature reaches the thermostat calibration temperature and the thermostat begins to open. Coolant then flows to the radiator inlet tank, through the cooling tubes and into the outlet tank. The radiator fan and car motion cause air to flow past the cooling fins, removing heat from the coolant. As the coolant flows through the outlet tank, it passes the automatic transmission oil cooler, if equipped, and cools the automatic transmission fluid. Coolant is then drawn through the lower radiator hose into the water pump inlet to restart the cycle.

The thermostat continues to open, allowing more coolant flow to the radiator until it reaches maximum open position.

Heat causes the system pressure to rise, which raises the boiling point of the coolant. The pressure cap maintains pressure up to 14 psi. Above 14 psi, the relief valve in the cap allows pressurized coolant to vent through the filler neck overflow tube (fig. 1C-7) to the coolant recovery system bottle or to the road.

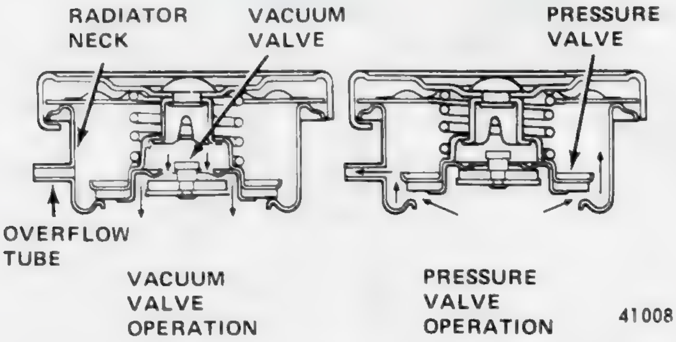


Fig. 1C-7 Radiator Cap Operation

NOTE: *Immediately after shutdown, the engine enters a condition known as heat soak, when the coolant is no longer circulating but engine temperature is still high. If coolant temperature rises above the boiling point, expansion and pressure may push some coolant out of the radiator overflow tube. Normal operation will not usually cause this to happen.*

As engine temperature drops, the coolant loses heat and contracts, forming a partial vacuum in the system. The radiator cap vacuum valve allows atmospheric pressure to enter the system to equalize the pressure.

During operation, the coolant temperature is monitored by the temperature sending unit. The sending unit electrical resistance varies as temperature changes, causing the temperature gauge to read accordingly.

The sender responds to temperature changes, so under high load or on hot days, the coolant will be hotter and the gauge will indicate higher temperatures. Unless the gauge needle is past the high end of the band or coolant loss occurs, this is normal.

Coolant Recovery Operation

As engine temperature increases, the coolant expands. The radiator cap pressure vent valve (normally open) slowly transfers expanding coolant to the coolant recovery bottle. Any air trapped in the system will be expelled during this period.

If ambient temperature is high, the system continues heating until vapor bubbles form. These vapor bubbles pass rapidly through the radiator cap vent valve, causing it to close. Further expansion of the coolant pressurizes the system up to 14 psi. Above 14 psi the relief valve in the cap allows pressurized coolant to vent to the coolant recovery system.

As engine temperature drops, the coolant loses heat and contracts, forming a partial vacuum in the system. The radiator cap vacuum valve then opens and allows atmospheric pressure to push coolant from the recovery bottle into the system to equalize the pressure. Air is not admitted as long as the recovery bottle tube remains submerged.

COOLING SYSTEM DIAGNOSIS

If the cooling system requires frequent addition of coolant in order to maintain the proper level, check all units and connections in the cooling system for evidence of leakage. Perform the inspection with cooling system cold. Small leaks, which may show up as dampness or dripping, can easily escape detection if they are rapidly evaporated by engine heat. Telltale stains of a grayish white or rusty color, or dye stains from antifreeze, may appear at joints in the cooling system. These stains are almost always a sure sign of small leaks even though there appears to be no damage.

Air may be drawn into the cooling system through leakage at the water pump seal or through leaks in the coolant recovery system. Combustion pressure may be forced into the cooling system through a leak at the cylinder head gasket even though the passage is too small to allow water to enter the combustion chamber.

Service Diagnosis

Condition	Possible Cause	Correction
HIGH TEMPERATURE INDICATION-OVERHEATING	(1) Coolant level low.	(1) Replenish coolant level.
	(2) Fan belt loose.	(2) Adjust fan belt.
	(3) Radiator hose(s) collapsed.	(3) Replace hose(s).
	(4) Radiator blocked to airflow.	(4) Remove restriction (bug screen, fog lamps, etc.)
	(5) Faulty radiator cap.	(5) Replace cap.
	(6) Car overloaded.	(6) Reduce load.
	(7) Ignition timing incorrect.	(7) Adjust ignition timing.
	(8) Idle speed low.	(8) Adjust idle speed.
	(9) Air trapped in cooling system.	(9) Purge air.
	(10) Car in heavy traffic.	(10) Operate at fast idle in neutral intermittently to cool engine.
	(11) Incorrect cooling system component(s) installed.	(11) Install proper component(s).
	(12) Faulty thermostat.	(12) Replace thermostat.
	(13) Water pump shaft broken or impeller loose.	(13) Replace water pump.
	(14) Radiator tubes clogged.	(14) Flush radiator.
	(15) Cooling system clogged.	(15) Flush system.
	(16) Casting flash in cooling passages.	(16) Repair or replace as necessary. Flash may be visible by removing cooling system components or removing core plugs.
	(17) Brakes dragging.	(17) Repair brakes.
	(18) Excessive engine friction.	(18) Repair engine.
	(19) Antifreeze concentration over 68%.	(19) Lower antifreeze content.
	(20) Missing air seals.	(20) Replace air seals.
	(21) Faulty gauge or sending unit.	(21) Repair or replace faulty component.
	(22) Loss of coolant flow caused by leakage or foaming.	(22) Repair leak, replace coolant.
	(23) Viscous drive failed.	(23) Replace unit.
LOW TEMPERATURE INDICATION—UNDERCOOLING	(1) Thermostat stuck open.	(1) Replace thermostat.
	(2) Faulty gauge or sending unit.	(2) Repair or replace faulty component.

NOTE: *Immediately after shutdown, the engine enters a condition known as heat soak. This is caused by the cooling system being inoperative while engine temperature is still high. If coolant temperature rises above boiling point, expansion and pressure may push some coolant out of the radiator overflow tube. If this does not occur frequently, it is considered normal.*

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
COOLANT LOSS—BOILOVER	Refer to Overheating Causes in addition to the following:	
	(1) Overfilled cooling system.	(1) Reduce coolant level to proper specification.
	(2) Quick shutdown after hard (hot) run.	(2) Allow engine to run at fast idle prior to shutdown.
	(3) Air in system resulting in occasional "burping" of coolant.	(3) Purge system.
	(4) Insufficient antifreeze allowing coolant boiling point to be too low.	(4) Add antifreeze to raise boiling point.
	(5) Antifreeze deteriorated because of age or contamination.	(5) Replace coolant.
	(6) Leaks due to loose hose clamps, loose nuts, bolts, drain plugs, faulty hoses, or defective radiator.	(6) Pressure test system to locate leak then repair as necessary.
	(7) Faulty head gasket.	(7) Replace head gasket.
	(8) Cracked head, manifold, or block.	(8) Replace as necessary.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER	(1) Faulty head gasket.	(1) Replace head gasket.
	(2) Crack in head, manifold or block.	(2) Replace as necessary.
COOLANT RECOVERY SYSTEM INOPERATIVE	(1) Coolant level low.	(1) Replenish coolant to FULL mark.
	(2) Leak in system.	(2) Pressure test to isolate leak and repair as necessary.
	(3) Pressure cap not tight or gasket missing or leaking.	(3) Repair as necessary.
	(4) Pressure cap defective.	(4) Replace cap.
	(5) Overflow tube clogged or leaking.	(5) Repair as necessary.
	(6) Recovery bottle vent plugged.	(6) Remove restriction.
NOISE	(1) Fan contacting shroud.	(1) Reposition shroud and check engine mounts.
	(2) Loose water pump impeller.	(2) Replace pump.
	(3) Dry fan belt.	(3) Apply silicone or replace belt.
	(4) Loose fan belt.	(4) Adjust fan belt.
	(5) Rough surface on drive pulley.	(5) Replace pulley.
	(6) Water pump bearing worn.	(6) Remove belt to isolate. Replace pump.
	(7) Belt alignment.	(7) Check for improper pulley locations. Shim power steering pump.

70170B

Service Diagnosis (Continued)

Condition	Possible Cause	Correction
NO COOLANT FLOW THROUGH HEATER CORE	(1) Plugged return pipe in water pump.	(1) Remove obstruction.
	(2) Heater hose collapsed or plugged.	(2) Remove obstruction or replace hose.
	(3) Plugged heater core.	(3) Remove obstruction or replace core.
	(4) Plugged outlet in thermostat housing.	(4) Remove flash or obstruction.
	(5) Heater bypass hole in cylinder head plugged.	(5) Remove obstruction.
TEMPERATURE LAMP ON, BUT TEMPERATURE IS OK (PACER ONLY)	(1) Wrong sending unit.	(1) Install correct sending unit.
	(2) Sending wire shorted to ground.	(2) Locate area of contact and and repair insulation.

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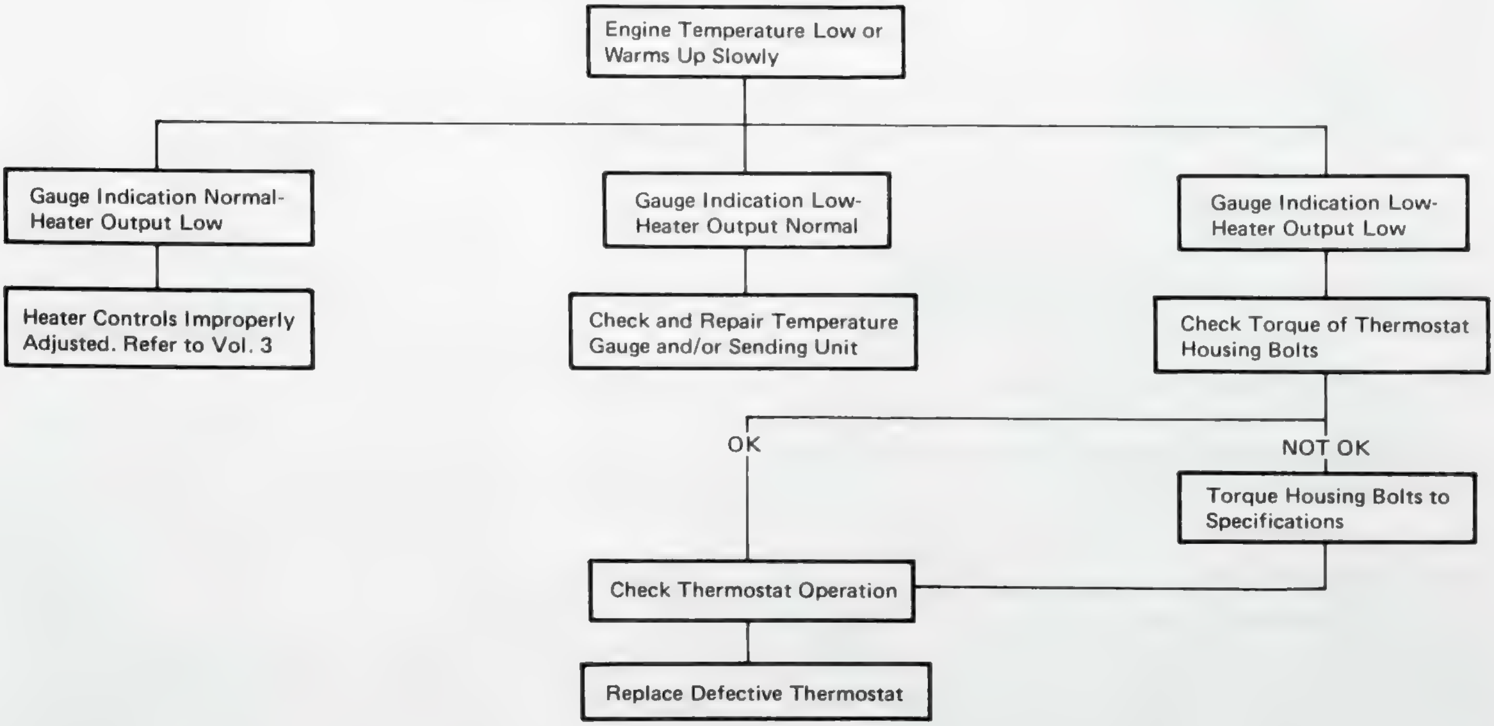
Low Engine Temperature Diagnosis Guide



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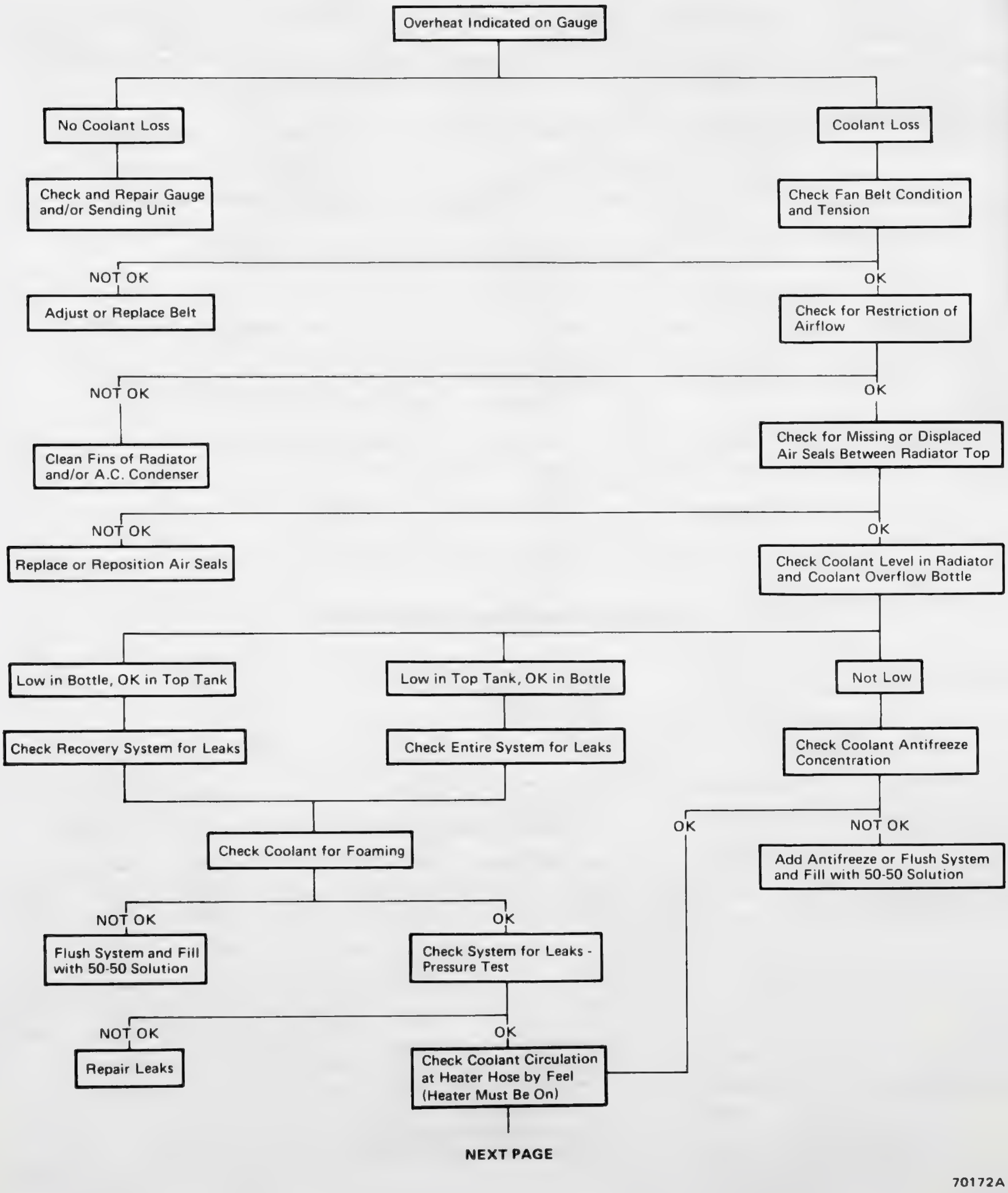
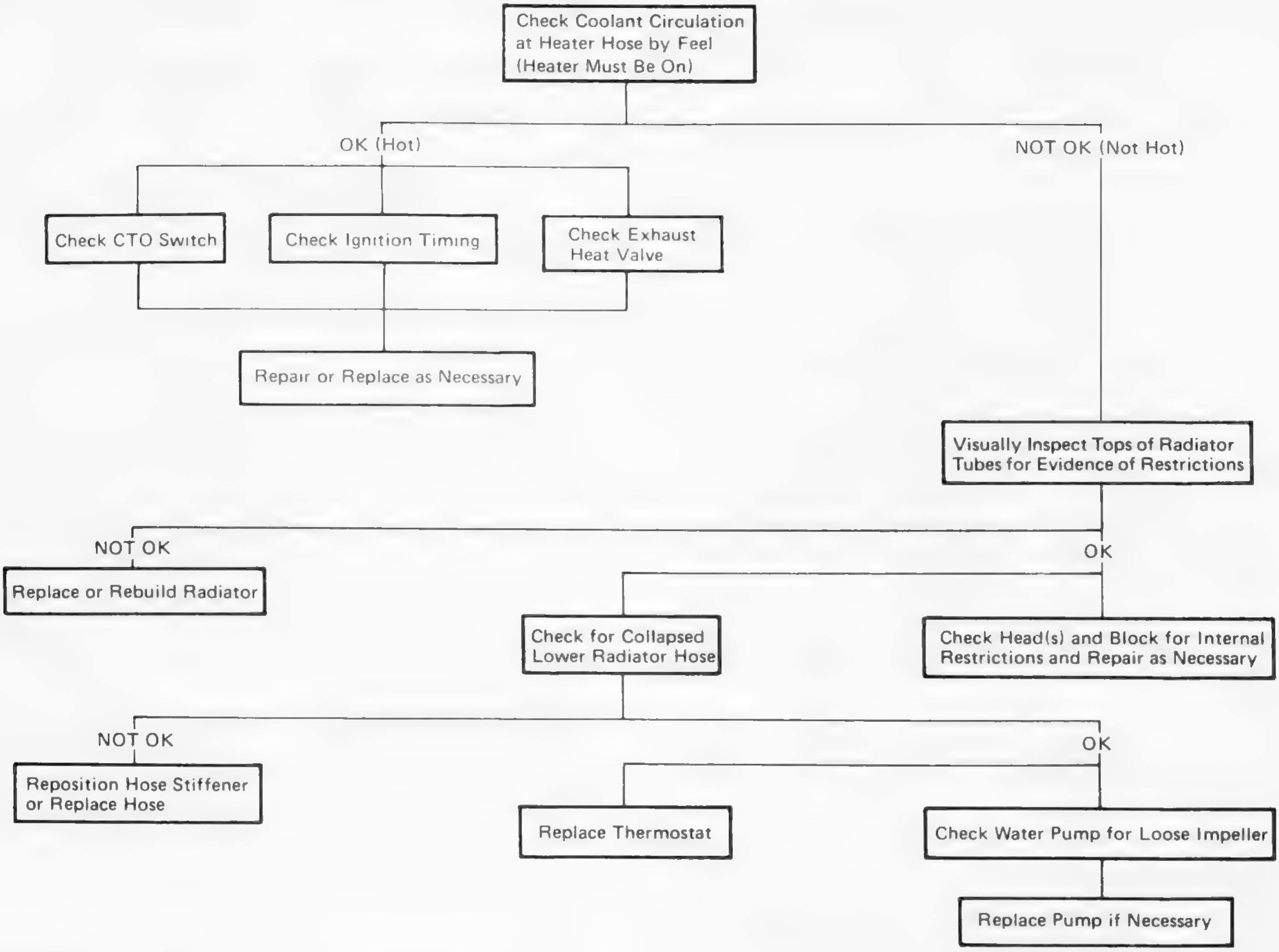
Engine Overheating Diagnosis Guide



Engine Overheating Diagnosis Guide (Continued)



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TROUBLESHOOTING

Cooling System Leakage

NOTE: *Engine must be warm.*

(1) Carefully remove radiator pressure cap from filler neck and check coolant level.

NOTE: *Push down on the cap to disengage from the stop tabs.*

(2) Wipe inside of filler neck and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder bumps.

(3) Inspect overflow tube for internal obstructions. Run a wire through tube to be sure it is clear.

(4) Inspect cams on outside of filler neck. If cams are bent, seating of pressure cap valve and tester seal will be affected. Bent cams can be reformed if done carefully.

(5) Attach pressure tester to filler neck (fig. 1C-8). **Do not force**.

(6) Operate tester pump to apply 15 psi pressure to system. If hoses swell excessively while testing, replace as necessary.

(7) Observe needle:

(a) **Holds Steady:** If needle holds steady for two minutes, there are no serious leaks in the system.

NOTE: *There may be an internal leak that does not show up under normal system pressure. If it is certain that coolant is being lost and no leaks can be found, check for interior leakage or perform Combustion Leakage Check.*

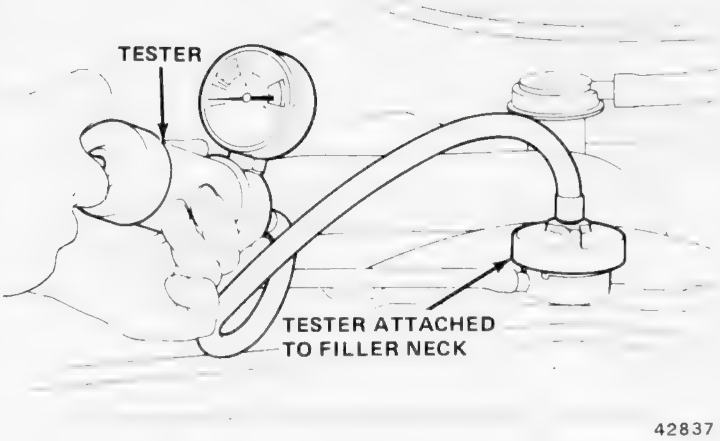

Fig. 1C-8 Cooling System Pressure Test

(b) **Drops Slowly:** Indicates presence of small leaks or seepage. Examine all points for seepage or slight leakage with a flashlight. Check radiator, hose, gaskets and heater. Seal tiny leaks with AMC Sealer Lubricant, or equivalent. Repair leaks and check system.

(c) **Drops Quickly:** Indicates that serious leakage is present. Examine system for serious external leakage. If no leaks are visible, check for internal leakage.

NOTE: *Have large radiator leaks repaired by a reputable radiator repair shop.*

Checking for Internal Leakage

(1) Remove oil pan drain plug and drain small amount of oil (water, being heavier, should drain first), or run engine to churn oil, then examine dipstick for water globules.

(2) Check transmission dipstick for water globules.

(3) Check transmission oil cooler for leakage. Refer to Oil Cooler Leakage.

(4) Run engine without pressure cap on radiator until thermostat opens.

(5) Attach Pressure Tester to filler neck. If pressure builds up quickly, leak exists as result of faulty head gasket or crack. Repair as necessary.

CAUTION: *Do not allow pressure to build up over 15 psi. Turn engine OFF. To release pressure, rock tester from side to side. While removing tester, do not turn tester more than 1/2 turn if system is under pressure.*

(6) If there is no immediate pressure increase, operate Pressure Tester until gauge reads within system range. Vibration of gauge hand indicates compression or combustion leakage into cooling system.

(7) Isolate compression leak by shorting each spark plug. Gauge hand should stop or decrease vibration when spark plug of leaking cylinder is shorted.

NOTE: *Do not operate engine with spark plug disconnected for more than a minute or catalytic converter may be damaged.*

Combustion Leakage (Without Pressure Tester)

(1) Drain sufficient coolant to allow thermostat removal.

(2) Disconnect water pump drive belt.

(3) **Four-Cylinder Engine:** Remove thermostat housing cover and remove thermostat.

Six-Cylinder Engine: Disconnect upper radiator hose from thermostat housing, remove thermostat and install thermostat housing to cylinder head.

Eight-Cylinder Engine: Disconnect thermostat housing from engine and remove thermostat.

(4) Add coolant to engine to bring level within 1/2 inch of top of thermostat housing or intake manifold.

(5) Start engine and accelerate rapidly to about 3000 rpm three times while watching coolant. If any internal engine leaks to cooling system exist, bubbles will appear in coolant. If bubbles do not appear, there are no internal leaks.

CAUTION: *Do not run engine too long, to avoid overheating. Open drain cock immediately after test to eliminate boilover.*

Oil Cooler Leakage

Oil cooler leaks can be detected by the presence of transmission fluid in the coolant. If fluid appears in the coolant, check the fluid level of the automatic transmission. If the fluid level is low, check the oil cooler as follows:

(1) Remove transmission-to-cooler lines at radiator.

(2) Plug one fitting in cooler.

(3) Remove radiator cap and make sure radiator is full.

(4) Apply shop line pressure (50 to 200 psi) to other fitting.

Bubbles in coolant at filler neck indicate a leak in oil cooler. If an oil cooler leak is discovered, remove radiator for oil cooler repair. Unsolder outlet tank for access to oil cooler.

CAUTION: *Because of high oil pressure, conventional soldering must not be used for oil cooler repair. All repairs must be silver-soldered or brazed.*

TESTING

Coolant Freezing Point Test

Check coolant freezing point, or freeze protection, with an antifreeze hydrometer to determine protection level. Refer to Coolant.

Radiator Pressure Cap

(1) Remove cap from radiator.

(2) Make sure seating surfaces are clean.

(3) Wet rubber gasket with water and install cap on tester (fig. 1C-9).

(4) Operate tester pump and observe needle at its highest point. Cap release pressure should be 12 to 15 pounds.

NOTE: *Cap is OK when pressure holds steady or holds within the 12 to 15 pound range for 30 seconds or more. If needle drops quickly, replace cap.*

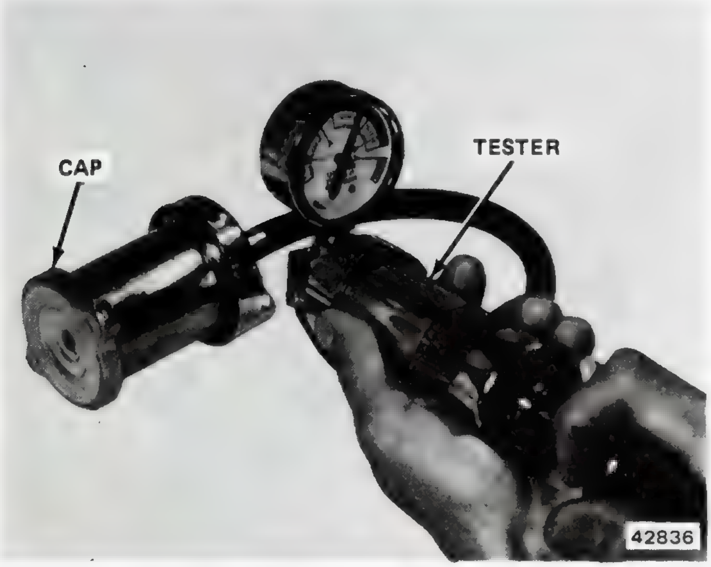

Fig. 1C-9 Radiator Cap Pressure Test

Thermostat

(1) Remove thermostat. Refer to Thermostat Replacement.

(2) Insert 0.003-inch feeler gauge, with wire or string attached, between valve and seat (fig. 1C-10).

(3) Submerge thermostat in container of pure anti-freeze, suspended so it does not touch sides or bottom of container.

(4) Suspend thermometer in solution so it does not touch container.

WARNING: *Do not breathe fumes.*

(5) Heat solution.

(6) Apply slight tension on feeler gauge while solution is heated. When valve opens 0.003 inch, feeler gauge will slip free from valve. Note temperature at which this occurs. Refer to Thermostat Calibrations chart below. If faulty, replace thermostat.

(7) Install thermostat.

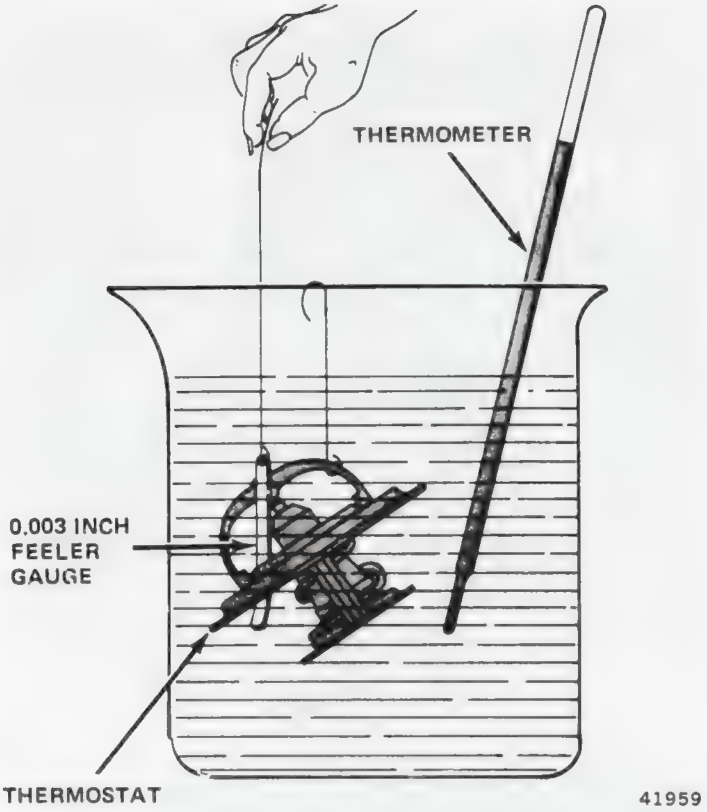

Fig. 1C-10 Testing Thermostat

Thermostat Calibrations

	4-Cyl.	6-Cyl.	8-Cyl.
Must Be Open 0.003-Inch (0.076 mm)	87°C 189°F	90°C 195°F	90°C 195°F
Must Be Fully Open	102°C 216°F	103°C 218°F	103°C 218°F

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Water Pump Tests

Loose Impeller

(1) Drain radiator.

(2) Loosen fan belt.

(3) Disconnect lower radiator hose from water pump.

(4) Bend stiff clothes hanger or welding rod (fig. 1C-11).

(5) Position rod in water pump inlet and attempt to turn fan. If impeller is loose and can be held with rod while fan is turning, pump is defective. If impeller turns, pump is OK.

(6) Connect hose and replenish coolant, or proceed with further repairs.

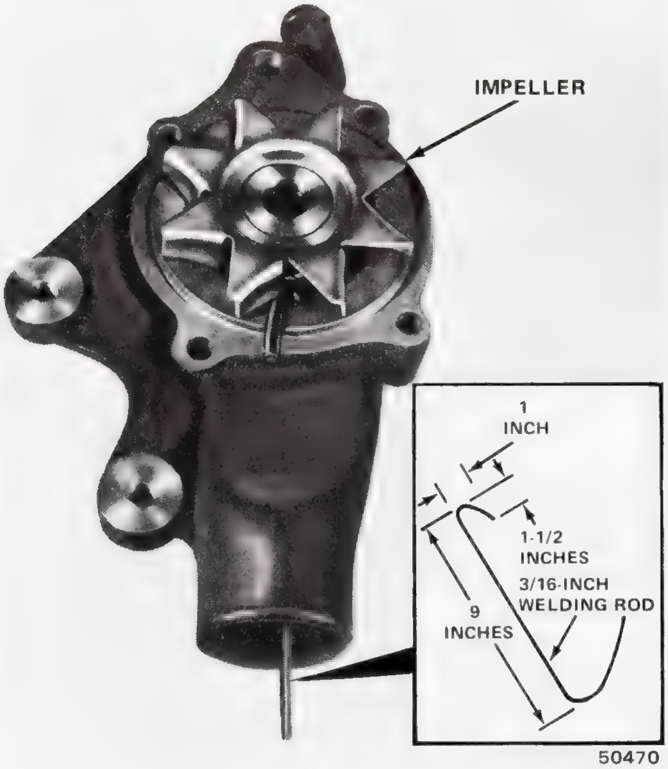

Fig. 1C-11 Checking Water Pump for Loose Impeller—Typical

Check for Inlet Restrictions

Poor heater performance may be caused by a casting restriction in the water pump heater hose inlet.

NOTE: *This procedure does not apply to the four-cylinder engine, in which the heater outlet hose is connected directly to the radiator bottom tank.*

(1) Drain sufficient coolant from radiator to permit removal of heater hose from water pump.

(2) Remove heater hose.

(3) Check inlet for casting flash or other restrictions.

NOTE: *Remove pump from engine before removing restriction to prevent contamination of coolant with debris. Refer to Water Pump Removal.*

Tempatrol Fan Test

Start the engine and allow it to warm up to operating temperature. From under the hood, gradually increase the engine speed until a definite **decrease** of the audible fan airflow is heard. Maintain this engine speed until a definite **increase** of the audible fan airflow is heard.

The Tempatrol unit is operating satisfactorily if the time interval between decrease and increase of the audible fan airflow does not exceed three minutes.

NOTE: *The cooling system must be in good condition prior to performing the above test to ensure against excessively high radiator air temperature.*

If a Tempatrol unit is suspected of causing an overheating condition, it may be tested while the vehicle is being driven. Disconnect the bimetal spring (fig. 1C-12) and rotate it 90° counterclockwise. This defeats the temperature-controlled, free-wheel feature and the Tempatrol performs like a conventional fan. If this cures the overheating condition, the Tempatrol is defective.

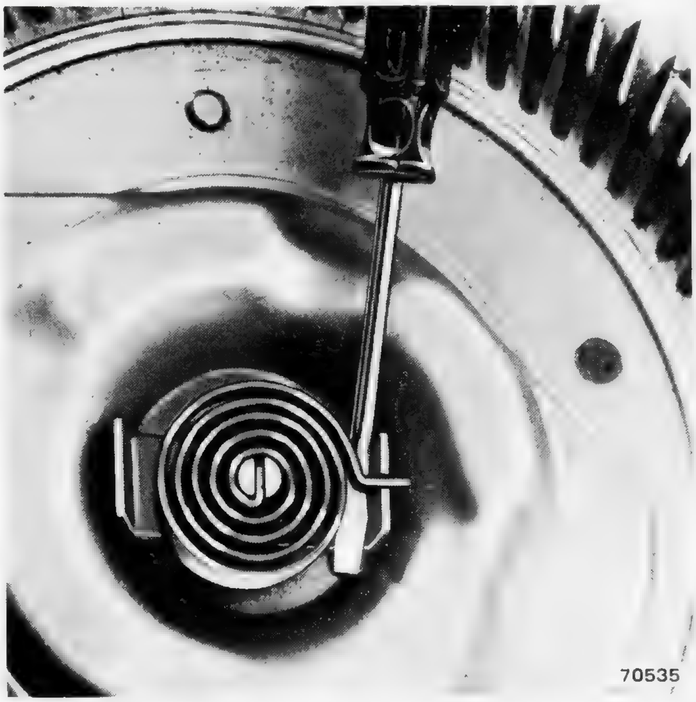

Fig. 1C-12 Disconnecting Tempatrol Spring

DRIVE BELT ADJUSTMENT

General

Inspect drive belts frequently for defects such as fraying or cracking.

CAUTION: *Do not use any commercial belt dressing or oil-based lubricant on any drive belt. A light application of silicone is acceptable. Do not dress the sides of any drive belt with a file or other abrasive. Each belt has 5 or 6 tensile members wrapped around it. If these members are cut, the belt could fail.*

Drive belts are adjusted by pivoting the driven component in its mount to achieve desired tension. In some cases, a belt may drive several components. It is necessary to loosen and pivot only one component.

Fan and Alternator Belt Adjustment

Four Cylinder—All

(1) Loosen alternator pivot screw and adjusting screw (fig. 1C-13).

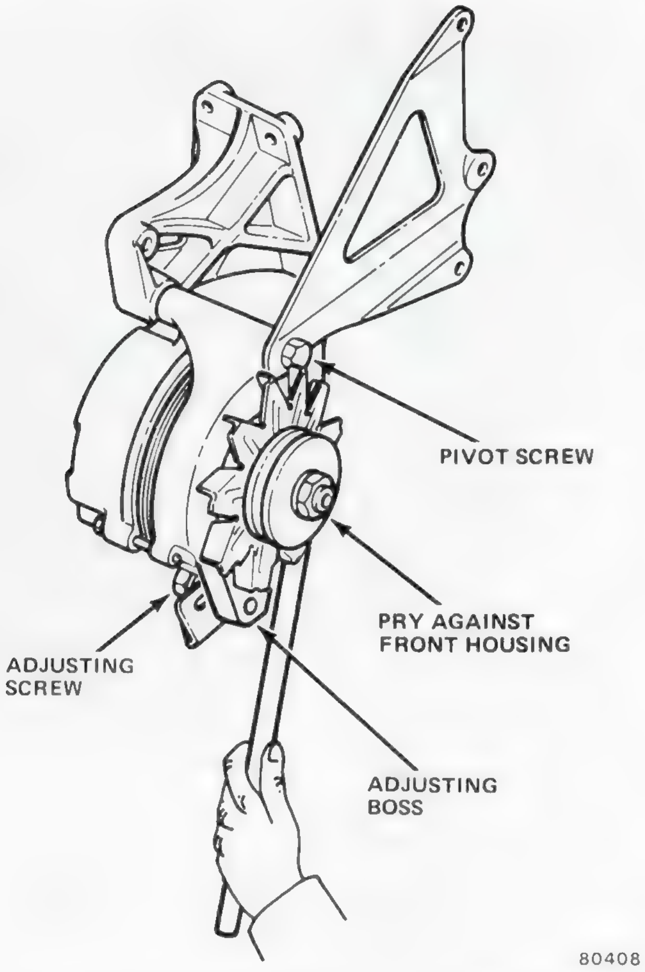

Fig. 1C-13 Alternator Adjustment—Four-Cylinder

(2) Adjust belt using suitable pry bar. Pry only on front housing from underneath car.

(3) Tighten adjusting screw.

(4) Check belt tension with Tension Gauge J-23600. Correct if necessary.

(5) Tighten adjusting screw to 18 foot-pounds (24 Nm) torque and pivot screw to 28 foot-pounds (38 Nm) torque.

Six-Cylinder—All Pacers and Gremlin, Concord and Matador without Air Conditioning

(1) Loosen alternator pivot screw and adjusting screw.

(2) Adjust belt using suitable pry bar. Pry only on alternator front housing. On Pacer models, pry from underneath car (fig. 1C-14). On all others, pry from top (fig. 1C-15).

(3) Tighten adjusting screw.

(4) Check belt tension with Tension Gauge J-23600. Correct if necessary.

(5) Tighten adjusting screw to 18 foot-pounds (24 Nm) torque and pivot screw to 28 foot-pounds (38 Nm) torque.

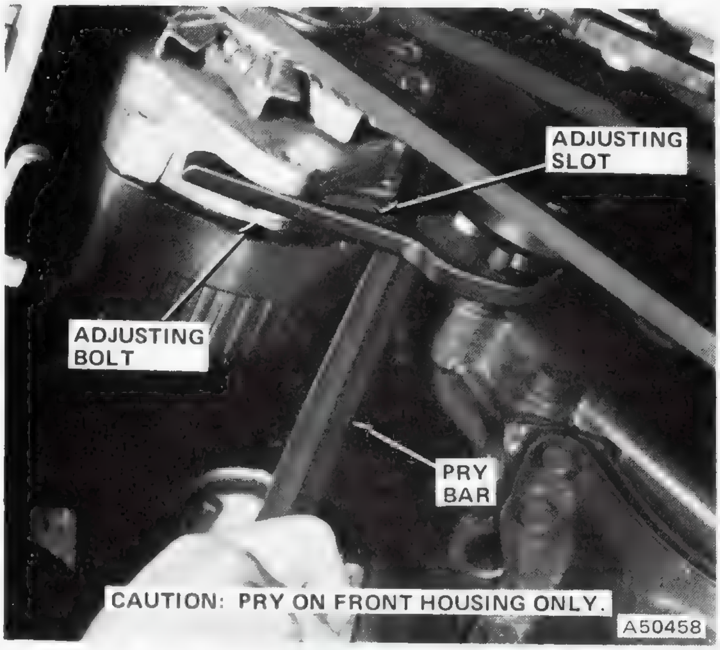

Fig. 1C-14 Alternator Adjustment—Pacer

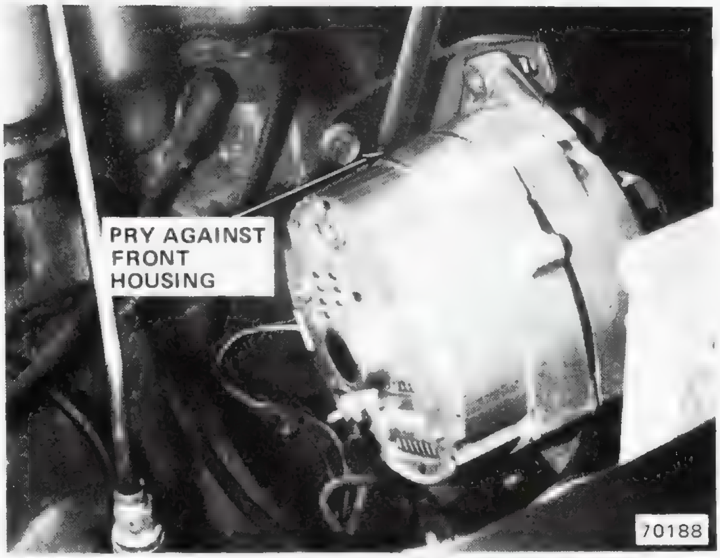

Fig. 1C-15 Alternator Adjustment—Six-Cylinder without Air Conditioning (Except Pacer)

Six Cylinder—Gremlin, Concord and Matador with Air Conditioning

(1) From underneath car, loosen alternator bracket lower mounting pivot screw.

(2) Loosen back idler attaching screw, if equipped.

(3) Loosen alternator bracket adjusting screw.

(4) Adjust alternator using suitable pry bar. Insert pry bar through hole on bottom of bracket (fig. 1C-16).

(5) Tighten adjusting screw.

(6) Check belt tension using Tension Gauge J-23600. Correct if necessary.

(7) Tighten adjusting screw to 18 foot-pounds (24 Nm) torque, mounting screws to 28 foot-pounds (38 Nm) torque, and back idler, if equipped, to 33 foot-pounds (45 Nm) torque.

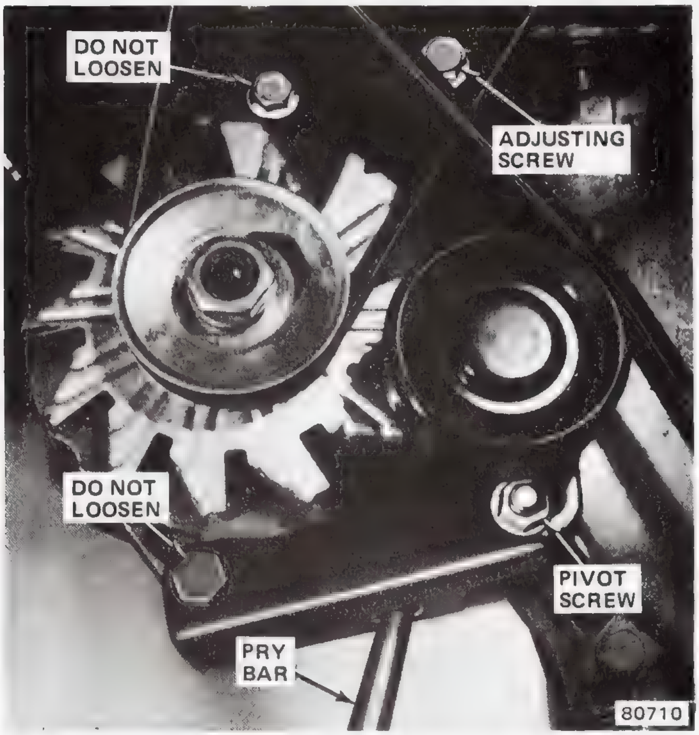

Fig. 1C-16 Alternator Adjustment—Six-Cylinder with Air Conditioning (Except Pacer)

Eight-Cylinder

NOTE: *Eight-cylinder engines equipped with air conditioning use a matched pair of belts to drive the air conditioning compressor and alternator. When checking belt tension, check only one belt, not both together, or incorrect tension will be indicated.*

(1) Loosen alternator pivot screw and alternator adjusting screw.

(2) Adjust belt using 1-inch open-end wrench on adjusting boss of alternator (fig. 1C-17).

(3) Snug adjusting screw.

(4) Check belt tension sith Tension Gauge J-23600. Correct if necessary.

(5) Tighten adjusting screw to 18 foot-pounds (24 Nm) torque and pivot screw to 28 foot-pounds (38 Nm) torque.

Air Conditioning Belt Adjustment

Air conditioning drive belts pass around the crankshaft damper pulley, the compressor pulley and either the alternator or an idler pulley. Adjustment of the alternator is covered under Fan and Alternator Belt Adjustment. The idler pulley bracket is manufactured with a square socket which accepts a 1/2 inch drive wrench. To adjust, loosen clamp screw and pivot screw, apply pressure to socket with suitable wrench and tighten screws.

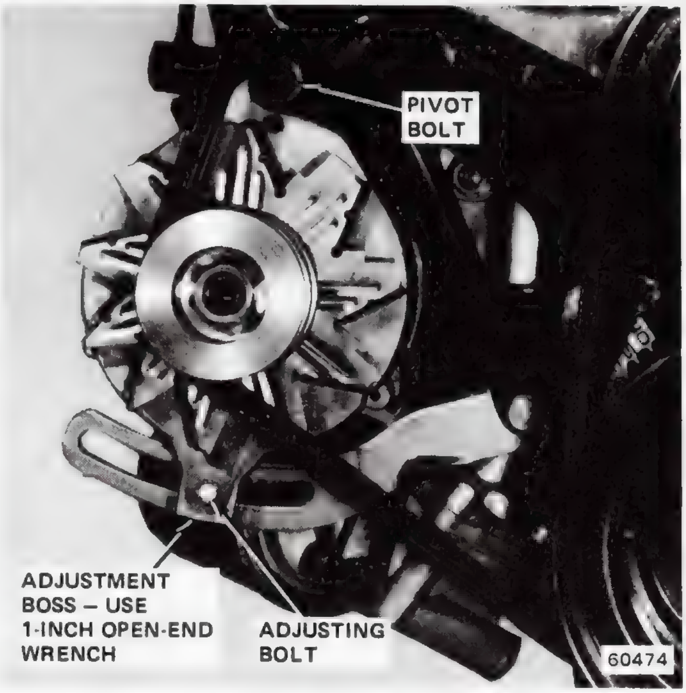

Fig. 1C-17 Alternator Adjustment—Eight-Cylinder

Power Steering Drive Belt

Power steering pumps require care when adjusting the drive belt. **Do not pry on the pump housing to adjust the drive belt.**

Four-Cylinder

(1) Loosen nuts retaining pump to mounting bracket (fig. 1C-18).

(2) Use 1/2-inch ratchet in square hole in pivot bracket to apply tension.

(3) Check tension and tighten retaining nuts.

Six-Cylinder

The six-cylinder power steering pump is sandwiched between two bracket halves (fig. 1C-19).

(1) Loosen clamping screw and pivot screws.

(2f) Insert suitable wrench in bracket socket and tighten belt.

(3) Tighten clamping screw and pivot screws.

Eight-Cylinder

(1) Before adjusting power steering pump belt, loosen air pump drive belt.

(2) Loosen nuts retaining pump to mounting bracket (fig. 1C-20).

(3) Use 1/2-inch ratchet in square hole in pivot bracket to apply tension.

(4) Check tension and tighten retaining nuts.

(5) Adjust tension of air pump drive belt.

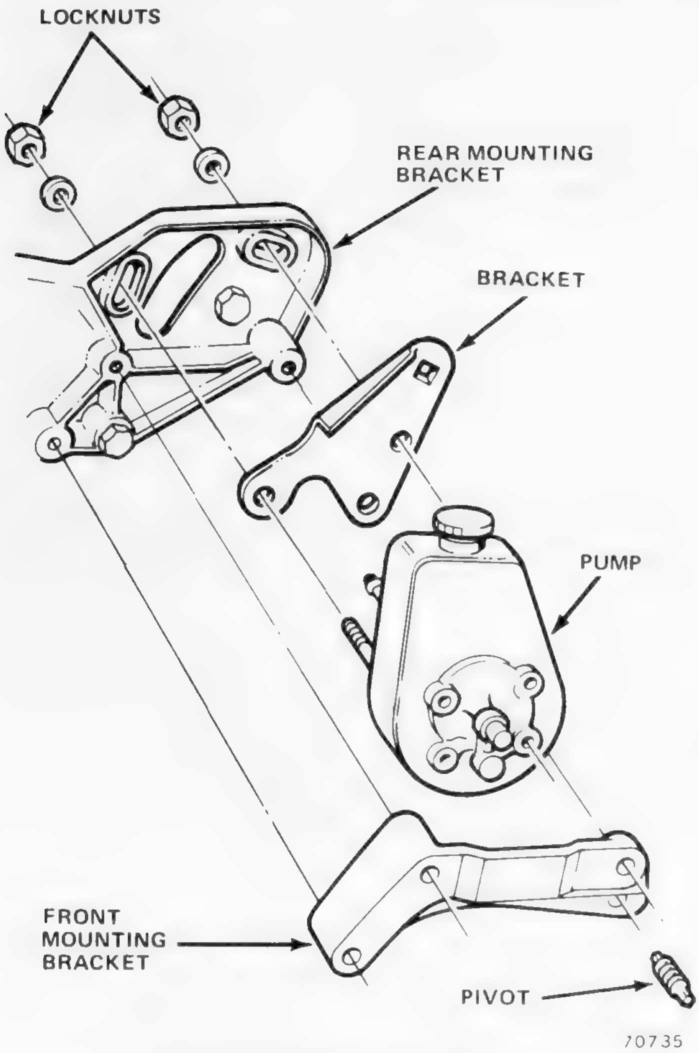

Fig. 1C-18 Power Steering Pump Drive Belt Adjustment—Four Cylinder

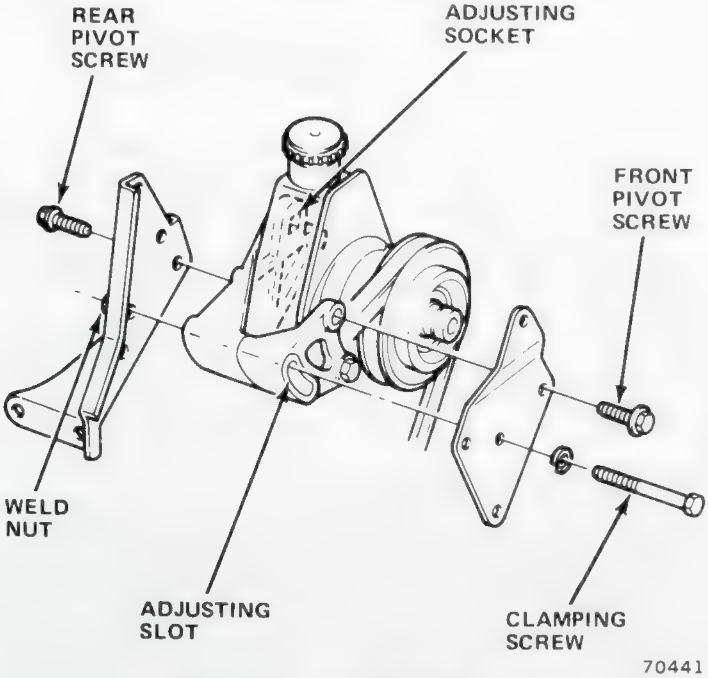

Fig. 1C-19 Power Steering Pump Drive Belt Adjustment—Six-Cylinder

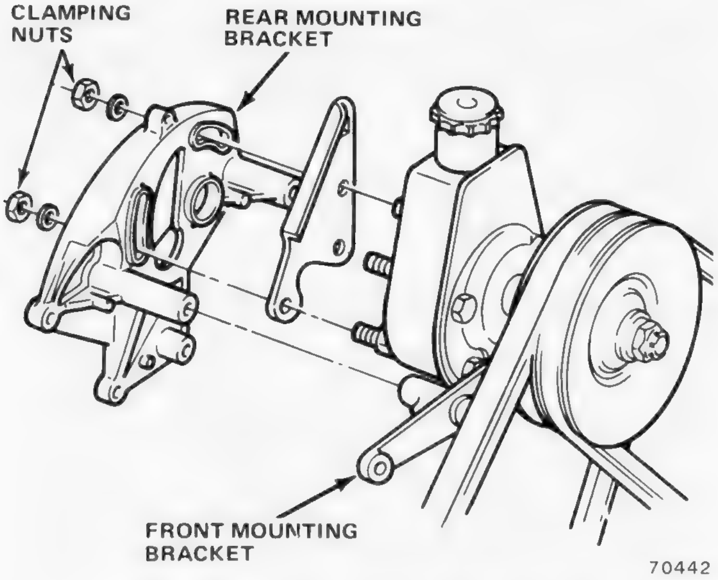

Fig. 1C-20 Power Steering Pump Drive Belt Adjustment—Eight-Cylinder

HOSES

Check hoses at regular intervals. Replace hoses that are cracked, feel brittle when squeezed or swell excessively when under pressure.

In places where specific routing clamps are not provided, make sure hoses are positioned to clear exhaust pipes, fan blades and drive belts. Improperly positioned hoses may be damaged, resulting in coolant loss and overheating.

The lower radiator hose on all six- and eight-cylinder engines is fitted with an internal spring to prevent hose collapse. When performing a hose inspection, check for proper position of the spring.

FAN SHROUD

In some extreme cases, the engine fan may contact the shroud. An examination for proper engine mounting should locate the trouble. If not, examine the shroud position. To compensate for normal engine movement, loosen the shroud mounting screws and relocate shroud to prevent fan-to-shroud contact.

COOLANT

Maintain coolant level with a mixture of ethylene glycol based antifreeze and low mineral content water.

CAUTION: *Antifreeze concentration should always be maintained to meet local requirements, or 50 percent, whichever is greater. Maximum protection against freezing is provided with 68 percent antifreeze, which prevents freezing to -90°F. A higher percentage will freeze at a higher point. For example, pure antifreeze* *freezes at -8°F. Antifreeze concentration MUST ALWAYS be at least 50 percent, year-round and in all climates. If concentration is lower, engine parts may be eroded by cavitation.*

CAUTION: *Do not use coolant additives which claim to improve engine cooling.*

Coolant Level—Without Coolant Recovery

Coolant level when cold should be 1-1/2 inches to 2 inches below the rear of the radiator filler neck sealing surface, and at normal operating temperature it should be 1/2 inch to 1 inch below this surface.

WARNING: *When removing the cap from a hot engine, coolant can rush out and scald hands. If necessary to check level, allow engine to idle for a few moments. Use a heavy rag or towel wrapped over cap and turn cap slowly to the first notch to relieve pressure, then push down to disengage locking tabs and remove cap. If engine is overheated, operate engine above curb idle speed for a few moments with hood up, then shut engine OFF and let it cool 15 minutes before removing cap. Pressure can be reduced during cooldown by spraying the radiator with cool water.*

Coolant Level—With Coolant Recovery

Coolant level in the recovery bottle should be checked only at normal operating temperatures. It should be between the FULL and ADD marks on the coolant recovery bottle (fig. 1C-5).

NOTE: *Do not add coolant unless level is below ADD mark at operating temperature.*

When adding coolant during normal maintenance, add only to the recovery bottle, not to the radiator.

NOTE: *Remove the radiator cap only for testing or when refilling the system after service. Removing the cap unnecessarily can cause loss of coolant and allow air to enter the system which produces corrosion.*

Draining Coolant

NOTE: *DO NOT WASTE reusable coolant. If solution is clean and is being drained only to service the cooling system, collect coolant in a clean container for re-use.*

Drain the coolant from the radiator by loosening the drain cock on the bottom tank.

On four-cylinder engines, drain the engine block by removing the lower radiator hose.

NOTE: *Because there are no drain plugs, coolant will remain in the lower part of the block.*

On six- and eight-cylinder engines, drain the coolant from the engine block by removing the drain plugs.

- Six-Cylinder—Two located on left side of block, which may be replaced by one or two CTO switches.
- Eight-Cylinder—Centrally located on each side of block.

WARNING: *DO NOT remove block drains with system under pressure as serious burns from coolant may occur.*

Filling

Before filling, install radiator hose and all drain plugs. Tighten radiator drain cock. Add the proper mixture of coolant to meet local requirements for freeze protection.

CAUTION: *The antifreeze concentration must always be at least 50 percent, year-round and in all climates. If concentration is lower, engine parts may be eroded by cavitation.*

Fill the radiator to the proper coolant level. On cars with a coolant recovery system, fill the radiator to the top and install the radiator cap. Add sufficient coolant to the recovery bottle.

After refilling the system or when air pockets are suspected, bleed the cooling system of excess air.

Bleeding Air from System

Trapped air will hamper or stop coolant flow or cause burping of engine coolant out of the radiator.

Move the heater control to the HEAT position and the heater temperature control to the full WARM or HIGH position.

On cars without a coolant recovery system, bleed air by operating the engine with a properly filled cooling system with the radiator cap off until coolant has completely circulated throughout the engine, or until normal operating temperature is reached. Add coolant if necessary, and install radiator cap.

On cars with a coolant recovery system, fill the system with coolant and operate the engine with all coolant caps in place. After coolant has reached normal operating temperature, shut engine off and allow to cool. Add coolant to recovery bottle as necessary.

NOTE: *This procedure may have to be repeated several cycles to maintain full coolant level at operating temperature.*

Removing Coolant from Crankcase

If coolant mixes with engine oil, **it will clog the oil lines and cause the pistons to seize. Severe damage to the engine will result.** If coolant has leaked into the lubricating system, locate the cause for the coolant leak, such as a faulty head gasket or cracked block, and make the necessary repairs. After repairing the leak, use AMC Crankcase Cleaner, or equivalent, to flush engine.

Engine Flushing

(1) Remove thermostat housing and thermostat. Install thermostat housing.

(2) Attach flushing gun to upper radiator hose at radiator end.

(3) Attach leadaway hose to water pump inlet.

(4) Connect water supply hose and air supply line to flushing gun.

(5) Allow engine to fill with water.

(6) When engine is filled, apply air in short blasts, allowing system to fill between air blasts. Continue until clean water flows through leadaway hose.

(7) Remove thermostat housing and install thermostat. Install thermostat housing, using a replacement gasket.

(8) Connect radiator hoses.

(9) Refill cooling system.

CORE PLUGS

Prior to hot tanking for block boiling, remove casting flash causing hot spots or coolant flow blockage. Remove core plugs with hammer, chisel and prying tool. Apply a sealer to edges of replacement plug and position plug with lip to outside of block. Install with hammer and suitable tool. Refer to Core Plug Sizes chart.

Core Plug Sizes

Location	Diameter (inches)
Six-Cylinder Head — Left Side (3)	7/8
Eight-Cylinder Heads — Outer Sides (2 ea)	1
Eight-Cylinder Block (3 ea side)	1 1/2
Eight-Cylinder Heads (1 ea end)	1 1/2
Six-Cylinder Block (3 on left side, 1 at rear)	2
Six-Cylinder Head (1 at rear)	2

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ENGINE BLOCK HEATER

Installation

(1) Drain coolant from engine.

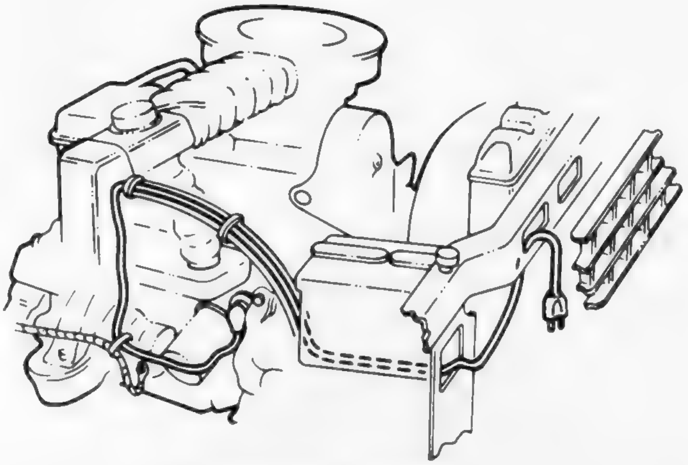
(2) Remove core plug and install block heater (fig. 1C-21). Tighten T-bolt type to 20 inch-pounds (2.3 Nm) torque. Tighten compression nut type to 10 foot-pounds (14 Nm) torque.

CAUTION: *Be careful when tightening block heater attaching parts. Improper tightening may damage seal or allow heater to loosen, resulting in coolant loss and engine damage.*

(3) From front of car, route heater (female) end of power cord through hole in front panel, along wire harness and connect to block heater.

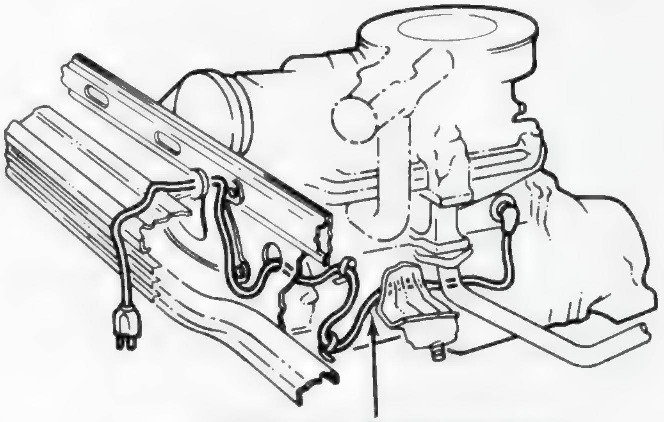
(4) Use nylon straps furnished to tie cord to wire harness and to inside of grille, and allow cord to extend outside of grille.

(5) Install coolant in engine.



TYPICAL 4-CYL. ENGINE

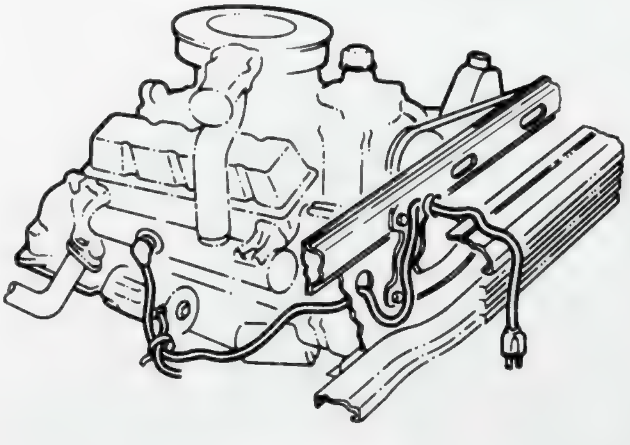
80053A



ROUTE CORD BETWEEN MOTOR MOUNT BRACKET AND BLOCK

TYPICAL 6-CYL. ENGINE

80053B



TYPICAL 8-CYL. ENGINE

80053C

Fig. 1C-21 Engine Block Heater Installation

FAN

Fan blade assemblies are balanced within 0.25 in.-oz. and should not be altered in any way. Replace a damaged or bent fan. Do not attempt repair. Refer to the Cooling System Components chart for fan applications.

CAUTION: *Fans are designed to fit certain applications only. DO NOT attempt to increase cooling capacity by installing a fan not intended for a given engine. Fan or water pump damage and noise may result.*

Replacement—All Models

(1) Disconnect fan shroud from radiator, if equipped.
(2) Remove fan attaching screws.
(3) Remove fan, spacer and shroud.
(4) Install fan, spacer and shroud.
(5) Install fan attaching parts and tighten.
(6) Install shroud attaching screws and tighten, if removed.

WATER PUMP PULLEY

Replacement

(1) Disconnect fan shroud from radiator, if equipped.
(2) Remove fan attaching screws.
(3) Remove fan, spacer and shroud.
(4) Loosen all belts passing around water pump pulley.
(5) Remove pulley.
(6) Install pulley.
(7) Position fan, spacer and shroud.
(8) Install and tighten belts.
(9) Install fan attaching screws and tighten.
(10) Install shroud attaching screws and tighten.

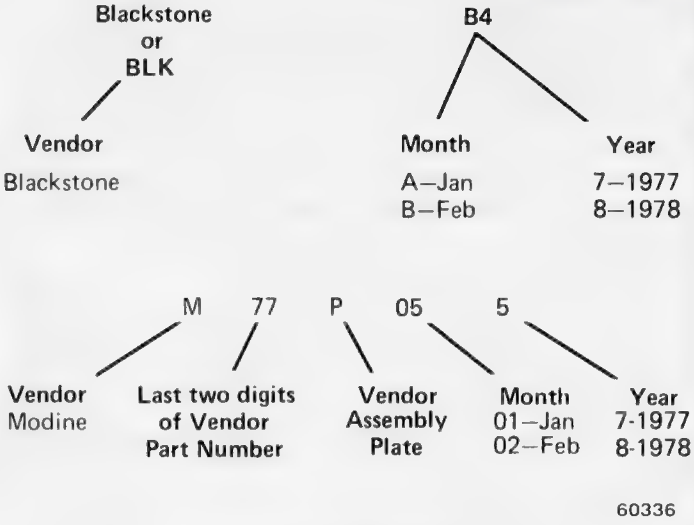
COOLANT RECOVERY BOTTLE

Replacement

(1) Remove hose from radiator filler neck.
(2) Remove bottle from front wheelhouse panel.
(3) Pour coolant into clean container for re-use.
(4) Remove hose from bottle.
(5) Install hose in bottle.
(6) Install bottle to front wheelhouse panel.
(7) Connect hose to radiator filler neck.
(8) Install coolant in bottle. Be sure hose is submerged in coolant.

RADIATOR

Radiators are identified by AMC part number and the vendor build code number embossed on the upper tank.



Radiator Identification

NOTE: *For testing radiator for leaks or pressure loss, see Cooling System Leakage.*

The radiator should be free from any obstruction to airflow. This includes bugs, clogged bug screens, leaves, mud, emblems, flags, fog lamps, improperly mounted license plates, large non-production bumper guards or collision damage.

NOTE: *Remove dirt by blowing compressed air from the engine side of the radiator through the fins.*

Several problems may affect radiator performance:

- Bent or damaged tubes.
- Corrosive deposits restricting coolant flow.
- Tubes blocked by improper soldering.

Repair damaged tubes which affect proper operation. Leaks can be detected by applying 3 to 5 psi air pressure to the radiator while it is submerged in water. Repair tubes with solder. Clean a clogged radiator by solvent cleaning or by reverse flushing.

Replacement—All Models

(1) Position drain pan under radiator and open drain cock.

NOTE: *DO NOT WASTE reusable coolant. If solution is clean, collect in a clean container for re-use.*

(2) Open hood and remove radiator cap.
(3) Disconnect upper radiator hose.
(4) Disconnect coolant recovery hose, if equipped.
(5) Remove fan shroud screws, if equipped.
(6) Remove top radiator attaching screws.
(7) Remove lower hose.
(8) Disconnect and plug oil cooler lines, if equipped with automatic transmission. On Pacers only, remove battery to gain access to oil cooler lines.

(9) Remove bottom radiator attaching screws.

(10) Remove radiator.

(11) Install radiator.

(12) Install attaching screws.

(13) Position fan shroud and install screws, if removed.

(14) Install drain cock.

(15) Remove plugs and connect oil cooler lines, if disconnected.

(16) Install lower hose, using replacement clamp.

(17) Install upper hose, using replacement clamp.

(18) Install battery, if removed.

(19) Install coolant.

(20) Connect coolant recovery hose, if removed.

(21) Install radiator cap.

Solvent Cleaning

In some cases, installing a radiator cleaner (AMC Radiator Kleen, or equivalent) before flushing will soften scale and deposits and reinforce the flushing operation.

CAUTION: *Be sure to follow directions on the container.*

Reverse Flushing

CAUTION: *The cooling system normally operates at 12 to 15 psi pressure. Exceeding this pressure may damage the radiator, heater core, or hoses.*

(1) Disconnect radiator hoses.

(2) Attach piece of radiator hose to radiator bottom outlet and insert flushing gun.

(3) Connect water supply hose and air supply line to flushing gun.

(4) Allow radiator to fill with water.

(5) When radiator is filled, apply air in short blasts, allowing radiator to refill between blasts.

Continue this reverse flushing until clean water flows through top radiator opening. If flushing fails to clear radiator passages, have the radiator cleaned more extensively by a radiator repair shop.

Oil Cooler Repairs

Because of the high pressure in the oil cooler, do not attempt conventional soldering to repair leaks. **All repairs must be silver soldered or brazed.**

THERMOSTAT REPLACEMENT

On four-cylinder engines, install the thermostat with the pellet inside the thermostat housing. Insert replacement gasket between thermostat and housing cover.

On six- and eight-cylinder engines, install the thermostat so that the pellet, which is encircled by a coil spring, faces the engine. All thermostats are marked on the outer flange to indicate proper installed position. Observe the recess in the cylinder head (six-cylinder) or intake manifold (eight-cylinder) and fit the thermostat in the groove (fig. 1C-22 and 1C-23). Then install the gasket and thermostat housing. Tightening the housing unevenly or with the thermostat out of its recess will result in a cracked housing.

WATER PUMP

The water pump impeller is pressed on the rear of the pump shaft and bearing assembly. The water pump is serviced only as a complete assembly.

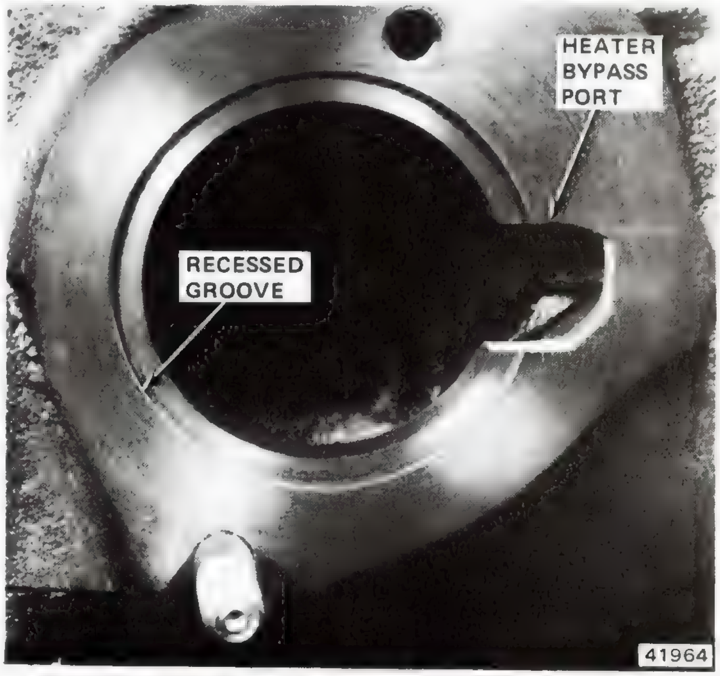


Fig. 1C-22 Thermostat Recess—Six-Cylinder

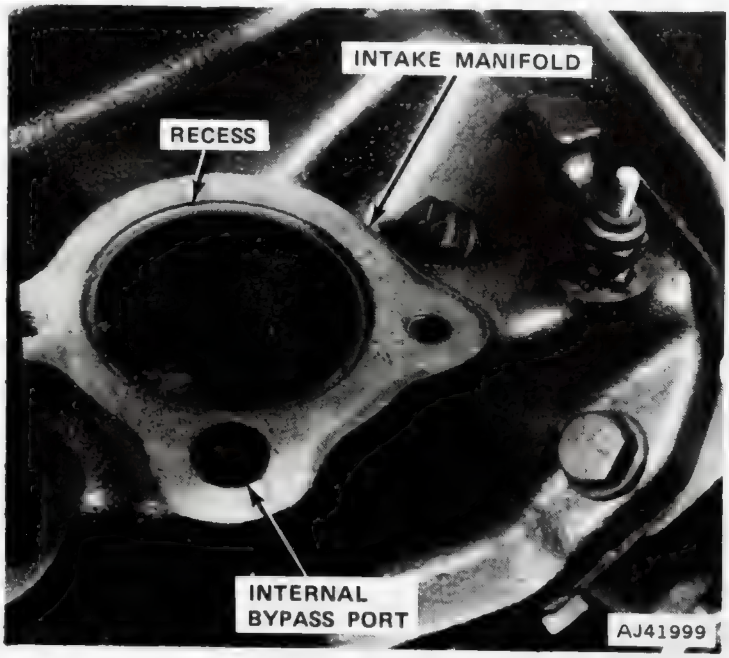


Fig. 1C-23 Thermostat Recess—Eight-Cylinder

Removal—Four-Cylinder

(1) Drain coolant.

(2) Turn crankshaft until camshaft and crankshaft are at TDC for number 1 cylinder.

(3) Remove fan shroud screws.

(4) Loosen power steering pump and remove belt, if equipped.

(5) Loosen air conditioning belt idler pulley and remove belt, if equipped.

(6) Loosen alternator.

(7) Loosen air pump.

(8) Remove fan, spacer and pulley.

(9) Remove camshaft drive belt guard.

(10) Remove air pump bracket.

(11) Remove camshaft drive belt idler pulley.

(12) Loosen hose clamps on hoses to water pump.

(13) Disconnect all hoses from pump except hose from thermostat.

(14) Remove water pump screws.

(15) Remove water pump and pull pump out of hose to thermostat.

Installation—Four-Cylinder

(1) Scrape gasket from block and pump.

(2) Install replacement gasket. Insert pump into thermostat hose and tighten water pump to block.

(3) Connect all water hoses and tighten clamps.

(4) Install air pump bracket.

(5) Install camshaft drive belt and adjust belt tension.

(6) Install camshaft drive belt guard.

(7) Install belts over pulley and install pulley, spacer and fan.

(8) Tighten air pump belt.

(9) Install alternator belt and adjust tension.

(10) Install air conditioning belt and adjust tension, if equipped.

(11) Install power steering belt, if equipped, and adjust belt tension.

(12) Install coolant.

(13) Run engine for 3 minutes. Check for leaks and coolant level.

Removal—Six-Cylinder

The following procedure applies to all cars with or without power steering, Air Guard and air conditioning.

(1) Drain cooling system.

(2) Disconnect radiator and heater hoses from pump.

(3) Remove drive belts.

(4) Remove fan ring or shroud attaching screws from radiator, if equipped.

(5) Remove fan and hub assembly and remove fan ring or shroud.

NOTE: *On some models, fan removal may be easier if the fan shroud is rotated 1/2 turn.*

(6) Remove water pump and gasket.

Installation—Six-Cylinder

Before installing pump, clean gasket sealing surfaces and remove deposits and other foreign material from impeller cavity. Inspect block surface for erosion or other faults.

(1) Install replacement gasket and water pump. Tighten screws to 13 foot-pounds (18 Nm) torque. Rotate shaft by hand to be sure it turns freely.

(2) Position shroud or ring against front of engine, if removed, and install fan and hub assembly. Tighten screws to 18 foot-pounds (24 Nm) torque.

(3) Install shroud or fan ring to radiator.

(4) Install drive belts and tighten to specified tension, using Tension Gauge J-23600. Refer to Specifications.

(5) Connect hoses to water pump.

(6) Fill radiator with coolant.

(7) Operate engine with heater control valve open and radiator cap off until thermostat opens to purge air from cooling system.

(8) Check coolant level and add as required.

Removal—Eight-Cylinder

(1) Disconnect battery negative cable.

(2) Drain radiator and remove hose from top of radiator.

(3) Disconnect fan shroud from radiator, if equipped.

(4) Remove drive belts, fan and hub assembly and shroud.

(5) Remove power steering pump, air pump and mounting bracket assembly from engine and place aside. Do not disconnect hoses (fig. 1C-24).

(6) Remove air conditioning compressor and bracket as an assembly, if equipped, and lay aside. Do not discharge.

(7) Remove alternator and front bracket and lay aside. Do not disconnect wires.

(8) Disconnect heater hose, bypass hose and radiator lower hose from water pump.

(9) Remove water pump and clean gasket surfaces.

Installation—Eight-Cylinder

NOTE: *Check timing case cover for erosion damage caused by cavitation.*

(1) Install replacement gasket and water pump. Tighten pump to timing case cover screws to 48 inch-pounds (5.4 Nm) torque and pump/timing case cover screws to 25 foot-pounds (34 Nm) torque. Rotate shaft by hand to be sure it turns freely.

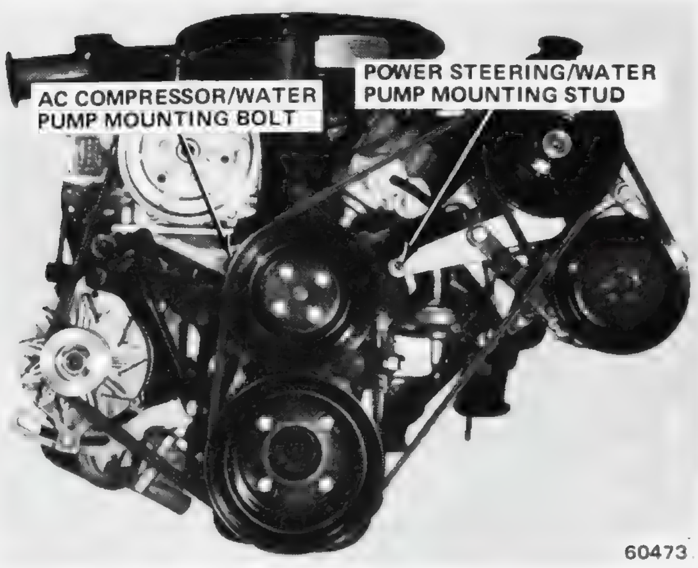


Fig. 1C-24 Water Pump Removal—Eight-Cylinder

(2) Connect heater hose, bypass hose and radiator lower hose to pump.

(3) Install alternator and front bracket. Tighten screws to 28 foot-pounds (38 Nm) torque.

(4) Install air conditioning compressor and bracket assembly, if removed.

(5) Install power steering pump, air pump and mounting bracket assembly.

(6) Position fan shroud against front of engine, if removed, and install fan and hub assembly. Tighten bolts to 18 foot-pounds (24 Nm) torque.

(7) Install fan shroud to radiator.

(8) Install drive belts and tighten to specified tension, using Belt Tension Gauge J-23600. Refer to Specifications.

(9) Connect upper radiator hose.

(10) Fill cooling system with coolant.

(11) Connect battery negative cable.

(12) Operate engine with heat control valve open and radiator cap off until thermostat opens to purge air from cooling system.

(13) Check coolant level.

NOTE: *Reset clock, if equipped.*

SPECIFICATIONS

Cooling System Specifications

	Four Cylinder	Six Cylinder	Eight Cylinder
Radiator Cap Relief Pressure	96.5 kPa (14 psi)	14 psi	14 psi
Thermostat Rating	87°C (189°F)	90°C (195°F)	90°C (195°F)
Must be Open 0.003-inch	87°C (189°F)	90°C (195°F)	90°C (195°F)
Fully Open	102°C (216°F)	103°C (218°F)	103°C (218°F)
Water Pump Type	Centrifugal	Centrifugal	Centrifugal
Drive	V-Belt	V-Belt	V-Belt
Radiator Type			
Pacer	—	Crossflow Tube and Spacer	—
Gremlin	Downflow Tube and Spacer	Downflow Tube and Spacer	—
Concord, Matador	—	Downflow Tube and Spacer	Downflow Tube and Spacer
Cooling System Capacities	Refer to Cooling System Components Chart		
Fan	Refer to Cooling System Components Chart		
Drive Belt			
Angle of V	36°	38°	38°
Width-top of groove	9.65 mm (0.38-inch)	0.391-0.453 inch	0.391-0.453 inch
Type (Plain or Cogged)	plain	plain	plain

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Cooling System Components

Model	Engine					Package			Fan				Coolant Recovery	Shroud
	2 Liter	232	258	304	360	Std	HD	A/C	Tempatrol	No. of Blades	Spacer	Flex		
Pacer		●	●			●				4①	●		●	
		●	●				●			7	●	●	●	●
		●	●					●		7	●	●	●	●
Gremlin	●					●				5	●			●
	●						●			7	●			●
	●							●		7	●			●
		●	●			●				4	●			●
		●	●				●			7	●	●	●	●
		●	●					●		7	●	●	●	●
Concord		●	●			●				4	●			
		●	●				●			7	●	●	●	●
		●	●					●		7	●	●	●	●
				●		●				5	●	●	●	●
				●			●		●	7			●	●
				●				●	●	7			●	●
Matador			●			●				4	●		●②	
			●				●			7	●	●	●②	●
			●					●		7	●	●	●②	●
					●	●				5	●	●	●②	●
					●		●			7	●	●	●②	●
					●			●		7	●	●	●②	●

① 5-Blade Flex Fan on 258-2V Standard Cooling

② 2-Door Coupe Only

NOTE: Consult parts catalog for correct listing of spacer and radiator application. Correct spacer is determined by length. Radiator is identified by part number on upper tank.

NOTE: All radiators have two rows of core tubes except radiators on Matadors with trailer towing package or fleet heavy-duty cooling, which have three rows.

80413

Cooling System Capacities

Series	Engine					Capacity-Quarts	
	4-Cyl	6-Cyl 232	6-Cyl 258	8-Cyl 304	8-Cyl 360	W/O A.C.	W/A.C. or H.D.
Pacer		●	●			14	14
Gremlin	●					6.5	6.5
Gremlin		●	●			11	14
Concord		●	●			11	14
				●		18	18
Matador 2-Door Coupe		●	●			13.5	13.5
					●	17.5	17.5
Matador — Sedan — Wagon		●	●			11.5	11.5
					●	15.5①	15.5①

①Add two quarts with Coolant Recovery

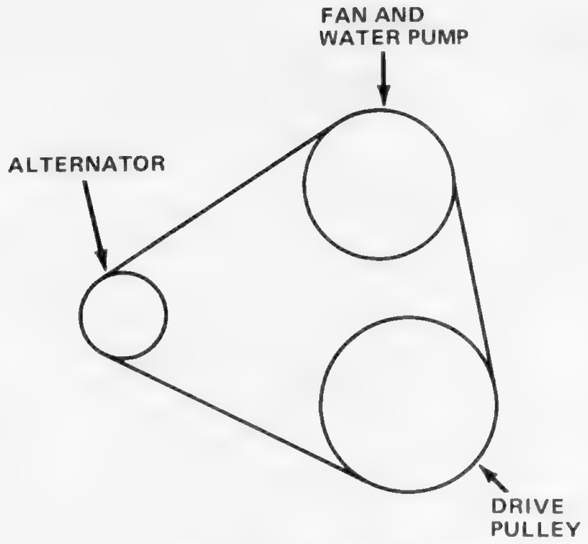
80412

Engine Drive Belt Tension

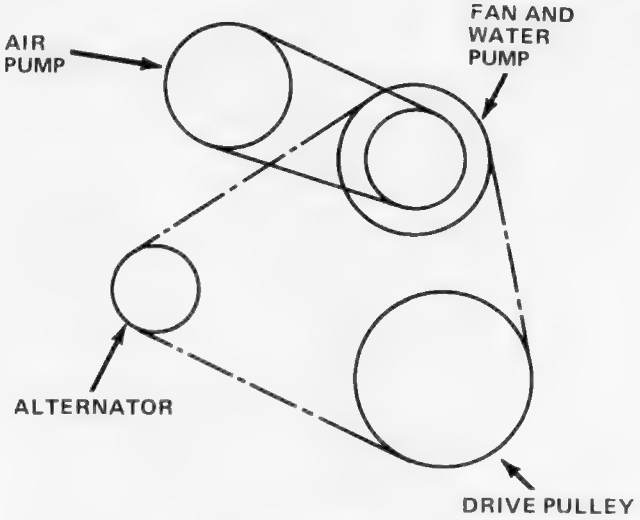
	Initial Newtons New Belt	Reset Newtons Used Belt	Initial Pounds New Belt	Reset Pounds Used Belt
Air Conditioner				
Four-Cylinder	556-689	400-512	125-155	90-115
Six-Cylinder	556-689	400-512	125-155	90-115
Eight-Cylinder	556-689	400-512	125-155	90-115
Air Pump				
Four-Cylinder	178-267	178-267	40-60	40-60
Six-Cylinder w/PS	289-334	267-311	65-75	60-70
Other Six-Cylinder and all Eight-Cylinder	556-689	400-512	125-155	90-115
Fan — All Engines	556-689	400-512	125-155	90-115
Power Steering — All Engines	556-689	400-512	125-155	90-115

80414

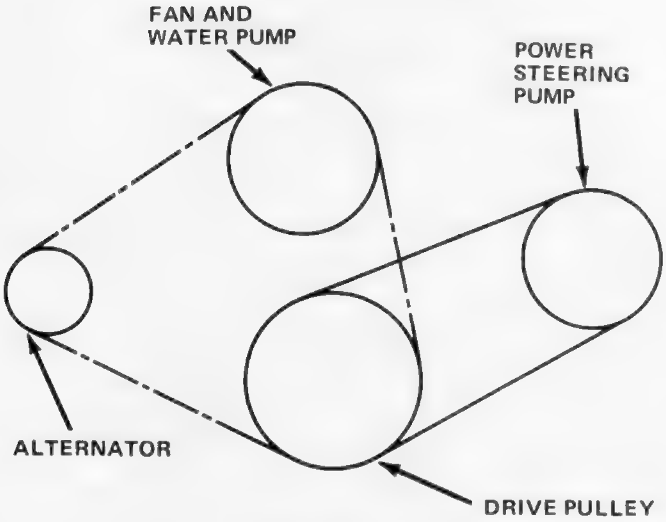
Engine Drive Belt Arrangement



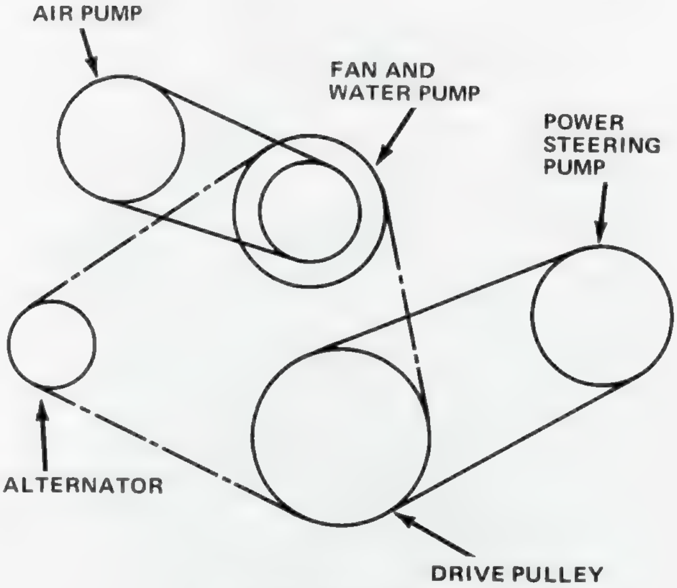
BASIC BELT ARRANGEMENT
FOUR-CYLINDER GREMLIN



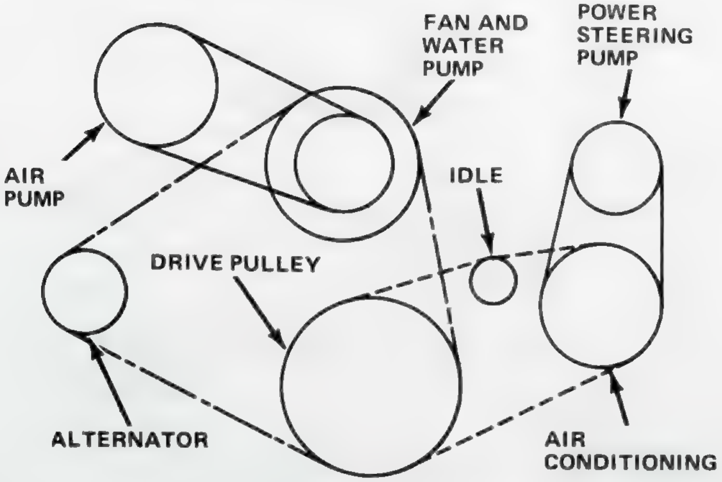
AIR GUARD
FOUR-CYLINDER
GREMLIN



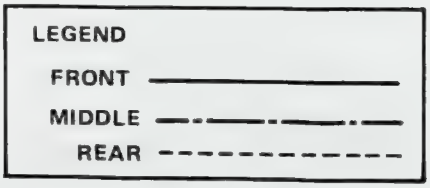
POWER STEERING
FOUR-CYLINDER
GREMLIN



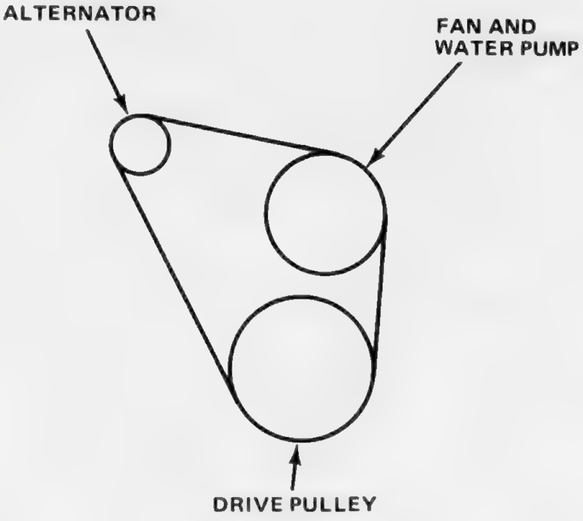
AIR GUARD AND
POWER STEERING
FOUR-CYLINDER
GREMLIN



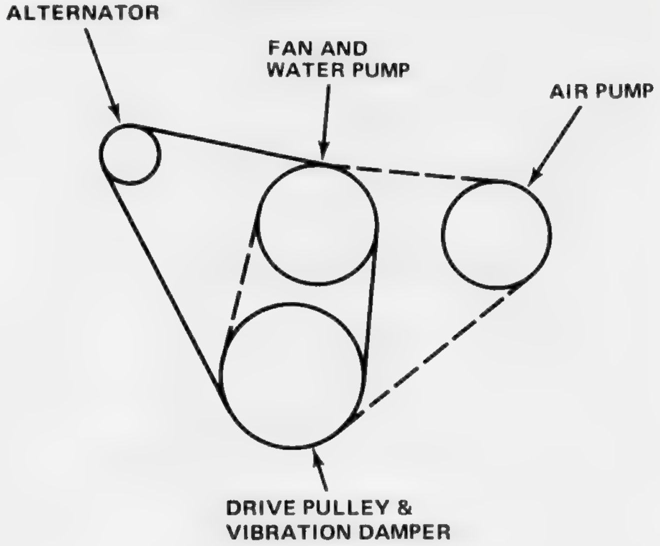
AIR CONDITIONING
FOUR-CYLINDER GREMLIN



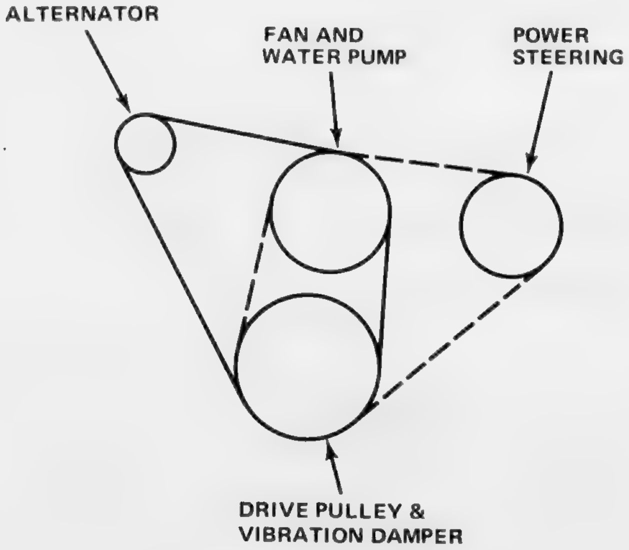
Engine Drive Belt Arrangement



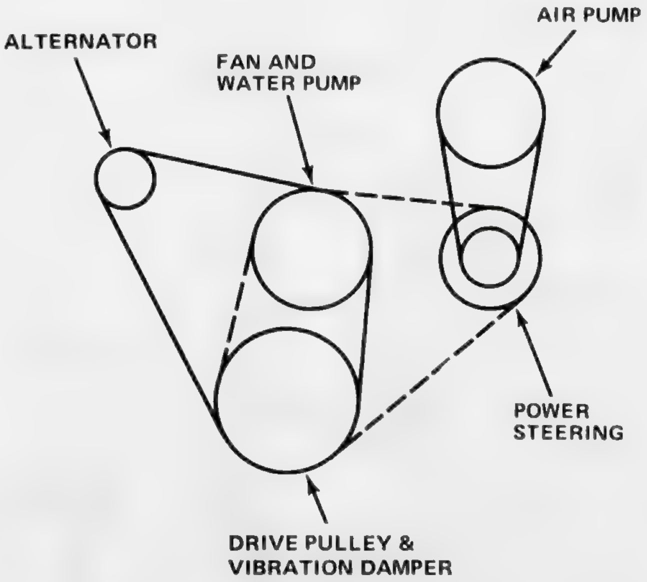
BASIC BELT ARRANGEMENT
SIX-CYLINDER
PACER, GREMLIN, CONCORD



AIR GUARD
SIX-CYLINDER
ALL MODELS



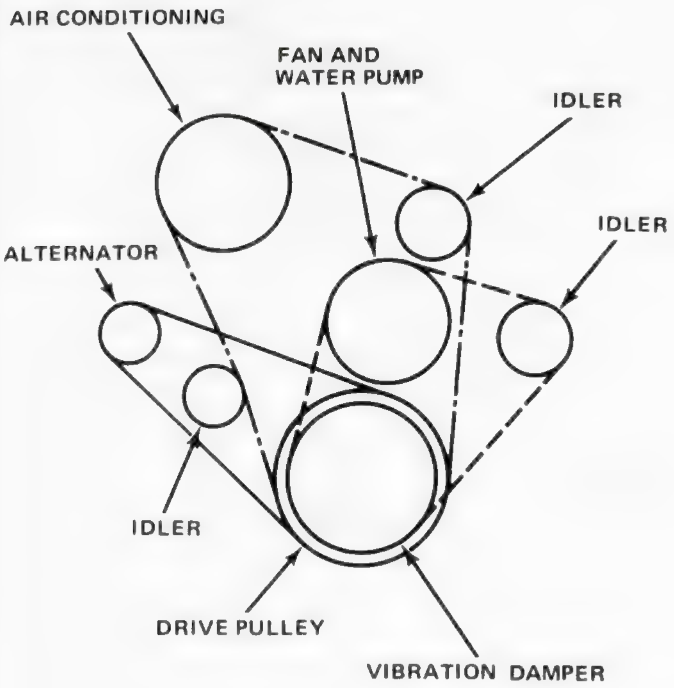
POWER STEERING
SIX-CYLINDER
PACER, GREMLIN, CONCORD



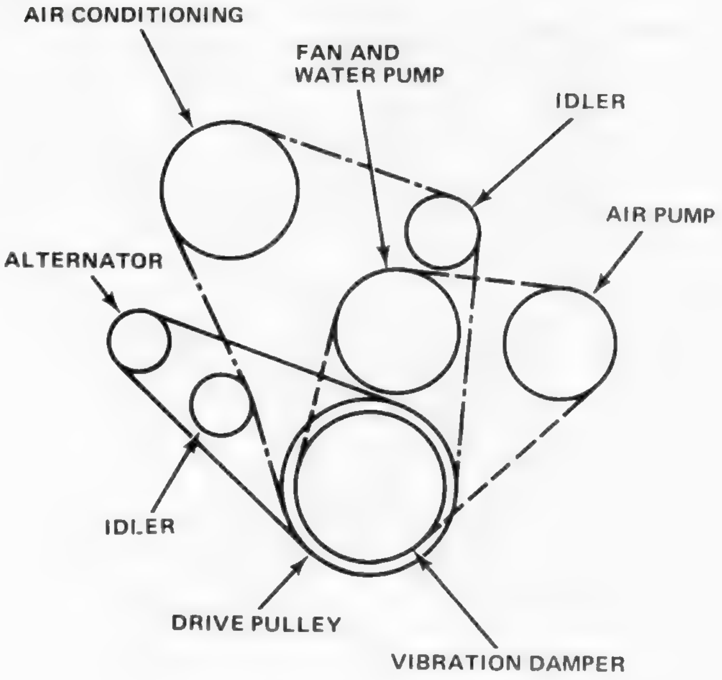
AIR GUARD AND POWER STEERING
SIX-CYLINDER
ALL MODELS

LEGEND
FRONT BELT ————————
MIDDLE BELT ———- · ———
REAR BELT — — — — —

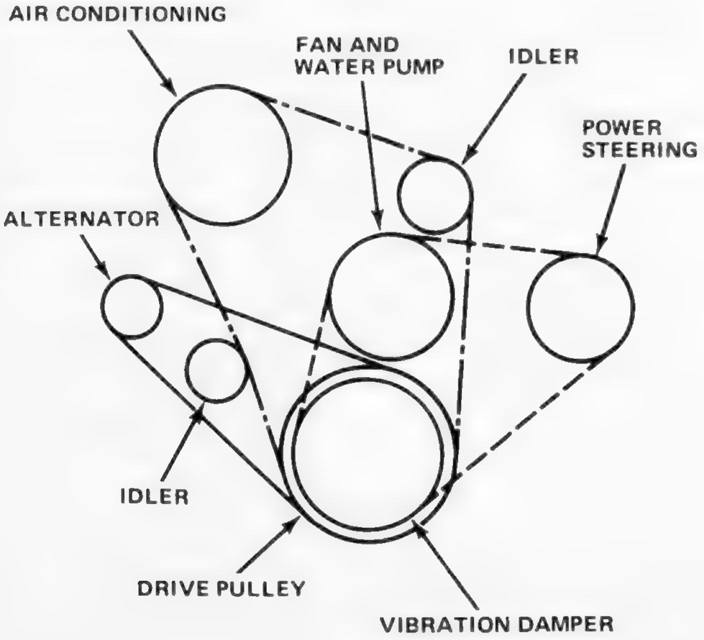
80415A



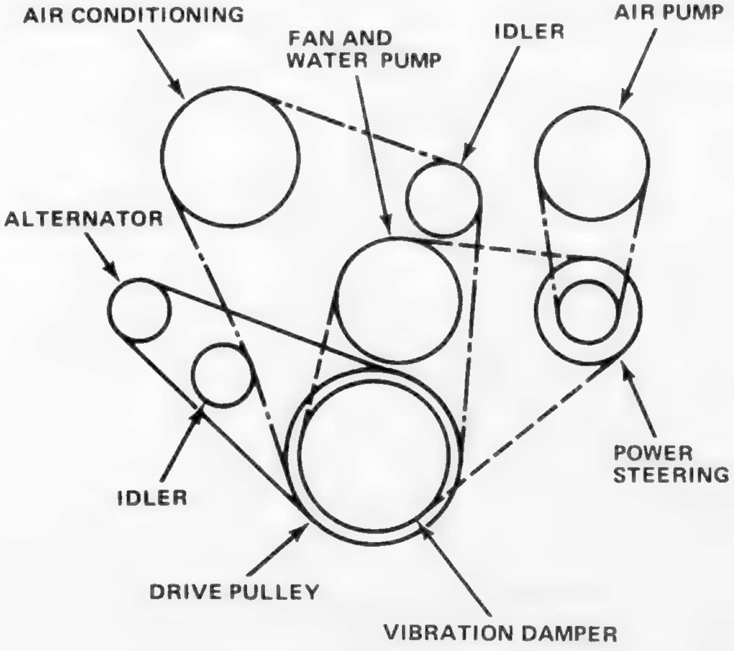
AIR CONDITIONING ONLY
SIX-CYLINDER
PACER ONLY



AIR GUARD AND AIR CONDITIONING
SIX-CYLINDER
PACER ONLY



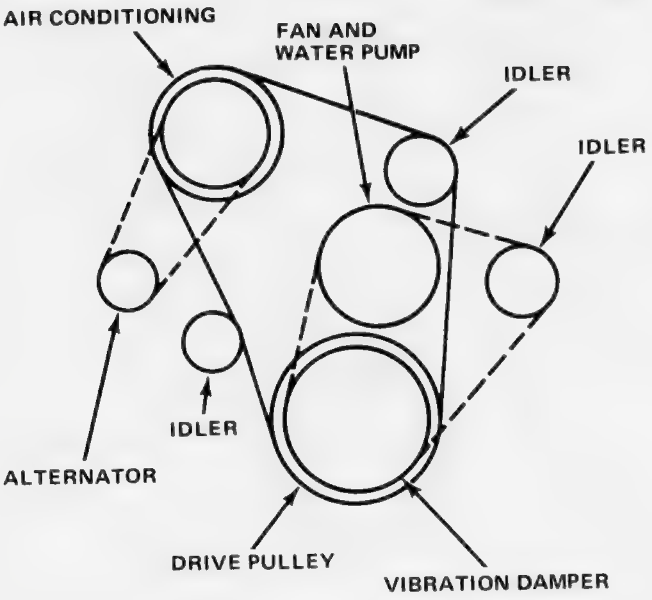
AIR CONDITIONING AND POWER STEERING
SIX-CYLINDER
PACER ONLY



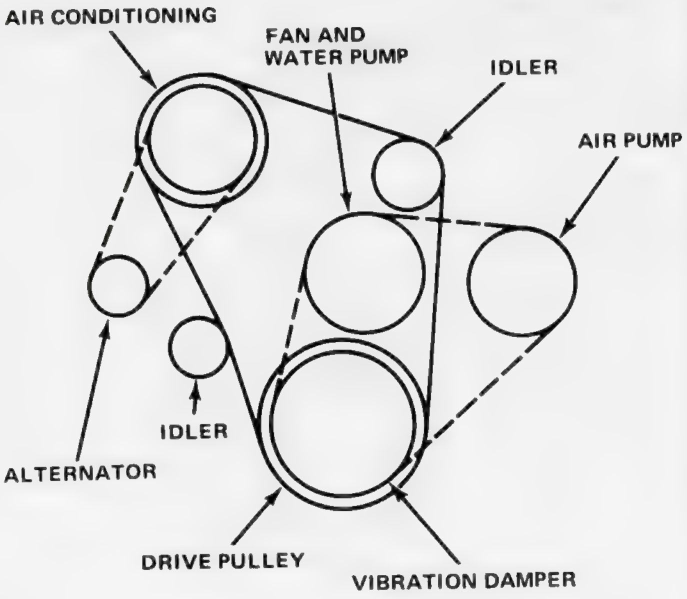
POWER STEERING, AIR GUARD AND
AIR CONDITIONING – SIX-CYLINDER
PACER ONLY

LEGEND
FRONT BELT ————————
MIDDLE BELT ——— - - ———
REAR BELT — — — — — —

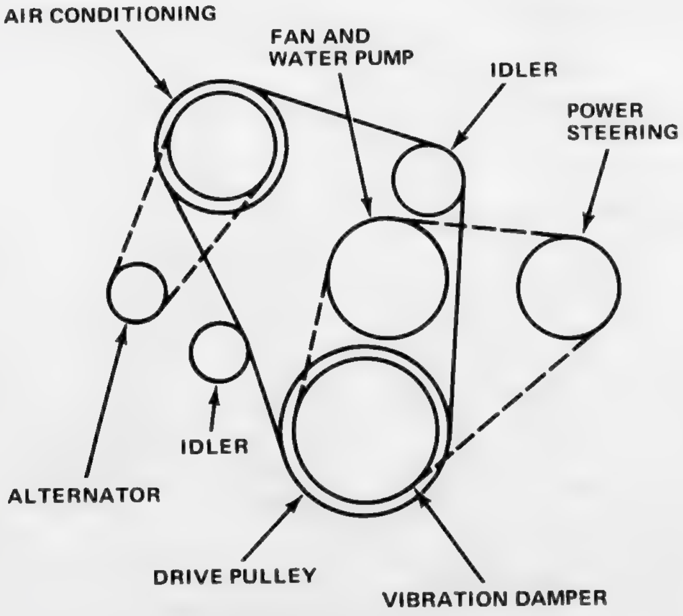
80415B



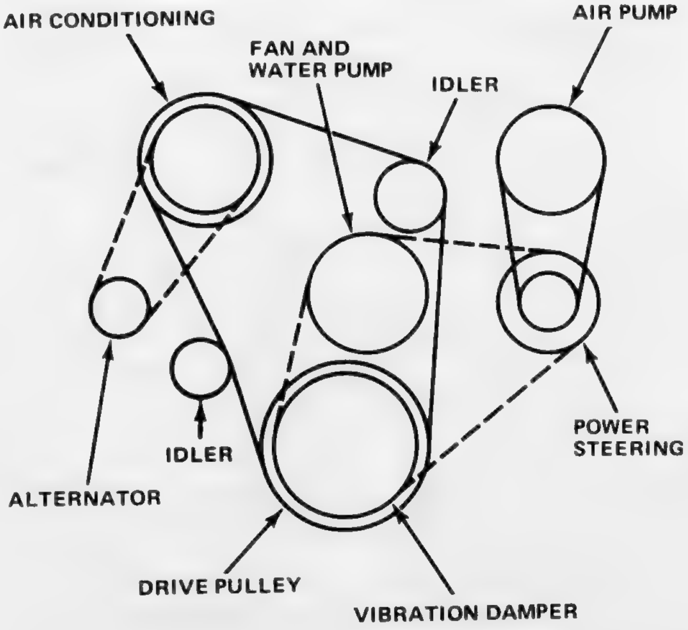
AIR CONDITIONING ONLY
SIX-CYLINDER
GREMLIN, CONCORD



AIR GUARD AND AIR CONDITIONING
SIX-CYLINDER
GREMLIN, CONCORD, MATADOR



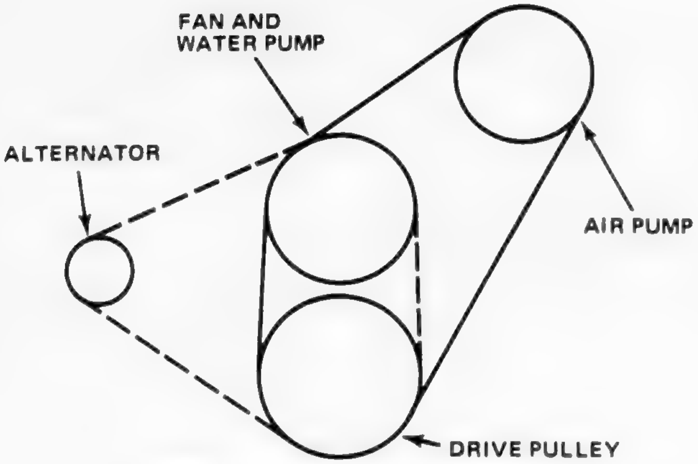
POWER STEERING AND AIR CONDITIONING
SIX-CYLINDER
GREMLIN, CONCORD



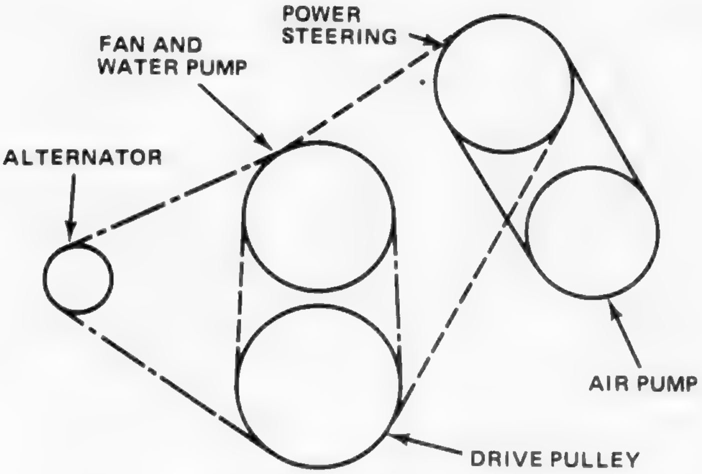
AIR GUARD, POWER STEERING AND
AIR CONDITIONING – SIX-CYLINDER
GREMLIN, CONCORD, MATADOR

LEGEND
FRONT BELT ————
MIDDLE BELT —— - ——
REAR BELT — — — — —

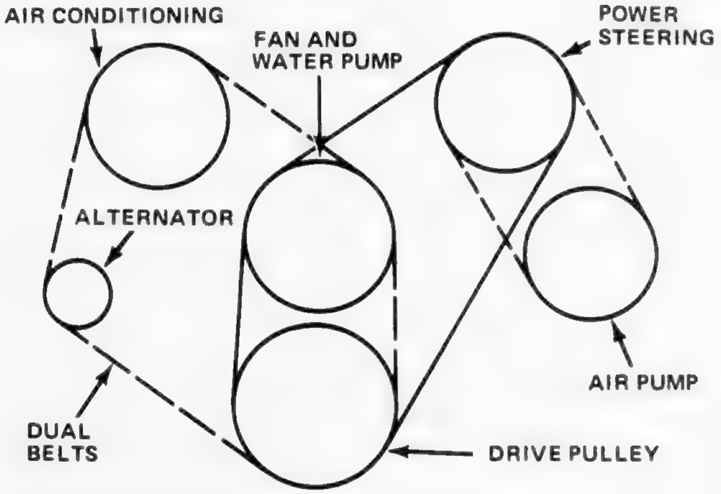
80415C



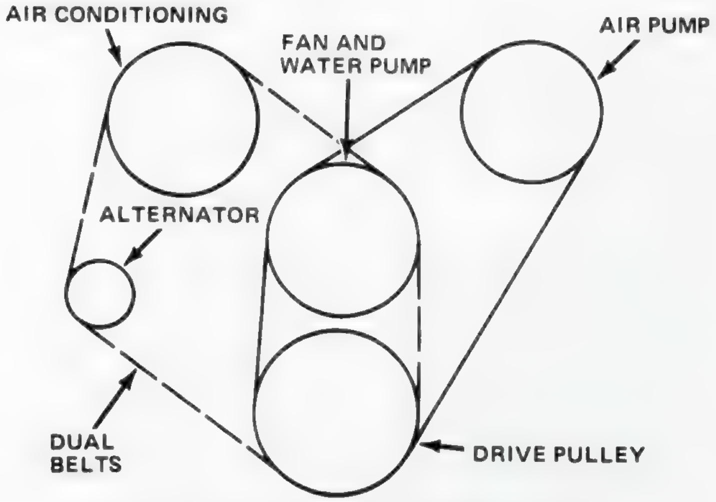
BASIC BELT ARRANGEMENT WITH AIR GUARD — EIGHT CYLINDER CONCORD, MATADOR



AIR GUARD AND POWER STEERING EIGHT-CYLINDER—ALLMODELS



AIR GUARD, AIR CONDITIONING, AND POWER STEERING—EIGHT-CYLINDER—ALL MODELS



AIR GUARD, AIR CONDITIONING—EIGHT CYLINDER CONCORD, MATADOR

LEGEND
FRONT BELT ————
MIDDLE BELT —— – ——
REAR BELT – – – – –

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	In-Use Recheck Torque	Service Set-To Torque	In-Use Recheck Torque
Accessory Drive Pulley Screws — Six-Cylinder	24	16-34	18	12-25
Air Pump Adjusting Screw				
Four-Cylinder	24	20-28	18	15-21
Six and Eight-Cylinder	27	20-30	20	15-22
Air Pump Pivot				
Four-Cylinder	27	23-31	20	17-23
Six and Eight-Cylinder	27	20-30	20	15-22
Alternator Adjusting Screw				
Four-Cylinder	24	20-28	18	15-21
Six and Eight-Cylinder	24	20-27	18	15-20
Alternator Pivot Screw				
Four-Cylinder	45	41-47	33	30-35
Six and Eight-Cylinder	45	41-47	33	30-35
Crankshaft Pulley to Damper Screw				
Six-Cylinder	27	20-34	20	15-25
Eight-Cylinder	41	34-47	30	25-35
Engine Block Heater				
T-Type	2	2-3	20 in-lbs.	17-25 in-lbs.
Compression Type	14	11-18	10	8-13
Fan and Pulley to Hub Screw				
Four-Cylinder	24	20-28	18	15-21
Six and Eight-Cylinder	24	16-34	18	12-25
Oil Cooler Line Flared Fitting Nuts	34	20-41	25	15-30
Oil Cooler Line Radiator Fitting	20	14-41	15	10-30
Power Steering Pump Adjusting Screw — Six-Cylinder	41	34-47	30	25-35
Power Steering Pump Pivot Screw — Six-Cylinder	41	34-47	30	25-35
Power Steering Pump-to-Bracket Nuts — Four-Cylinder	38	32-44	28	24-32
Power Steering Pump-to-Bracket Nuts — Eight-Cylinder	38	32-44	28	24-32
Thermostat Housing				
Four-Cylinder	19	16-22	14	12-16
Six and Eight-Cylinder	18	14-24	13	10-18
Thermostat Housing Cover Screw — Four-Cylinder	9	8-11	7	6-8
Water Pump Mounting Screws				
Four-Cylinder, M6	9	8-11	7	6-8
Four-Cylinder, M8	22	19-24	16	14-18
Six-Cylinder	18	12-24	13	9-18
Eight-Cylinder, to Block	34	24-45	25	18-33
Eight-Cylinder, to Timing Case	5	5-6	48 in-lbs.	40-55 in-lbs.

All torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

80416

Special Tools

J-23600
BELT TENSION GAUGE

COOLING SYSTEM PRESSURE
TESTER AND ADAPTER
(TYPICAL)

42005

BATTERIES 1D

SECTION INDEX

GENERAL

For 1978, all batteries use plates containing low-antimony lead compound. The benefits are less-frequent electrolyte check, lower self-discharge rate and longer shelf life. It is necessary to check electrolyte only at the beginning of the winter season and every 15,000 miles. A difficult-to-remove cell fill cap design discourages casual removal.

Also new for 1978 is the method of rating batteries. The former amp-hour rating will no longer be used. The new designation refers to the reserve capacity. Refer to Reserve Capacity below. Available batteries are rated at 75, 95, 110 and 135 minutes. Each rating has the capacity to provide the starting power needed for specific engine applications and accessories. All batteries are 12-volt, lead-acid units. Refer to Specifications for a particular battery model.

WARNING: *Explosive gases are present within the battery at all times. Avoid open flames and sparks.*

Reserve Capacity Rating

Reserve capacity is defined as the number of minutes a fully charged battery at 80°F (26.7°C) can be discharged at a steady 25 amperes and maintain a voltage of 1.75 volts per cell (10.50 volts total battery voltage) or higher. Reserve capacity ratings of AMC batteries are identified by color codes.

Reserve Capacity Rating Chart

Color Code	Reserve Capacity (Minutes)	Cold Cranking Amps at 0°F
Black	75	305
Green	95	385
Red	110	410
Blue	135	440

80492

Cold Crank Rating

The cold crank rating specifies the minimum amps a fully charged battery will deliver at 0°F for thirty seconds without falling below 7.2 volts.

Battery Coding

Each battery is date coded at the time of shipment from the manufacturer. This code is heat stamped into the end of the plastic case cover (fig. 1D-1). A second number stamped on the side of the battery case contains manufacturing codes which may be ignored.

The date code is decoded as follows:

- **Month:** A—Jan., B—Feb. (the letter I is not used)
- **Year:** 7—1977, 8—1978

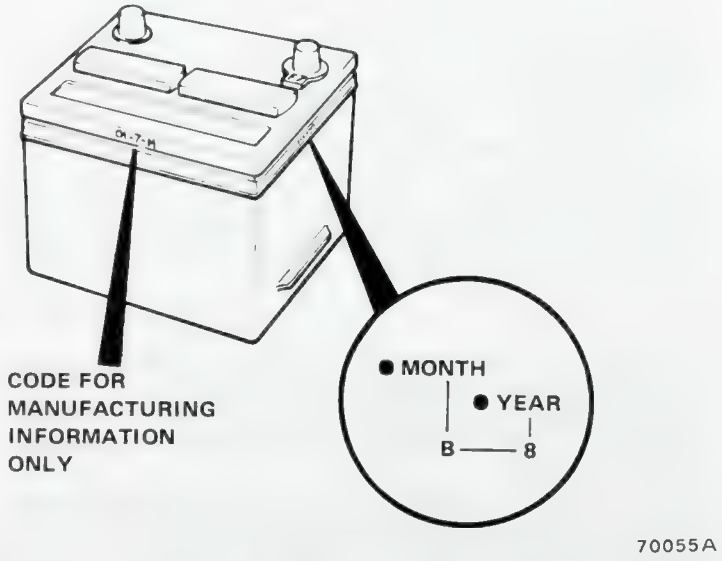


Fig. 1D-1 Date Code Location

REPLACEMENT

Removal

(1) Loosen cable clamps.

(2) Use puller to remove negative (ground) cable from battery terminal. Then remove positive cable.

(3) Note location of positive and negative terminals so battery can be properly positioned during installation.

(4) Loosen holddowns and remove battery.

(5) Inspect cables for corrosion and damage. Remove corrosion using wire brush and soda solution. Replace cables that have damaged or deformed terminals.

(6) Inspect battery tray and holddowns for corrosion. Remove corrosion with wire brush and soda solution. Paint exposed bare metal. Replace damaged components.

(7) Clean outside of battery case if original battery is to be installed. Flush top cover with soda solution to remove acid film. Be careful to prevent soda solution from entering cells. Remove corrosion from terminals with wire brush. Inspect case for cracks or other damage which would result in leakage of electrolyte.

Installation

(1) Refer to Specifications to determine that battery is of correct rating for engine.

(2) Use hydrometer to test battery. Charge if necessary.

(3) Position battery in tray. Be sure positive and negative terminals are correctly located. Cables should be able to reach their respective terminals without stretching.

CAUTION: *Be sure battery tray is clear of loose hardware or debris which could damage battery case.*

(4) Tighten holddowns, a little at a time, and alternating from end to end, so as to not distort or break battery case. On cars with single holddown at base of battery, be sure tang on tray is engaged in battery base before tightening holddown.

(5) Connect and tighten positive cable first. Then connect and tighten negative cable.

NOTE: *The tapered positive terminal is 1/16 inch larger in diameter than the negative terminal, and the opening in the positive cable clamp is correspondingly larger to fit.*

CAUTION: *It is imperative that the cables be connected to the battery, positive-to-positive and negative-to-negative. Reverse polarity will damage alternator diodes and radio.*

(6) Apply thin coating of grease to cable terminals.

(7) Inspect engine-to-crossmember negative strap for condition and good connection.

MAINTENANCE

CAUTION: *Always observe the correct polarity. Reversed battery connections will damage the alternator diodes and radio.*

The NEGATIVE battery terminal is grounded to the engine.

It is important that the battery be in a fully charged condition when a new car is delivered. The continual operation of a partially charged battery could shorten its life.

Check electrolyte level in the battery at 15,000-mile intervals and at the beginning of the winter season. Add distilled water to each cell until the liquid level reaches the bottom of the vent well. DO NOT OVERFILL. Use a putty knife or other suitable wide tool to pry filler caps off (fig. 1D-2). Do not use a screwdriver.

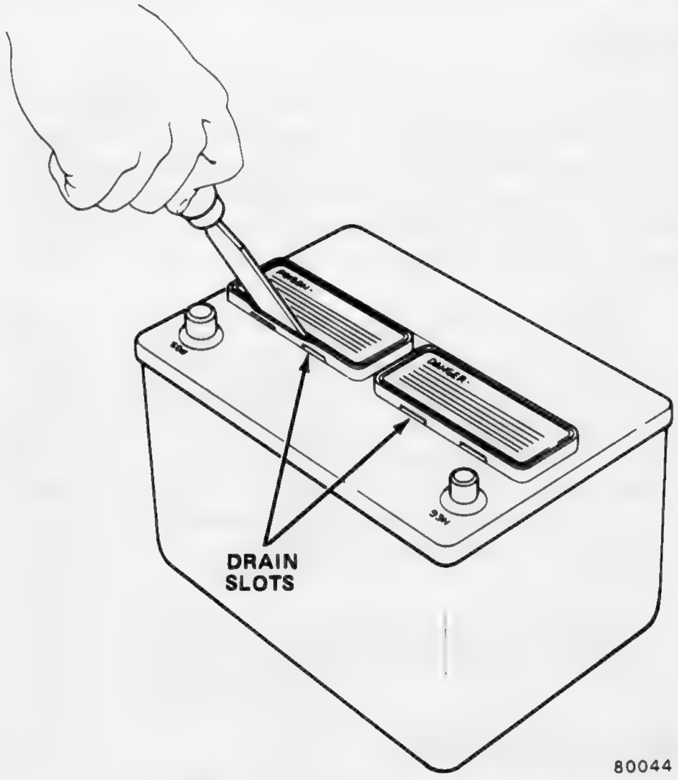


Fig. 1D-2 Removing Filler Cap

Operate the engine immediately after adding water, particularly in cold weather, to assure proper mixing of the water and acid.

Check the external condition of the battery and the cables periodically.

The holddown should be tight enough to prevent the battery from shaking to prevent damage to the battery case.

Take particular care to see that the top of the battery is free of acid film and dirt between the battery terminals. For best results when cleaning the battery, wash with a diluted ammonia or soda solution to neutralize any acid present and then flush with clean water. Keep filler caps tight so that the neutralizing solution does not enter the cells.

To ensure good contact, the battery cables must be tight on the battery posts. Check to be sure the terminal clamp has not stretched. This could cause the clamp ends to become butted together without actually being tight on the post. If the battery posts or cable terminals are corroded, disconnect the cables by loosening the terminal clamp screw and removing the clamp with the aid of a puller. Do not twist, hammer or pry on the cable to free it from the battery post. Clean the terminals and clamps with a soda solution and a wire brush. Connect the cables to the battery posts, and apply a thin coat of grease. Inspect the battery negative cable and engine-to-crossmember negative strap for good connection and condition.

Frozen Electrolyte

A 3/4-charged automotive battery is in no danger of damage from freezing. Keep batteries at 3/4 charge or more, especially during winter weather.

Replace the battery if the electrolyte is either slushy or frozen. A battery with this condition, depending on the severity of the freeze, may accept and retain a charge and even perform satisfactorily under a load test. However, after 120 to 150 days in service, a reduction in capacity and service life will become apparent as the individual plates lose their active material.

CAUTION: *Do not attempt to charge or use a booster on a battery with frozen electrolyte as it may cause the frozen battery to explode.*

Freezing Temperature Chart

Specific Gravity (Corrected to 80° F)	Freezing Temperature
1.270	– 84°F
1.250	– 62°F
1.200	– 16°F
1.150	+ 05°F
1.100	+ 19°F

60339

Battery Storage

All automotive wet batteries will discharge slowly when stored. Batteries discharge faster when warm than when cold. For example, at 100°F (37.8°C), a normal self-discharge of 0.0024 specific gravity per day could be expected. At 50°F (10°C), a discharge of 0.0003 specific gravity would be normal. Refer to Self-Discharge Rate chart.

Before storage, clean the battery case with a baking soda solution and wipe the case dry. When storing a battery, charge fully (no change in specific gravity after three readings taken one hour apart) and then store in as cool and dry a place as possible.

Fully charge a stored battery before putting it into service. Refer to Replacement for installation procedures.

Self-Discharge Rate Chart

Temperature	Approximate Allowable Self-Discharge Per Day For First Ten Days (Specific Gravity)
100°F (37.8°C)	0.0024 points
80°F (26.7°C)	0.0009 points
50°F (10°C)	0.0003 points

60338

CHARGING

Discharge Chemical Action

A cell is discharged by completing an external circuit such as cranking a starter motor. Sulfuric acid, acting on both positive and negative plates, forms a new chemical compound called lead sulfate. The sulfate is supplied by the acid solution (electrolyte). The acid becomes weaker in concentration as the discharge continues. The amount of acid consumed is in direct proportion to the amount of electricity removed from the battery. When the acid in the electrolyte is partially used up by combining with the plates and can no longer deliver electricity at a useful voltage, the battery is said to be discharged.

The gradual weakening of the electrolyte in proportion to the electricity delivered allows the use of a hydrometer to measure how much unused acid remains with the water in the electrolyte. This information then can be used to determine approximately how much electrical energy is left in each cell.

Charge Chemical Action

The lead sulfate in the battery is decomposed by passing a current through the battery in a direction opposite to that of the discharge. The sulfate is expelled from the plates and returns to the electrolyte, gradually restoring it to its original strength. Hydrogen and oxygen gases are given off at the negative and positive plates as the plates approach the fully charged condition. This is caused by an excess of charging current not totally accepted by the plates. A perforated filler and a relief valve in each cap relieve excess gases.

Dry Charge Battery

WARNING: *Before activating a dry-charged battery, carefully read the instructions and poison/danger warning on the electrolyte carton.*

Do not remove vent seals until battery is to be activated. Once the vent seals are removed, the battery must be activated immediately. Discard vent seals after removal.

Activation Procedure

(1) Fill each cell with battery electrolyte to bottom of vent well, observing handling precautions listed on electrolyte carton.

(2) After cells are filled, tilt battery from side to side to release air bubbles.

(3) Recheck electrolyte level in each cell and add as necessary.

NOTE: *Uneven filling of cells will affect the battery capacity and service life.*

(4) Install vent caps supplied with battery.

(5) Check battery case for leakage to make sure no damage occurred in handling.

(6) Boost charge for 15 minutes at 30 amps or slow charge until battery is gassing freely.

(7) Install battery in car.

NOTE: *Since the apparent state of charge of the battery as indicated by a hydrometer is depressed for the first few cycles, load testing is the only valid test at the time of activation. Hydrometer testing may be used after the battery has been cycled in service.*

The specific gravity of a newly installed AMC battery will be approximately 1.225 (±0.010). The specific gravity will normally rise to 1.250 to 1.265 after a few days in service.

NOTE: *Electrolyte is made up of sulfuric acid and pure water. Approximately 35 percent by weight or 24 percent by volume is acid.*

CAUTION: *Never add pure acid to a battery.*

Slow Charge

Slow charging is the preferred method of recharging a battery. The slow charge method may be safely used, regardless of charge condition of the battery, provided the electrolyte is at the proper level in all cells and is not frozen.

CAUTION: *Do not attempt to charge or use a booster on a battery with frozen electrolyte as it may cause the frozen battery to explode.*

The normal charging rate for a battery is one amp per positive plate per cell. For example, a 54-plate battery has nine plates per cell (54 plates divided by 6). There is always one more negative plate per cell than positive. The charging rate should be four amps. A 70-amp hour battery has 66 plates or 11 plates per cell. The charging rate for this battery would be five amps (5 positive and 6 negative plates per cell). A minimum period of 24 hours is required when using this method.

A battery may be fully charged by the slow charge method unless it is not capable of accepting a full charge. A battery is in a maximum charged condition when all cells are gassing freely and three corrected specific gravity readings, taken at hourly intervals, indicate no increase in specific gravity.

Fast Charge

CAUTION: *Always disconnect the battery cables before using a fast charger.*

A battery may be charged at any rate which does not cause the electrolyte temperature of any cell to exceed 125°F (51.7°C) and which does not cause excessive gassing and loss of the electrolyte.

A fast charger cannot be expected to fully charge a battery within an hour, but will charge the battery sufficiently so that it may be returned to service. The battery will then be fully charged by the car charging system, provided the car is operated a sufficient length of time.

Booster Charge

The correct method for starting a car with a discharged battery requires either a portable starting unit or a booster battery. When using either method, it is essential that connections be made correctly.

When using a portable starting unit, the voltage must not exceed 16 volts or damage to the battery, alternator, or starter may result. Because of the accompanying high voltage, a fast charger must not be used for booster starting.

WARNING: *Battery action generates hydrogen gas which is flammable and explosive. Hydrogen gas is present within a battery at all times even when a battery is in a discharged condition. Keep open flames and sparks (including cigarettes, cigars, pipes) away from the battery. Always wear eye protection when working with a battery.*

WARNING: *During cold weather, if fluid is not visible or ice is evident, do not attempt to jump-start as the battery could rupture or explode. The battery must be brought up to 40°F (4.4°C) and water added if necessary before it can be safely jump-started or charged.*

(1) Remove vent caps from booster battery and cover cap openings with moist cloth.

CAUTION: *If the car is being jump-started by a battery in another car, the cars must not contact each other.*

(2) Connect a jumper cable between positive posts of batteries. Positive post has "+" stamped on it. POS is also embossed on battery cover in 1/8-inch letters adjacent to battery terminal.

BATTERY DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

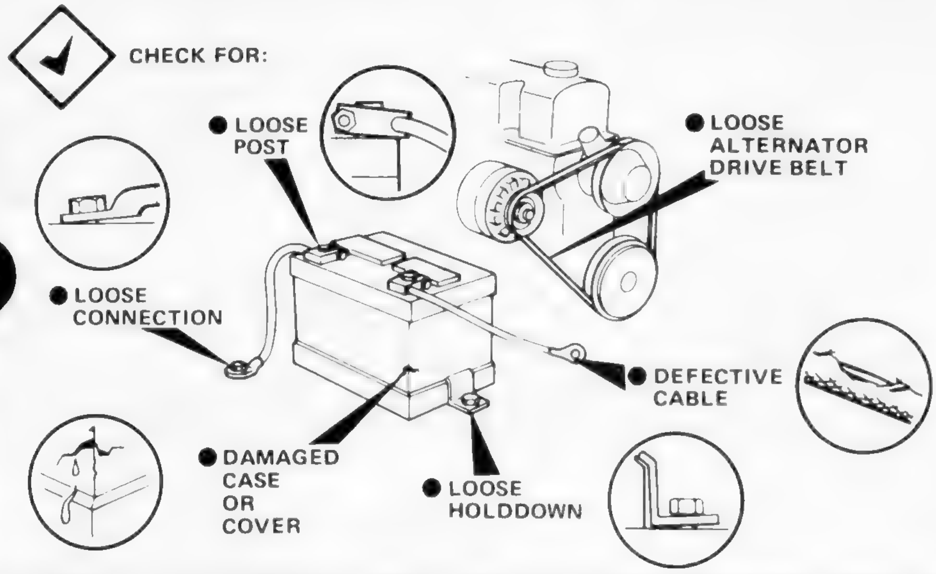
Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: ENGINE WILL NOT CRANK

Chart 1

STEP **SEQUENCE** **RESULT**

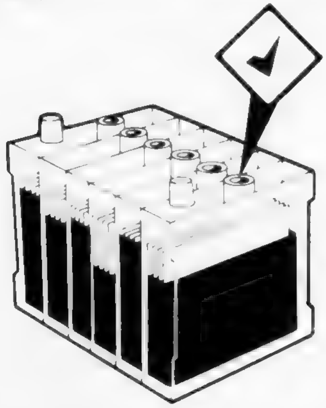
1



REPAIR OR REPLACE IF NECESSARY → **2**

2

● CHECK ELECTROLYTE LEVEL AND SPECIFIC GRAVITY IN EACH CELL AND RECORD READINGS.



ELECTROLYTE LEVEL TOO LOW FOR SPECIFIC GRAVITY TEST — ADD WATER. CHARGE BATTERY FOR 10 MIN. AT 20 AMPS. MEASURE SPECIFIC GRAVITY.

OK → **5**

AVERAGE SPECIFIC GRAVITY 1.225 OR MORE CELL READINGS EQUAL WITHIN .050

~~OK~~ — REPLACE BATTERY → **6**

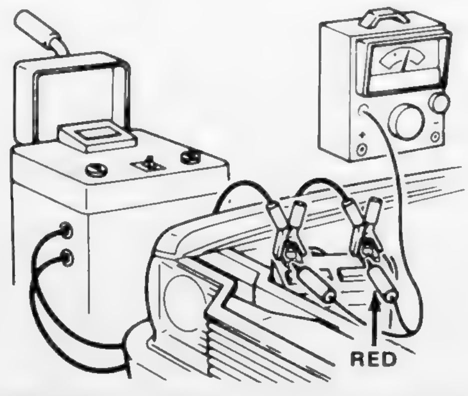
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE BUT CELL READINGS VARY .050 OR MORE

~~OK~~ → **3**

AVERAGE SPECIFIC GRAVITY BELOW 1.225

3

- CONNECT BATTERY CHARGER AND VOLTMETER
- CHARGE BATTERY FOR 3 MINUTES AT 40 AMPS
- AT THE END OF 3 MINUTES READ VOLTMETER WHILE CHARGER IS STILL CHARGING



OK → **4**

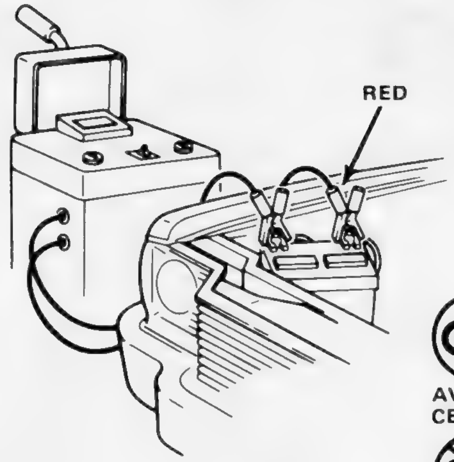
VOLTAGE IS 15.5 OR LESS

~~OK~~ — REPLACE BATTERY → **6**

VOLTAGE ABOVE 15.5

STEP | **SEQUENCE** | **RESULT**

4



CHARGE BATTERY AS INDICATED IN CHART, AFTER CHARGE IS COMPLETED, RECHECK SPECIFIC GRAVITY.

AVERAGE SPECIFIC GRAVITY	CHARGE RATE (AMPS)	TIME
LESS THAN 1.125	5	12 HOURS
1.125 TO 1.149	20	90 MIN.
1.150 TO 1.174	20	70 MIN.
1.175 TO 1.199	20	50 MIN.
1.200 TO 1.224	20	30 MIN.

OK → **5**

AVERAGE SPECIFIC GRAVITY 1.225 OR MORE
CELL READINGS EQUAL WITHIN .050

~~OK~~ → REPLACE BATTERY → **6**

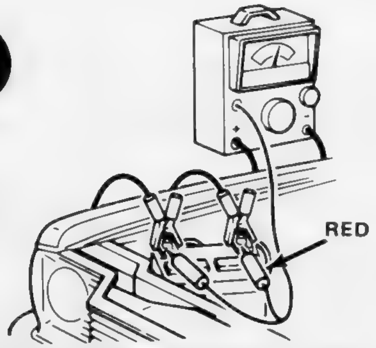
AVERAGE SPECIFIC GRAVITY 1.225 OR MORE
BUT CELL READINGS VARY .050 OR MORE

5

- CLEAN BATTERY POST AND CABLE ENDS
- CONNECT HEAVY LOAD TESTER
- DETERMINE HEAVY LOAD FROM CHART
- ADJUST TESTER TO LOAD
- HOLD LOAD FOR 15 SECONDS
- READ VOLTMETER

HEAVY LOAD OUTPUT TEST

BATTERY COLOR CODE	RESERVE CAPACITY (MINUTES)	HEAVY LOAD
BLACK	75	145
GREEN	95	180
RED	110	190
BLUE	135	230



- VOLTAGE READING 9.6 OR MORE → **6**
- VOLTAGE READING LESS THAN 9.6 → REPLACE BATTERY → **6**

6

OK → STOP

ENGINE CRANKS

~~OK~~ → PERFORM STARTER DIAGNOSIS IN STARTER CHAPTER

ENGINE DOES NOT CRANK

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(3) Connect one end of second jumper cable to negative terminal of booster battery. NEG is embossed on battery cover in 1/8-inch letters adjacent to battery terminal. Make certain clamps are making good contact. DO NOT CONNECT OTHER END OF JUMPER CABLE TO NEGATIVE TERMINAL OF DISCHARGED BATTERY. Connect to a screw, bracket or nut on engine. Do not connect jumper to carburetor, air cleaner or fuel line. Keep cables clear of belts and pulleys.

(4) When engine starts, remove jumper cables. Disconnect clamp on engine first.

(5) Discard cloth used to cover cap openings because it has been exposed to sulfuric acid.

(6) Install vent caps.

TESTING

General

NOTE: *A complete battery test includes cleaning the top of the battery case, cleaning terminals and cable clamps, and performing hydrometer and heavy load tests.*

The condition of a battery may be determined from the results of two tests—state of charge (hydrometer test) and ability to deliver current (heavy load test).

Perform the hydrometer test first. If specific gravity indicates less than 1.225, charge the battery before further testing. A battery which does not accept a charge is defective and no further testing is required.

NOTE: *A sulfated battery may require an overnight slow charge to determine if the sulfation is light enough to be broken down by a charge.*

A battery which is over 75 percent charged and does not pass the heavy load test is defective.

In rare cases where a battery goes dead and no apparent cause can be found, fully charge the battery and allow it to stand on a shelf for three to seven days to determine if self-discharge is excessive. The Self-Discharge Rate chart shows allowable self-discharge for the first ten days of standing after a battery has been fully charged. A battery is fully charged when all cells are gassing freely and three corrected specific gravity readings, taken at hourly intervals, indicate no increase in specific gravity.

Hydrometer Test

NOTE: *Periodically disassemble the hydrometer and wash components with soap and water. Inspect the float for possible leaks. If the paper inside has turned brown, the float is defective.*

Before testing, visually inspect the battery for any damage (broken container, cover, loose post, etc.) that would make the battery unserviceable. To read the hydrometer correctly, position the top surface of the electrolyte in the hydrometer at eye level (fig. 1D-3). Disregard the curvature of the liquid where the surface rises against the float due to surface tension. Draw in only enough electrolyte to keep the float off the bottom of the hydrometer barrel with the bulb released. Keep the hydrometer in a vertical position while drawing in liquid and taking the reading. Be careful when inserting the tip of the hydrometer into the cell to avoid damage to separators. Broken separators could result in premature battery failure.

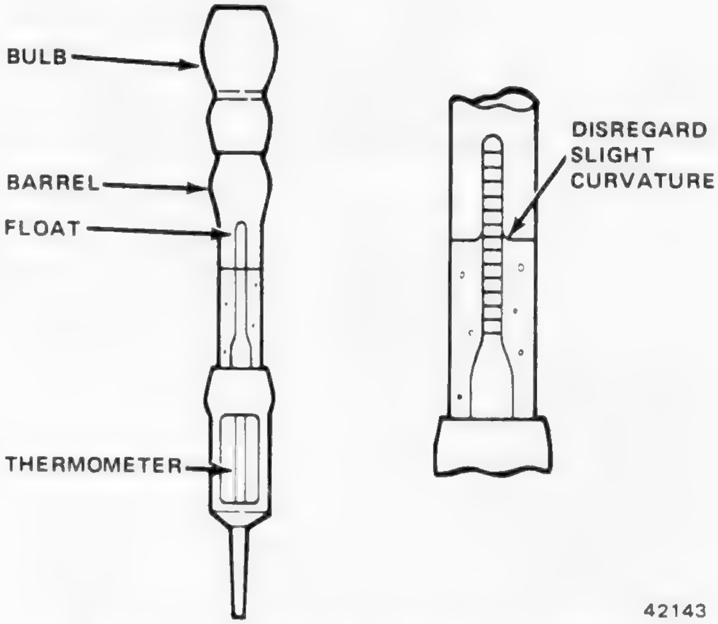

Fig. 1D-3 Hydrometer and Proper Method of Reading

Hydrometer floats are generally calibrated to indicate correctly at only one fixed temperature, 80°F. When taking a reading at any other temperature, a correction factor is required. The correction factor is approximately 0.004 specific gravity, referred to as 4 points of gravity. For each 10°F above 80°F, add 4 points. For each 10°F below 80°F, subtract 4 points. Always correct the readings for temperature variation. Test the specific gravity of the electrolyte in each battery cell.

Example: A battery is tested at 10°F and has a specific gravity of 1.240. The actual specific gravity is found as follows:

Number of degrees above or below 80°F equals 70 degrees (80° -10 degrees).

70° divided by 10° (each 10° difference) equals 7.

7 x 0.004 (temperature correction factor) equals 0.028.

Temperature is below 80° so temperature correction is subtracted.

Temperature corrected specific gravity is 1.212 (1.240 minus 0.028)

A fully charged battery should have a specific gravity of 1.250 to 1.265.

Specific Gravity

State of Charge	Specific Gravity (Cold and Temperate Climates)
Fully Charged	1.265
75% Charged	1.225
50% Charged	1.190
25% Charged	1.155
Discharged	1.120

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If the average specific gravity of all cells is above 1.225, but the variation between cells is more than 50 points (0.050), the battery is unserviceable. Remove the battery from the car for further testing.

If the average specific gravity of one or more cells is less than 1.225, recharge the battery at approximately 5 amperes until 3 consecutive hourly readings are constant.

At the end of the charge period, if the cell variation is more than 50 points (0.050), replace the battery.

When the specific gravity of all cells is above 1.225 and variation between cells is less than 50 points, the battery may be tested under load.

Heavy Load Test

NOTE: *The following instructions refer to Amserv Battery-Alternator-Regulator Tester, Model 21-307.*

(1) Before performing heavy load test, battery must be fully charged. Refer to Slow Charge.

(2) Turn carbon pile knob of battery tester to OFF position (fig. 1D-4).

(3) Turn selector knob to AMP position.

(4) Connect test leads as shown.

(5) Turn carbon pile knob clockwise until ammeter reading indicates as follows:

- 150 amperes for 75 minute reserve capacity
- 180 amperes for 95 minute reserve capacity
- 190 amperes for 110 minute reserve capacity
- 230 amperes for 135 minute reserve capacity

(6) Maintain load for 15 seconds. Turn selector switch to VOLTS, and read scale.

If the the voltmeter reading was 9.6 volts or higher with the battery temperature at a minimum of 70°F, the battery has good output capacity. If less than 9.6 volts, replace the battery.

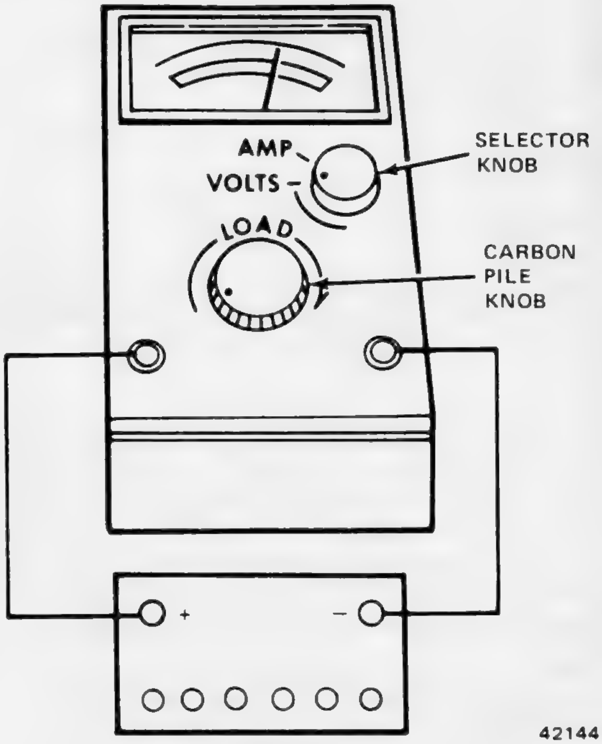

Fig. 1D-4 Heavy Load Test

SPECIFICATIONS

Battery Specifications

Rating	
232-258-304 Engines	
Reserve	75 min
Plates	54
360 Engines	
Reserve	95 min
Plates	66

Optional Batteries	
Reserve	95 min
Plates	66
Reserve	110 min
Plates	66
Reserve	*135 min
Plates	66

*Fleet and Dealer Option

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Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (in.lbs.)	
	Service Set-To Torque	In-Use Recheck Torque	Service Set-To Torque	In-Use Recheck Torque
Battery Box Screw	16	14-20	145	125-175
Battery Cable Clamp	8	—	75	—
Battery Holddown Screws (except Gremlin and Concord with 50 amp and Pacer)	7	6-10	65	50-90
Battery Holddown Screw (Gremlin and Concord with 50 amp and all Pacer)	15	12-18	135	110-160

All Torque values given in newton-meters and inch-pounds with dry fits unless otherwise specified. Refer to the Standard Torque Specifications and Capscrew Markings Chart in Section A of this manual for any torque specifications not listed above.

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CHARGING SYSTEMS

1E

SECTION INDEX

FOUR- AND SIX-CYLINDER CHARGING SYSTEM

GENERAL

The Delco 10-SI series charging system is a negative-ground system consisting of three main components: an alternator, a regulator and a battery. It is used on all four- and six-cylinder engines. The non-adjustable regulator is a solid-state device and is mounted inside the alternator housing.

Available alternators are rated at 37, 55 and 63 amperes.

COMPONENTS

Alternator

The alternator (fig. 1E-1) is belt-driven by the engine. Its major components are front and rear housings, stationary windings (stator), rotating field windings (rotor) and rectifying diodes.

The rotor assembly is supported in the drive end housing by a ball bearing and in the slip ring end housing by a roller bearing. These rotor bearings are manufactured with adequate lubricant and do not require periodic service. Two brushes carry current through the two slip rings to the field coil mounted on the rotor and provide service-free operation. The alternator assembly requires no periodic adjustments or maintenance.

The stator windings are assembled on the inside of a laminated core that forms part of the alternator frame. A rectifier bridge connected to the stator windings contains six diodes (three positive and three negative) molded into an assembly which is connected to the stator windings. The rectifier bridge changes the stator AC voltage to DC voltage which appears at the output terminal. The blocking action of the diodes prevent battery discharge through the alternator.

The diode blocking action eliminates need for a conventional cutout relay. Alternator field current is supplied through a diode trio which is also connected to the stator windings.

A capacitor, or condenser, mounted in the end housing protects the rectifier bridge and diode trio from high voltages and suppresses radio noise.

Voltage Regulator

The voltage regulator utilizes an integrated circuit to regulate current supplied to the alternator field. All regulator components are enclosed in a solid mold, and this unit along with the brush holder assembly is attached to the rear housing. The voltage regulator is not adjustable.

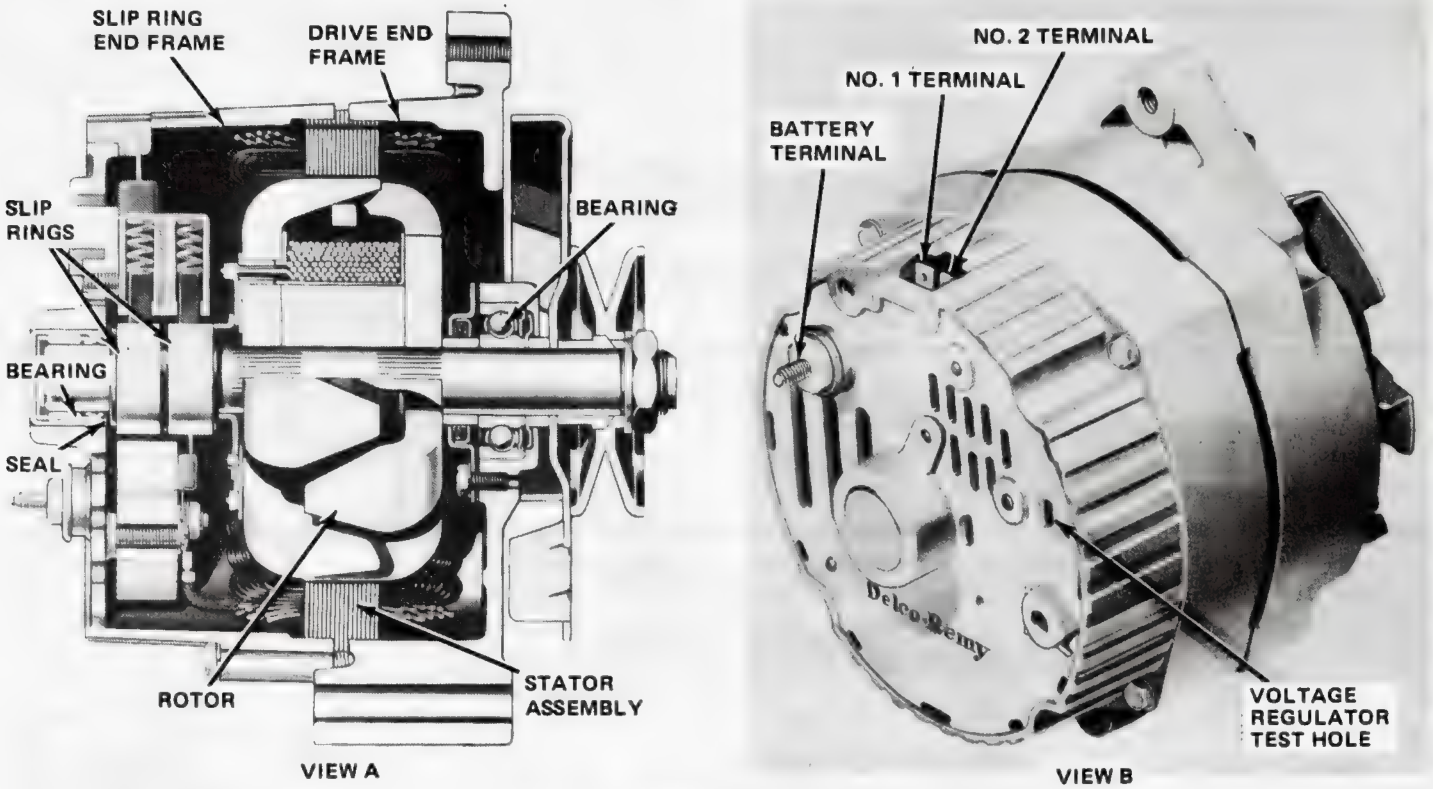


Fig. 1E-1 Delco 10-SI Series Alternator

OPERATION

General

Charging of the battery is accomplished by supplying current directly from the alternator output terminal (heavy red wire) to the battery, using the starter solenoid as a junction point. The positive battery cable joins the heavy red wire at the solenoid. The alternator is grounded to the engine to complete the return circuit to the negative side of the battery. The amount of charge the battery receives depends upon the state of charge and internal condition of the battery, proper operation of the voltage regulator and the amount of current being consumed by electrical loads such as heater blower motor, lamps and rear window defogger.

Energizing the System

When the ignition switch is turned to the ON position (fig. 1E-2), current from the battery flows through the indicator lamp and 15-ohm resistance wire to the alternator No. 1 terminal, through resistor R1, diode D1, and the base-emitter of transistor TR1 to ground, then back to the battery. This turns transistor TR1 ON and current flows through the alternator field coil and TR1 back to the battery. The indicator lamp then lights.

Voltage Output

When the rotor starts turning, AC voltage is generated in the stator windings. The diode trio converts some of this to DC field current which flows through the field, TR1, and then through the grounded diodes in the rectifier bridge back to the stator. The six diodes in the rectifier bridge change the stator AC voltage to DC voltage which appears between ground and the alternator BAT terminal. As alternator speed increases, current is provided for charging the battery and operating electrical accessories. The same voltage also appears at the BAT and No. 1 terminals, and the indicator lamp goes out, indicating that the alternator is producing voltage.

Regulation

The No. 2 terminal on the alternator is always connected to the battery, but the discharge current is limited to a negligible value by the high resistances of R2 and R3. As the alternator speed and voltage increase, the voltage between R2 and R3 increases and causes zener diode D2 to conduct. Transistor TR2 then turns ON and TR1 turns OFF. With TR1 OFF, the field current and system voltage decrease, and D2 then blocks current flow, causing TR1 to turn back ON. The field current and system voltage increase. This cycle repeats many times per second to limit the alternator voltage to a preset value.

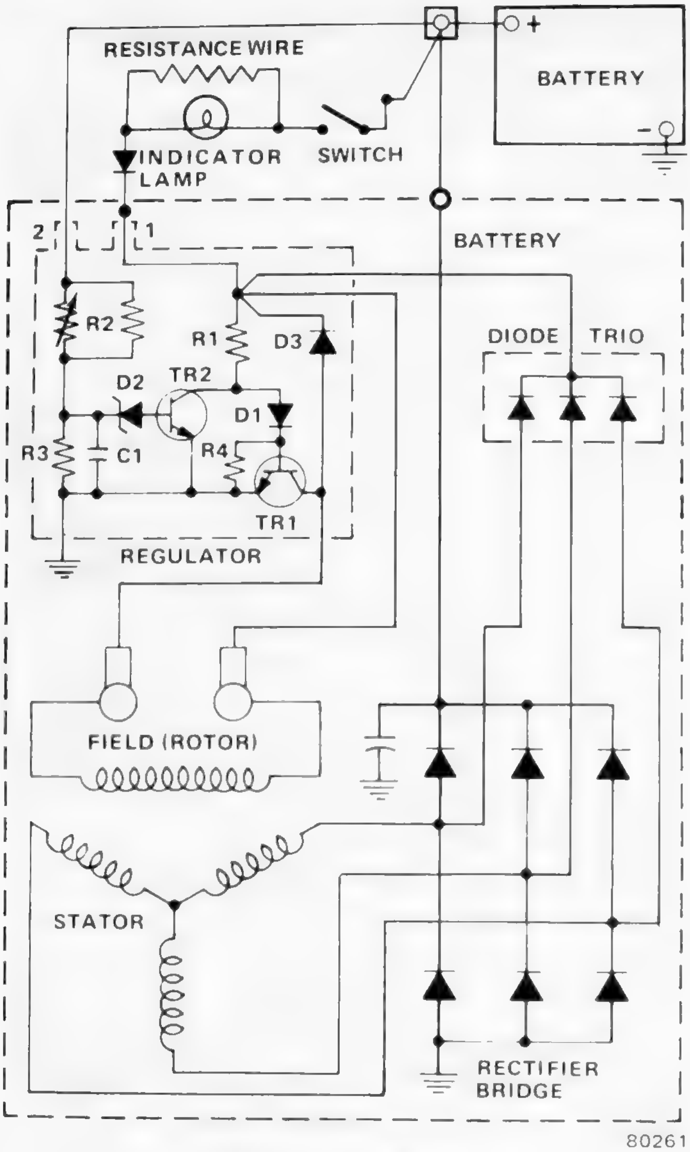


Fig. 1E-2 Charging System Schematic

Capacitor C1 provides voltage continuity across R3, R4 prevents excessive current through TR1 at high temperatures, and D3 prevents high induced voltages in the field windings when TR1 turns OFF. Resistor R2 is a thermistor which causes the regulated voltage to vary with temperature, thus providing the optimum voltage for charging the battery.

TROUBLESHOOTING

Close adherence to the following procedures in the order presented will lead to the location and correction of charging system defects in the shortest possible time.

To avoid damage to the electrical equipment, always observe the following precautions:

- Do not polarize the alternator.
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed.
- NEVER operate the alternator with the output terminal circuit open and No. 1 and No. 2 terminals connected to the alternator.
- Make sure the alternator and battery have the same ground polarity.
- When connecting a charger or a booster battery to the vehicle, connect negative to negative and positive to positive.

Trouble in the charging system is indicated by one or more of the following conditions:

- Faulty indicator lamp operation.
- An undercharged battery, evidenced by slow cranking and low specific gravity readings.
- An overcharged battery, evidenced by excessive water usage.

Before making any electrical checks, perform a visual inspection of all charging system components and wiring.

Visual Inspection

Check for clean and tight cable connections at the battery posts, engine block, and starter solenoid. Check for corrosion and loose wire connections at the alternator, starter motor solenoid, and the alternator voltage regulator. Inspect all wiring for cracked or broken insulation. Be sure alternator mounting bolts are tight and unit is properly grounded. Inspect the fluid level in the battery and add water if necessary. Check for loose alternator drive belt.

Alternator Noise

Alternator noise is usually caused by one of the following conditions:

- Loose mounting screws.
- Loose or misaligned pulley.
- Worn or dirty bearings.
- Out-of-round or rough slip rings.
- Defective brushes.
- Shorted rectifier diode (indicated by high-pitched whine).

Noise from the cooling system can also sound like alternator noise. Disconnect and plug the heater hoses to eliminate the possibility of the alternator bracket acting as a sounding board for heater core noises.

Indicator Lamp Diagnosis

For a complete diagnosis of faulty indicator lamp operation, refer to Chapter 1L—Power Plant Instrumentation.

Overcharged-Undercharged Battery

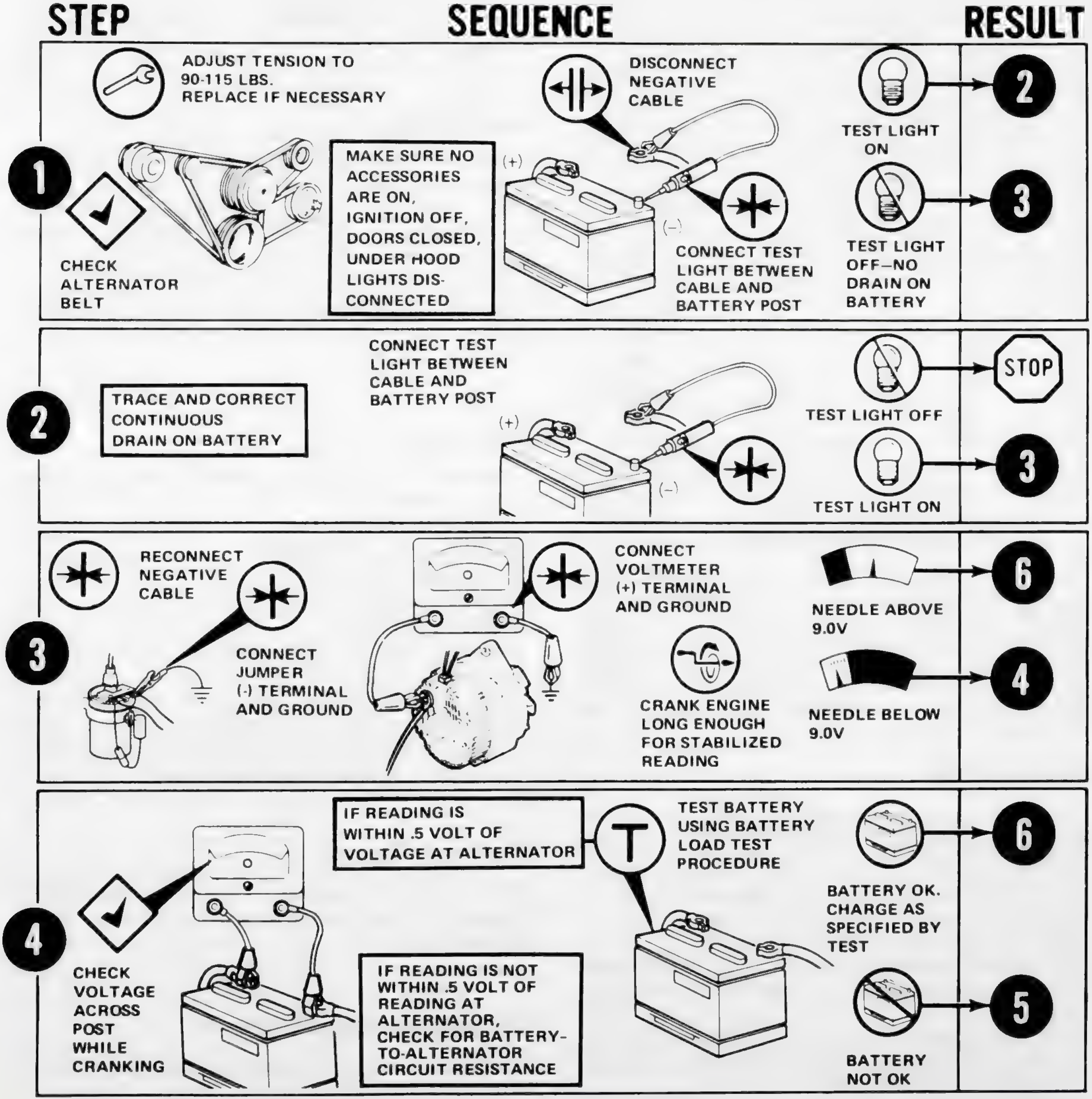
For battery overcharged-undercharged diagnosis, refer to DARS Charts 1 and 2.

FOUR- AND SIX-CYLINDER CHARGING SYSTEM DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: BATTERY UNDERCHARGED

Chart 1



1 CHECK ALTERNATOR BELT

ADJUST TENSION TO 90-115 LBS. REPLACE IF NECESSARY

MAKE SURE NO ACCESSORIES ARE ON, IGNITION OFF, DOORS CLOSED, UNDER HOOD LIGHTS DISCONNECTED

DISCONNECT NEGATIVE CABLE

CONNECT TEST LIGHT BETWEEN CABLE AND BATTERY POST

TEST LIGHT ON → 2

TEST LIGHT OFF—NO DRAIN ON BATTERY → 3

2 TRACE AND CORRECT CONTINUOUS DRAIN ON BATTERY

CONNECT TEST LIGHT BETWEEN CABLE AND BATTERY POST

TEST LIGHT OFF → STOP

TEST LIGHT ON → 3

3 RECONNECT NEGATIVE CABLE

CONNECT JUMPER (-) TERMINAL AND GROUND

CONNECT VOLTMETER (+) TERMINAL AND GROUND

CRANK ENGINE LONG ENOUGH FOR STABILIZED READING

NEEDLE ABOVE 9.0V → 6

NEEDLE BELOW 9.0V → 4

4 CHECK VOLTAGE ACROSS POST WHILE CRANKING

IF READING IS WITHIN .5 VOLT OF VOLTAGE AT ALTERNATOR

TEST BATTERY USING BATTERY LOAD TEST PROCEDURE

IF READING IS NOT WITHIN .5 VOLT OF READING AT ALTERNATOR, CHECK FOR BATTERY-TO-ALTERNATOR CIRCUIT RESISTANCE

BATTERY OK. CHARGE AS SPECIFIED BY TEST → 6

BATTERY NOT OK → 5

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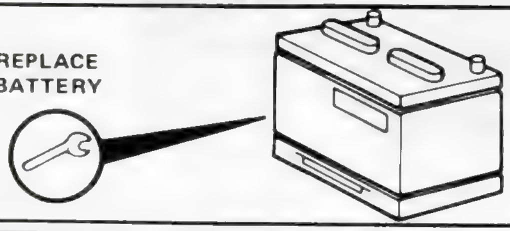
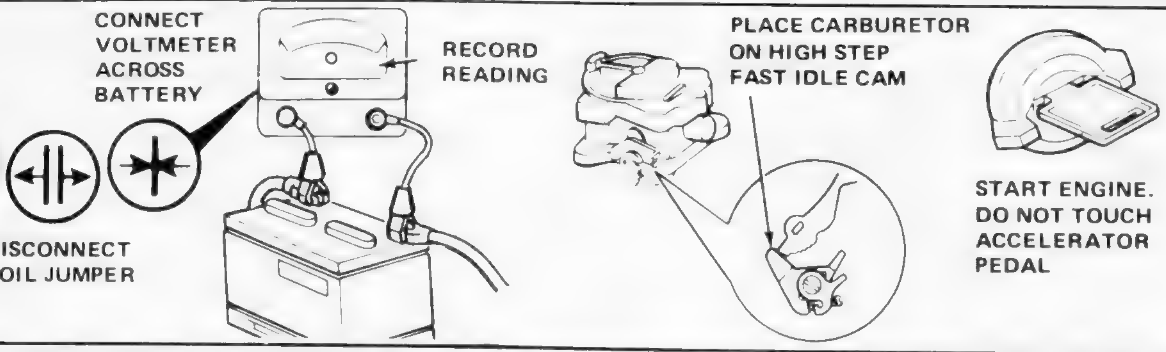
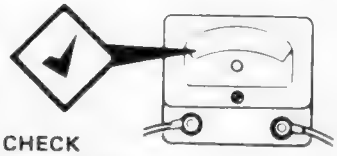
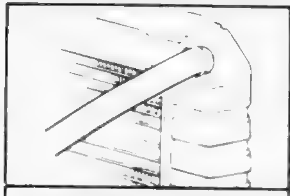
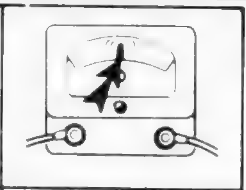
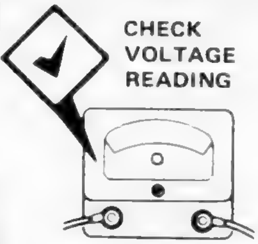
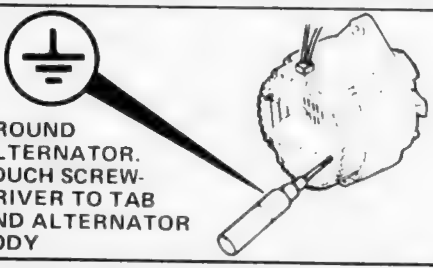
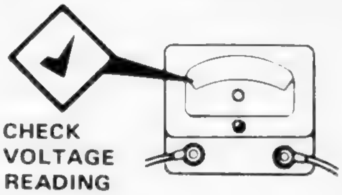
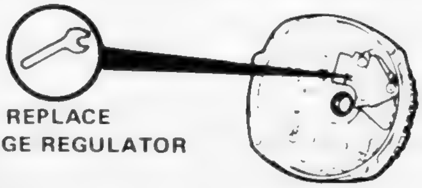
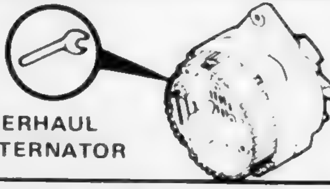
STEP	SEQUENCE	RESULT
5	 REPLACE BATTERY	6
6	 DISCONNECT COIL JUMPER CONNECT VOLTMETER ACROSS BATTERY RECORD READING PLACE CARBURETOR ON HIGH STEP FAST IDLE CAM START ENGINE. DO NOT TOUCH ACCELERATOR PEDAL	7
7	TURN ON ACCESSORIES HEADLIGHTS-HI A/C – HI RADIO BLOWER-TYPE DEFOGGER  CHECK VOLTAGE READING	IF VOLTAGE IS LOWER THAN PREVIOUS READING (STEP 6) → 9 IF VOLTAGE IS HIGHER THAN PREVIOUS READING (STEP 6) → 8
8	TURN OFF ACCESSORIES  WAIT UNTIL UPPER RADIATOR INLET IS HOT AND  VOLTMETER NEEDLE STOPS  CHECK VOLTAGE READING	IF METER READS UNDER 12.5V → 9 IF METER READS OVER 15.5V → 10 IF METER READS 12V TO 15.5V SEE NOTE → STOP
9	 GROUND ALTERNATOR. TOUCH SCREWDRIVER TO TAB AND ALTERNATOR BODY  CHECK VOLTAGE READING	IF VOLTAGE IS HIGHER THAN PREVIOUS READING (STEP 6) → 10 IF VOLTAGE IS LOWER THAN PREVIOUS READING (STEP 6) → 11
10	 REPLACE VOLTAGE REGULATOR	STOP
11	 OVERHAUL ALTERNATOR	STOP

NOTE: IF NOTHING HAS BEEN FOUND, EXPLAIN TO OWNER THAT EXCESSIVE IDLING, AND SLOW OR SHORT DISTANCE DRIVING WITH ALL ACCESSORIES ON, MAY CAUSE HEAVY DRAIN ON BATTERY – RESULTING IN UNDERCHARGED CONDITION.

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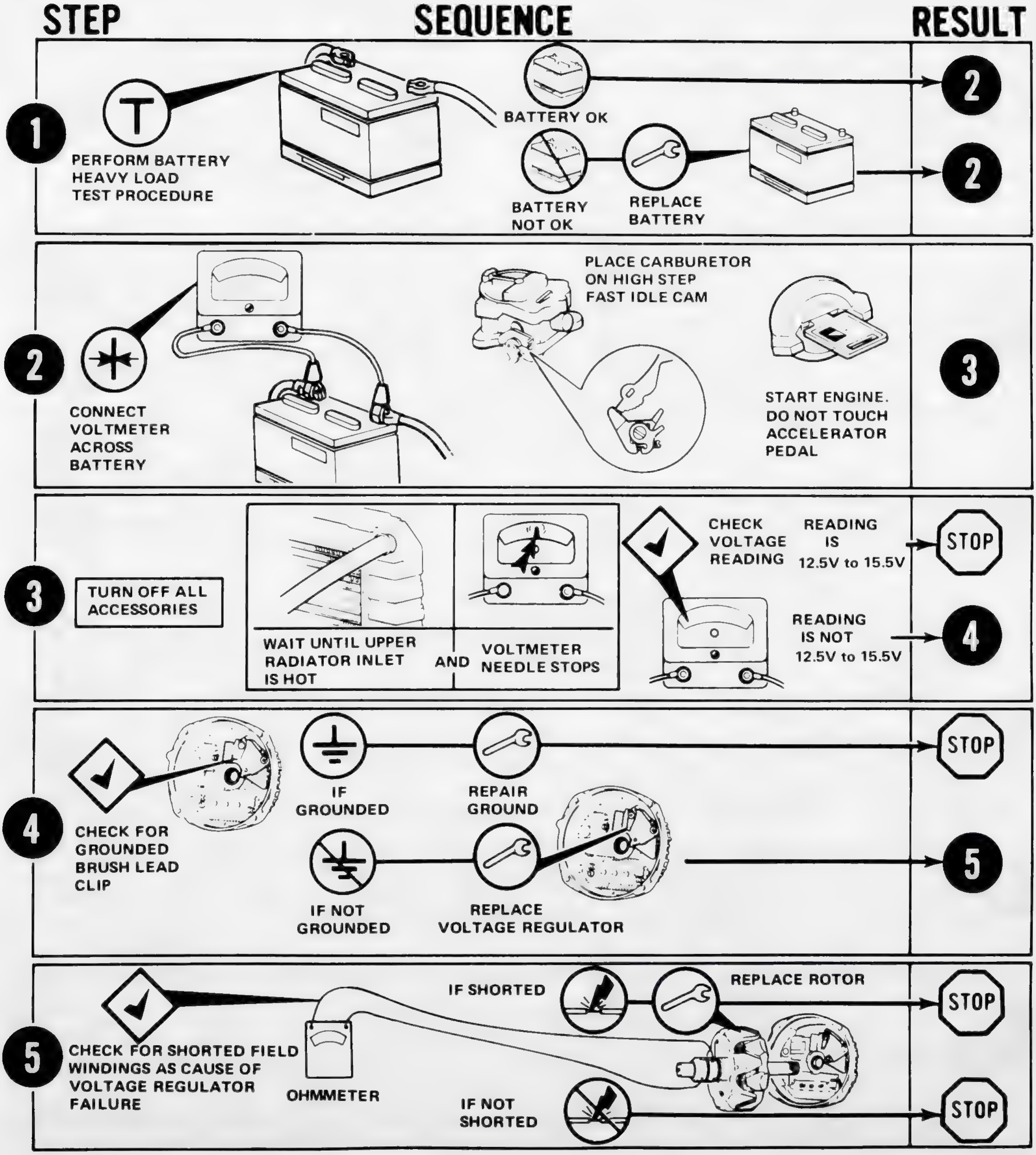
PROBLEM: BATTERY OVERCHARGED (USES TOO MUCH WATER)

Chart 2



1 PERFORM BATTERY HEAVY LOAD TEST PROCEDURE

BATTERY OK → 2

BATTERY NOT OK — REPLACE BATTERY → 2

2 CONNECT VOLTMETER ACROSS BATTERY

PLACE CARBURETOR ON HIGH STEP FAST IDLE CAM

START ENGINE. DO NOT TOUCH ACCELERATOR PEDAL → 3

3 TURN OFF ALL ACCESSORIES

WAIT UNTIL UPPER RADIATOR INLET IS HOT AND VOLTMETER NEEDLE STOPS

CHECK VOLTAGE READING

READING IS 12.5V to 15.5V → STOP

READING IS NOT 12.5V to 15.5V → 4

4 CHECK FOR GROUNDED BRUSH LEAD CLIP

IF GROUNDED — REPAIR GROUND → STOP

IF NOT GROUNDED — REPLACE VOLTAGE REGULATOR → 5

5 CHECK FOR SHORTED FIELD WINDINGS AS CAUSE OF VOLTAGE REGULATOR FAILURE

OHMMETER

IF SHORTED — REPLACE ROTOR → STOP

IF NOT SHORTED → STOP

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Alternator Leakage

If the alternator is suspected of discharging the battery because of excessive leakage, perform the following procedure. A bulb socket with jumper wires attached and a No. 158 bulb are required.

(1) Disconnect battery lead to alternator.

(2) Connect No. 158 bulb in series with battery lead and alternator output terminal. Bulb should not light. If bulb lights (even dimly), replace rectifier bridge.

(3) Disconnect connector from No. 1 and 2 terminals of alternator.

(4) Connect No. 158 bulb in series with No. 1 terminal at alternator and the battery positive post. Bulb should not light. If bulb lights (even dimly), test diode trio. If diode trio is not defective, replace voltage regulator.

(5) Connect No. 158 bulb in series with No. 2 terminal at alternator and battery positive post. Bulb should not light. If bulb lights (even dimly), replace voltage regulator.

TESTING—OFF CAR

Rotor Short-to-Ground Test

Before performing this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. The test may be performed with an ohmmeter set to the 1000 scale or with a 110-volt test lamp.

Hold one test lead to rotor shaft and touch other lead to one slip ring (fig. 1E-3). Repeat with other slip ring. In each case, the ohmmeter should indicate infinity (no needle movement) or the test lamp should not light.

Test Results

If ohmmeter indicates other than infinity or test lamp lights, a short to ground exists. Check soldered connections at slip rings to be sure they are secure and not grounding against rotor shaft, or that excess solder is not grounding rotor coil. Replace rotor if damaged.

Rotor Open Test

Before performing this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. The test may be performed with an ohmmeter set to the 1 scale or with a 110-volt test lamp.

Touch one test lead to one slip ring and other test lead to other slip ring (fig. 1E-4). Ohmmeter should indicate 2.2 to 3.0 ohms or test lamp should not light.

Test Results

If ohmmeter reading is infinite or test lamp fails to light, the rotor winding is open.

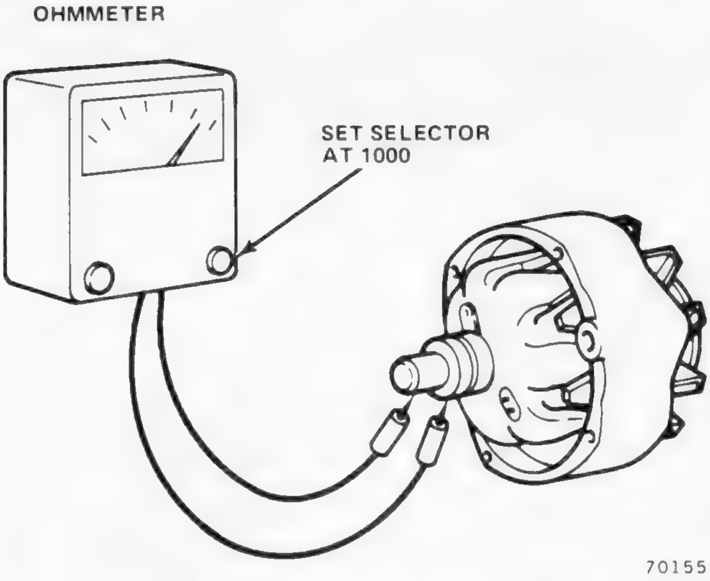


Fig. 1E-3 Rotor Short-to-Ground Test

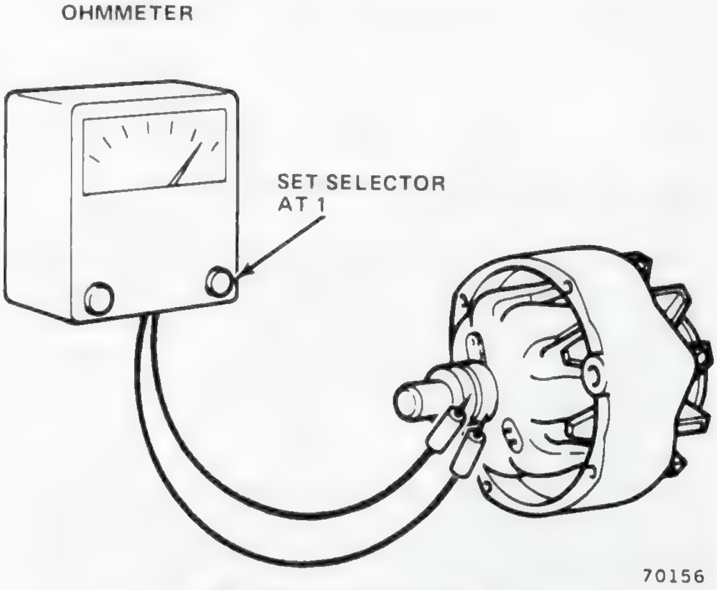


Fig. 1E-4 Rotor Open Test

Rotor Internal Short Test

Before performing this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. This test is performed with a 12-volt battery and an ammeter.

Connect battery and ammeter in series with slip rings (fig. 1E-5). The field current at 12 volts and 80°F should be between 4.0 and 5.0 amps.

Test Results

Any ammeter reading above 5.0 amps indicates shorted windings.

NOTE: *The winding resistance and ammeter readings will vary slightly with winding temperature changes. A reading below the specified value indicates excessive resistance. An alternate method is to check the resist-*

ance of the field by connecting an ohmmeter to the two slip rings. If the resistance reading is below 2.2 ohms at 80°F, the winding is shorted. If resistance is above 3.0 ohms at 80°F, the winding has excessive resistance.

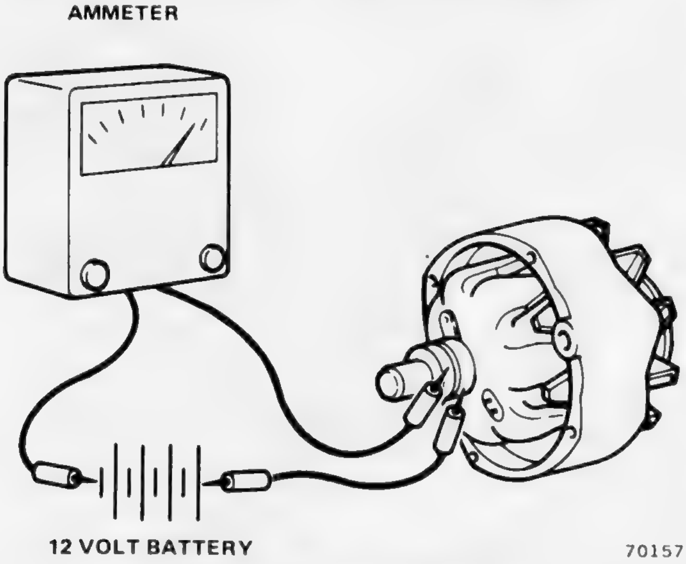


Fig. 1E-5 Rotor Internal Short Test

Stator Short-to-Ground Test

Before performing this test, remove stator and rear housing assembly from rotor and front housing assembly. Remove stator leads from rectifier terminals. Refer to Disassembly for procedures. The test may be performed with an ohmmeter set to the 1000 scale or with a 110-volt test lamp.

Touch one test lead to bare metal surface of stator core and other test lead to end of one stator lead (1E-6). Because all three stator leads are soldered together, it is not necessary to test each lead. Ohmmeter should indicate infinity (no needle movement) or test lamp should not light.

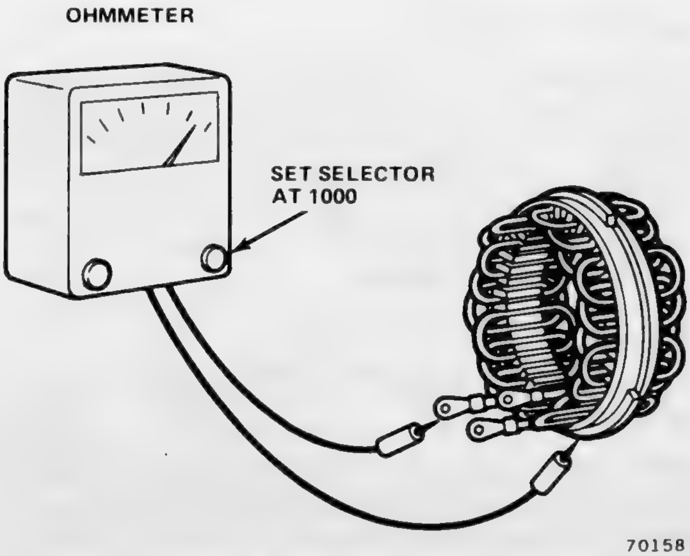


Fig. 1E-6 Stator Short-to-Ground Test

Test Results

If ohmmeter indicates other than infinity or test lamp lights, stator is grounded and must be replaced.

Stator Continuity Test

Before performing this test, remove stator and rear housing assembly from the rotor and front housing assembly. Refer to Disassembly for procedure. An ohmmeter set to the 1 scale is used to perform the tests.

Touch ohmmeter leads to two stator leads and note reading (fig. 1E-7). Test all stator leads in this manner. Equal readings should be obtained for each pair.

Test Results

An infinity reading (no needle movement) indicates an open winding. Check the neutral junction splice for a poor solder connection. Resolder the connection even though it looks good. Recheck continuity. If an open still exists, replace stator.

A reading of more than 1 ohm indicates a bad solder joint. Check the neutral junction splice.

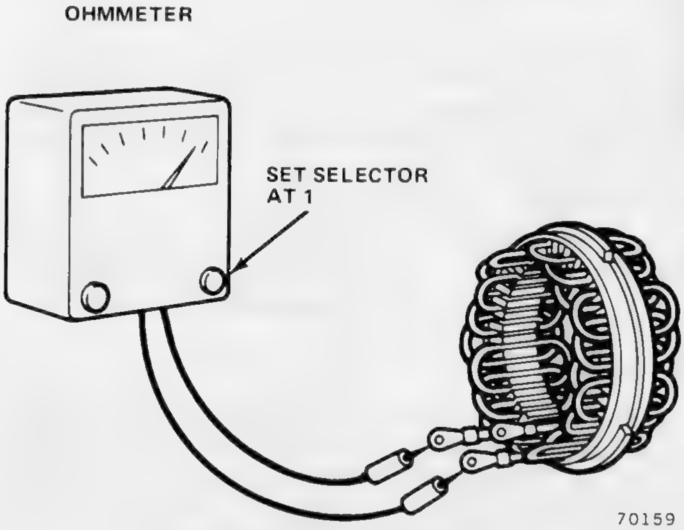


Fig. 1E-7 Stator Continuity Test

Stator Internal Short Circuit Test

An internal short (for instance, between adjacent windings) is difficult to locate without laboratory test equipment. If all other electrical checks are normal and alternator fails to supply rated output, shorted stator windings are indicated.

Diode Trio Short Circuit Test

The diode trio is tested in two ways: installed in the rear housing and removed from the rear housing.

NOTE: *Do not use high voltage, such as 110-volt test lamp, to check the diode trio.*

Test with Diode Trio Installed

(1) Before removing diode trio, connect ohmmeter, using lowest range scale, from brush lead clip to rear housing (fig. 1E-8).

(2) Reverse lead connections. If both readings are zero, check for grounded brush lead clip caused by omission of insulating washer, omission of insulating sleeve over screw or damaged insulation (fig. 1E-14).

(3) Remove screw to inspect sleeve.

If screw assembly is correct and both ohmmeter readings are the same, replace voltage regulator.

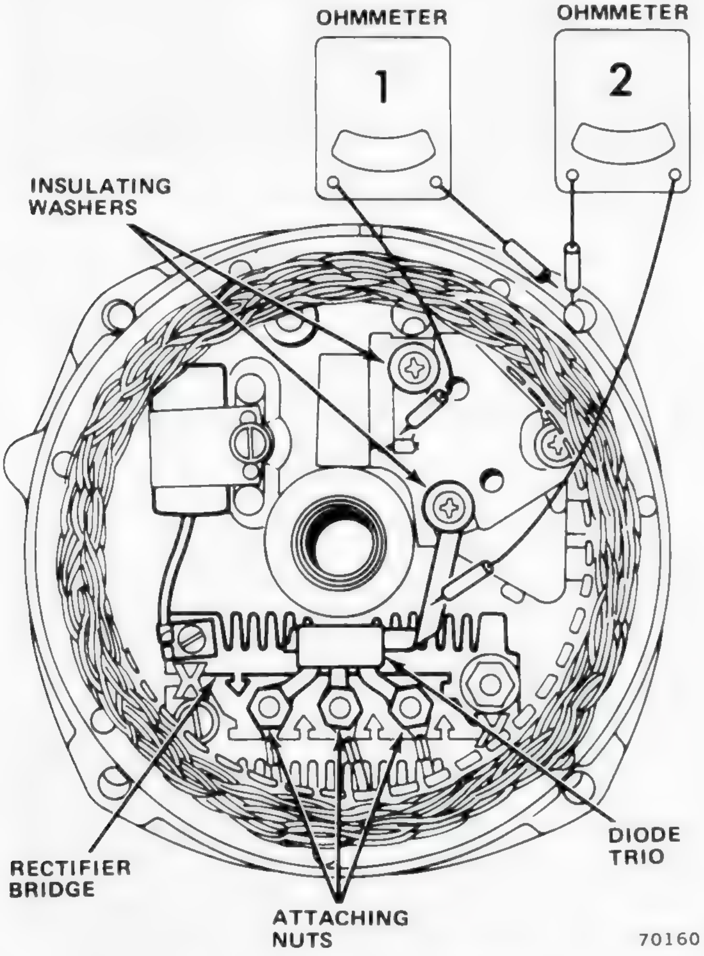


Fig. 1E-8 Rear Housing Assembly

Test with Diode Trio Removed

(1) Remove diode trio from rear housing assembly.

(2) Connect ohmmeter having 1-1/2 volt cell to single brush connector and one stator lead connector (fig. 1E-9). Observe reading on lowest range scale.

(3) Reverse leads to same two connectors.

(4) Replace diode trio if two readings are same. Good diode trio will give one high and one low reading.

(5) Repeat steps 2, 3, and 4 for each of three stator lead connectors of diode trio.

(6) Connect ohmmeter to two connectors. If reading is zero, open diode is indicated. Replace diode trio. Repeat test for each combination of stator lead connectors.

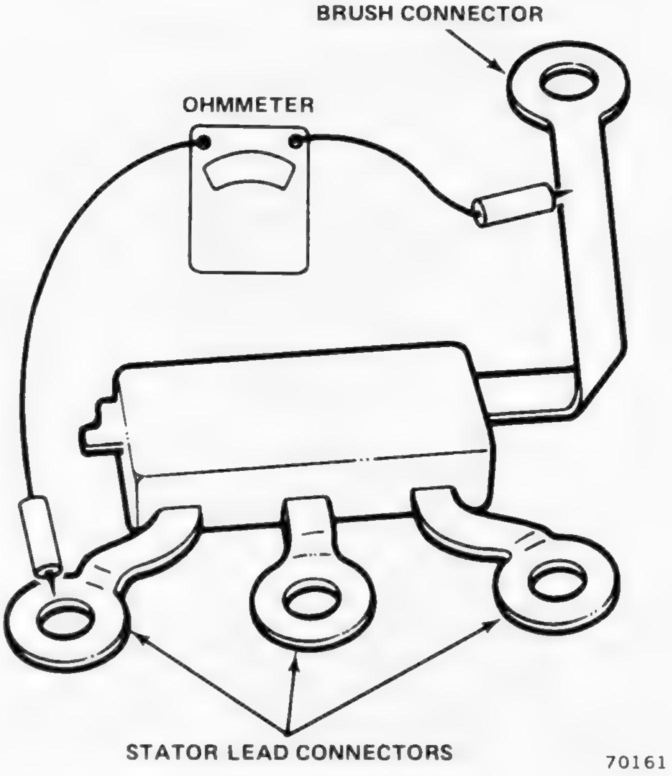


Fig. 1E-9 Testing Diode Trio

Rectifier Bridge Test

The rectifier bridge contains six diodes, three positive and three negative. If one diode is defective, the entire rectifier bridge must be replaced.

NOTE: *Do not use high voltage, such as a 110-volt test lamp, to check this unit.*

(1) Connect ohmmeter to grounded heat sink and one of three terminal tabs (fig. 1E-10). Note reading.

(2) Reverse lead connections to grounded heat sink and same terminal tab. Note reading.

(3) Replace rectifier bridge if both readings are the same.

(4) Repeat steps (1) and (2) for each of the other two terminal tabs.

(5) In the same manner, test between insulated heat sink and each of three terminal tabs.

NOTE: *Each combination of terminals tested will give one high and one low reading. Do not replace rectifier bridge unless at least one pair of readings is the same.*

ALTERNATOR REPLACEMENT

Removal

CAUTION: *Failure to disconnect battery negative cable may result in injury from battery lead at the alternator.*

(1) Disconnect battery negative cable.

(2) Disconnect two-terminal plug and battery lead at back of alternator.

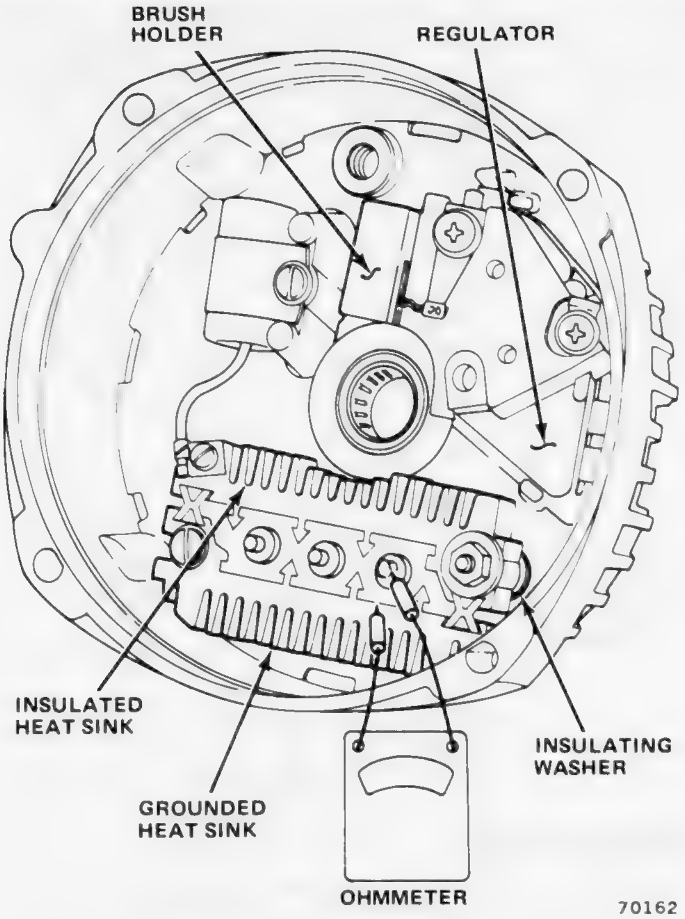


Fig. 1E-10 Testing Rectifier Bridge

NOTE: *On Pacers, the two-terminal plug is removed more easily if the mounting and adjusting screws are loosened.*

(3) Remove mounting and adjusting screws and washers.

(4) Remove alternator drive belt from alternator pulley. Remove alternator from mounting bracket.

(5) On Pacers with air conditioning and sway bar, slide alternator between sway bar and steering gear. See figure 1E-11 for proper positioning of alternator to obtain clearance.

Installation

(1) Install alternator to mounting bracket with washers and screws. Tighten screws finger-tight only. On Pacers, make electrical connections.

(2) Install alternator drive belt.

(3) Tighten belt to specified tension. Refer to Alternator Belt Adjustment for proper belt tensioning procedures.

(4) Tighten screw at sliding slot bracket to 20 foot-pounds (27 Nm) torque. Tighten remaining screws to 30 foot-pounds (41 Nm) torque.

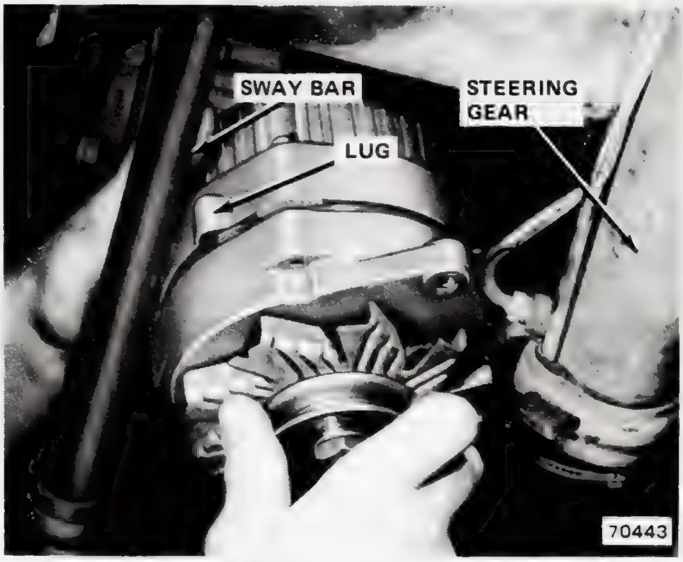


Fig. 1E-11 Pacer Alternator Removal

(5) Install terminal plug and battery lead to alternator.

(6) Connect battery negative cable.

ALTERNATOR OVERHAUL

Disassembly

CAUTION: *As rotor and drive end housing assembly is separated from slip ring housing assembly, the brushes will fall onto the rotor shaft and come in contact with lubricant. Brushes which contact shaft should be cleaned immediately to avoid contamination by lubricant, or they will have to be replaced.*

(1) Scribe marks on alternator case for location reference.

(2) Remove four through-screws, connecting rear housing to front housing (fig. 1E-12).

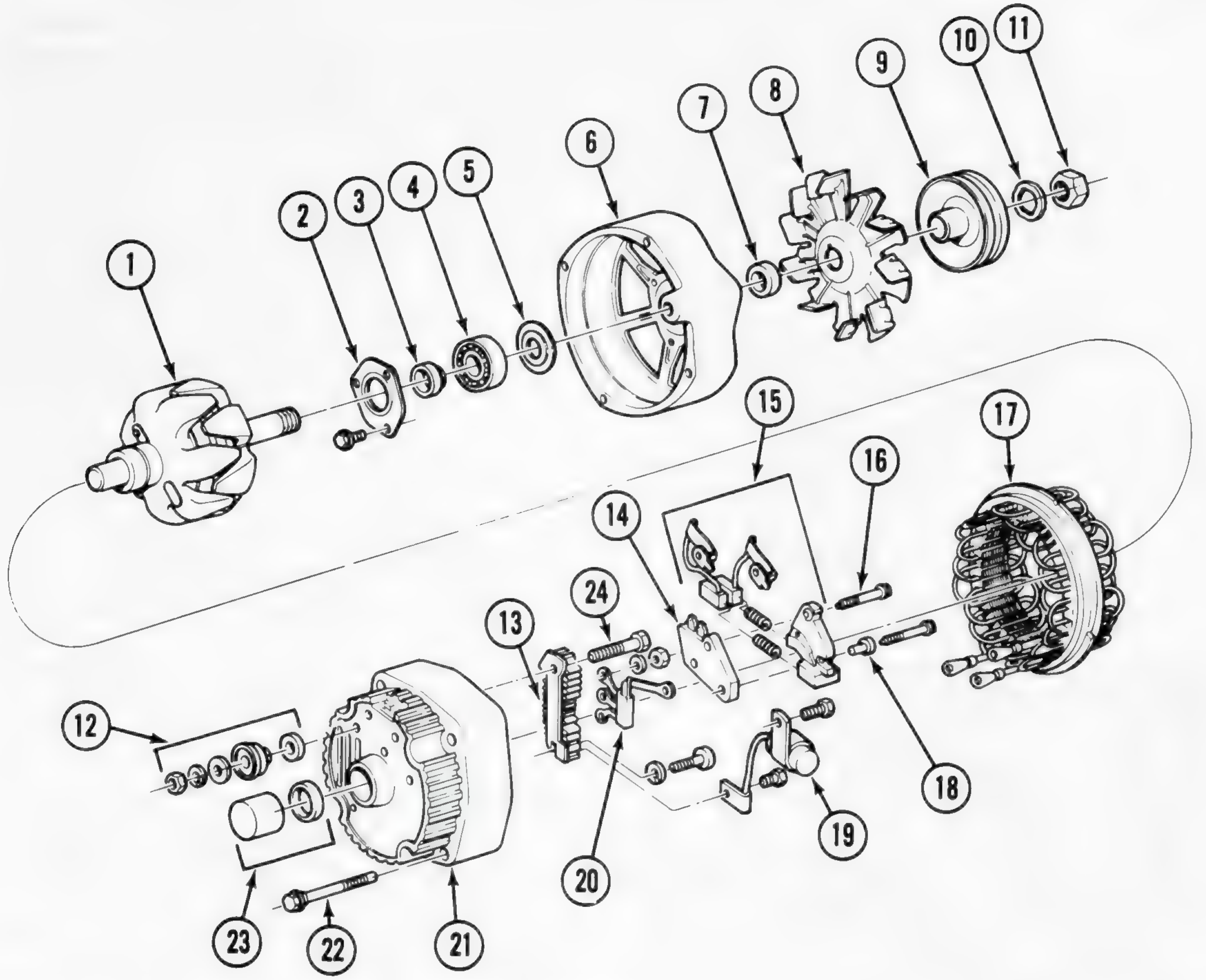
(3) Separate front housing and rotor assembly from stator assembly by prying apart with screwdriver placed between stator assembly and front housing.

NOTE: *After disassembly, place a piece of tape over the rear housing bearing to prevent entry of dirt and other foreign material, and also place a piece of tape over the rotor shaft on the slip ring end. Use pressure-sensitive tape and not friction tape, which would leave a gummy deposit on the shaft. If brushes are to be reused, clean with a soft, dry cloth.*

(4) Place rotor in vise and tighten vise only enough to permit removal of shaft nut.

NOTE: *Avoid excessive tightening of the rotor in the vise as this may cause rotor distortion.*

(5) Alternate pulley nut removal method requires use of Allen wrench to hold rotor from turning while loosening nut with wrench (fig. 1E-13).



1. ROTOR
2. FRONT BEARING RETAINER
3. COLLAR (INNER)
4. BEARING
5. WASHER
6. FRONT HOUSING
7. COLLAR (OUTER)
8. FAN
9. PULLEY
10. LOCKWASHER
11. PULLEY NUT
12. TERMINAL ASSEMBLY
13. RECTIFER BRIDGE
14. REGULATOR
15. BRUSH ASSEMBLY
16. SCREW
17. STATOR
18. INSULATING WASHER
19. CAPACITOR
20. DIODE TRIO
21. REAR HOUSING
22. THROUGH-BOLT
23. BEARING AND SEAL ASSEMBLY

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Fig. 1E-12 Delco 10-SI Alternator Components

(6) Remove shaft nut, washer, pulley, fan and collar.

(7) Separate drive end housing from rotor shaft.

(8) Remove three stator lead attaching nuts and washers and remove stator leads from rectifier bridge terminals.

(9) Separate stator from rear housing.

(10) Remove diode trio lead clip attaching screw and remove diode trio. Note that insulating washer on screw is assembled over top of diode trio connector.

(11) Remove capacitor lead attaching screw.

(12) Disconnect capacitor lead from rectifier bridge.

(13) Remove rectifier bridge attaching screws and battery terminal screw.

(14) Remove rectifier bridge. Note insulator between insulated heat sink and rear housing.

(15) Remove two brush holder screws and one diode trio lead strap attaching screw. Note position of all insulator washers for assembly (fig. 1E-14).

(16) Inspect brush holder screws for broken or cracked insulation.

(17) Remove brush holder and brushes. Carefully note stack-up of parts for assembly.

(18) Remove voltage regulator.

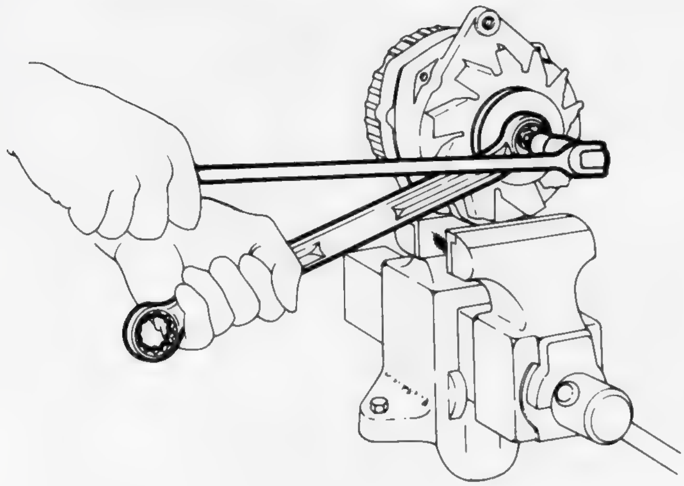

Fig. 1E-13 Removing Pulley Nut

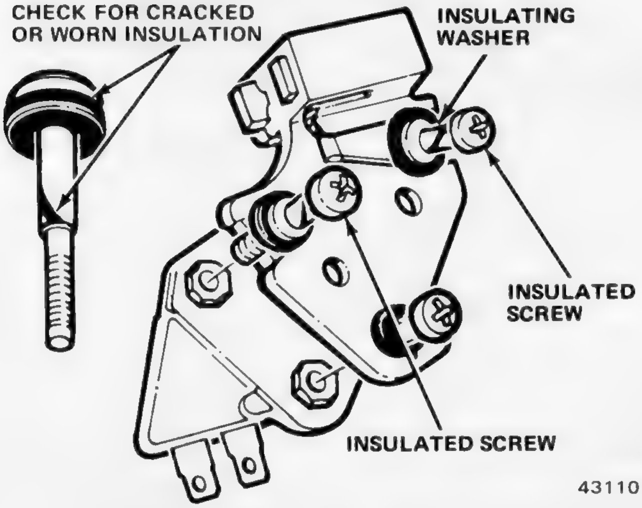

Fig. 1E-14 Brush Holder

(19) Remove front bearing retaining plate screws.

(20) Press front bearing from front housing with suitable tube or collar.

NOTE: *If the bearing is in satisfactory condition, it may be reused.*

(21) Press out rear bearing using tube or collar that fits inside rear housing. Press from inside of housing toward outside.

NOTE: *Replace the bearing in the rear housing if its lubricant supply is exhausted. Do not attempt to lubricate and reuse a dry bearing.*

Cleaning and Inspection

(1) Clean magnetic poles of rotor by brushing with oleum spirits.

NOTE: *Do not clean with degreasing solvent.*

(2) Inspect slip rings for dirt and roughness. Clean with solvent. If necessary, slip rings may be cleaned and finished with 400 grit or finer polishing cloth. **Do not use sandpaper.** Spin rotor in lathe or other support while holding polishing cloth against rings.

NOTE: *When using an abrasive, support the rotor while spinning to clean slip rings evenly. Cleaning slip rings without support may result in flat spots on slip rings, causing brush noise and premature brush wear.*

(3) True rough or out-of-round slip rings in lathe to 0.002 inch maximum indicator reading. Remove only enough material to make rings smooth and round. Finish with 400 grit or finer polishing cloth and blow away all dust.

(4) Clean stator by brushing with oleum spirits or equivalent.

NOTE: *Do not clean stator in solvent.*

(5) Inspect brush springs for evidence of damage or corrosion. Replace springs if there is any doubt about their condition

(6) Inspect brushes for wear or contamination. If brushes are to be reused, clean thoroughly with soft, dry cloth until completely free of lubricant.

Assembly

(1) Fill cavity between retainer plate and bearing one-quarter full with Delco-Remy lubricant No. 1948791, or equivalent.

NOTE: *Do not overfill as this may cause the bearing to overheat.*

(2) Assemble bearing and slinger into front housing (fig. 1E-15).

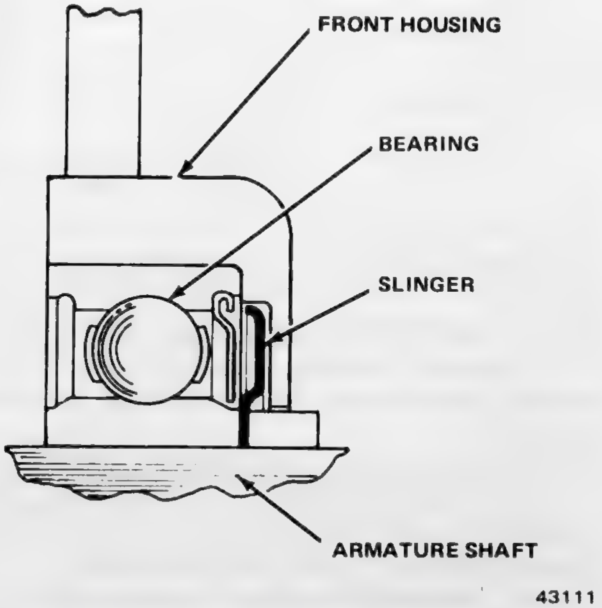

Fig. 1E-15 Front Housing Bearing Assembly

(3) Press bearing in with use of suitable tube or collar that fits over outer race.

NOTE: *Install a replacement retainer plate if the felt seal in the retainer plate is hardened.*

(4) Install retaining plate and screws.

(5) Position housing, collar, fan, pulley and washer on rotor shaft and install drive pulley nut.

(6) Place rotor in vise and tighten only enough to permit tightening of pulley nut.

(7) Alternate method of tightening pulley nut requires use of Allen wrench to hold rotor from turning while tightening nut with wrench (fig. 1E-16).

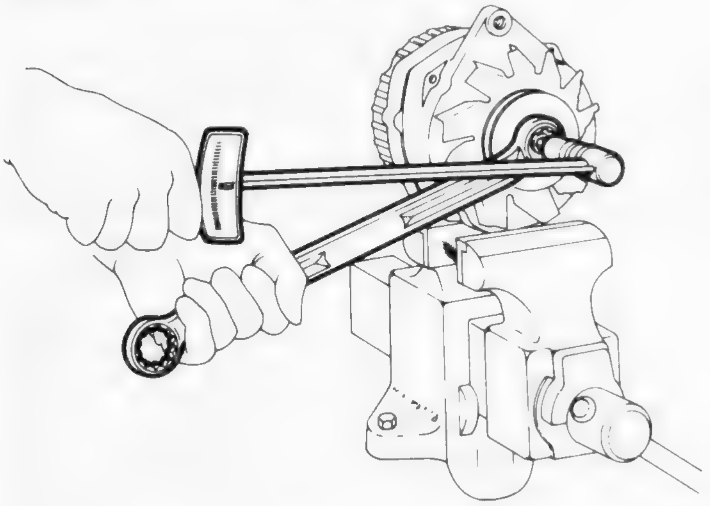

Fig. 1E-16 Tightening Pulley Nut

(8) If rear bearing was removed:

(a) Support inside of rear housing with hollow cylinder.

(b) Place flat plate over bearing and press bearing into housing from outside. Bearing must be pressed flush with outside of housing.

NOTE: *Use extreme care to avoid misalignment or placing undue stress on bearing.*

(9) Install replacement bearing seal. Lightly oil lip to facilitate installation of rotor shaft. Press seal in with lip away from bearing.

(10) Install springs and brushes into brush holder. Brushes should slide in and out of brush holder without binding.

NOTE: *If any of the brush holder assembly parts require replacement, replace the entire brush holder assembly. Individual parts are not serviced.*

(11) Insert straight wooden or plastic toothpick (to prevent scratching brushes) into hole at bottom of holder to retain brushes.

(12) Install voltage regulator.

(13) Attach brush holder into rear housing, carefully noting stack-up of parts (fig. 1E-14). Allow toothpick to protrude through hole in rear housing.

(14) Install diode trio lead strap attaching screw and washer.

(15) Securely tighten remaining two brush holder screws.

(16) Position rectifier bridge to rear housing with insulator between insulated heat sink and rear housing.

(17) Install rectifier bridge attaching screw and battery terminal screw.

(18) Connect capacitor lead to rectifier bridge and tighten securely.

(19) Position diode trio to end housing.

(20) Install diode trio lead clip screw, making sure insulating washer is over top of diode trio connector.

(21) Install stator to rear housing.

(22) Attach stator leads to rectifier bridge terminals. Secure with washers and nuts.

(23) Before assembling rotor and front housing assembly to stator and rear housing assembly, remove protective tape and make sure that bearing surface of shaft is perfectly clean.

(24) Position front housing and rear housing together, aligning scribe marks.

(25) Install through-screws and securely tighten.

(26) Remove toothpick from brush holder assembly.

DRIVE BELT ADJUSTMENT

If a belt has been in service for some time, inspect for general condition before attempting an adjustment. If it is severely cracked or oil-soaked, replace it.

(1) Install Belt Strand Tension Gauge J-23600 on longest accessible span, midway between pulleys (fig. 1E-17). Refer to Specifications for proper tension.

NOTE: *When using the gauge on a notched belt, the middle finger of the gauge should be in the notched cavity of the belt.*

(2) If drive belt requires adjustment, refer to Chapter 1C—Cooling for procedures.

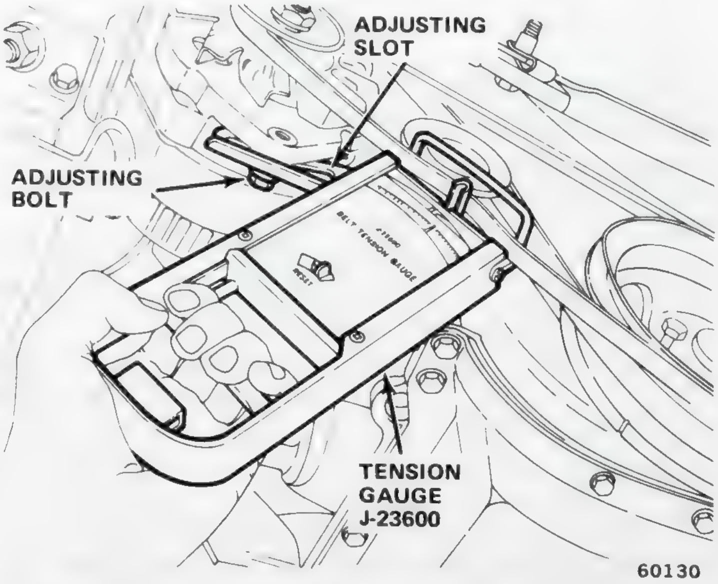

Fig. 1E-17 Checking Belt Tension

SPECIFICATIONS

Four- and Six-Cylinder Charging System Specifications

Alternator – Four- and Six-Cylinder Engine

Make	Delco-Remy
Rating	
Standard	37 amp
Optional	55 amp
Optional	63 amp
Field Current	4.0 to 5.0 amps at 80°F
Rotation (Viewing Drive End)	Clockwise
Pulley Size	2.62 inches (6.65 cm)
Belt Tension	125-155 pounds, set-to 90-115 pounds, recheck (57-70 kg, set-to 41-70 kg, recheck)

Voltage Regulator – Four- and Six-Cylinder Engine

Make	Delco-Remy
Model	1116387
Type	Solid State
Adjustment	None

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Torque Specifications—Four Cylinder

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Alternator Front Bracket to Head Stud	15	13-17	11	9-13
Alternator Front Bracket to Head Nut	19	16-22	14	12-16
Alternator and Air Pump Rear Bracket Screw	22	19-25	16	14-18
Alternator Adjusting Bracket and Rear Bracket	22	19-25	16	14-18
Alternator Adjusting Bracket/Block	22	19-25	16	14-18
Alternator Adjusting Bracket Brace to Adjusting Bracket	19	16-22	14	12-16
Alternator Adjusting Bracket Brace and Rear Bracket	22	19-25	16	14-18
Alternator Pivot	38	27-47	28	20-35
Alternator Adjustment	24	20-27	18	15-20

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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Torque Specifications—Six-Cylinder

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Alternator Adjusting Bolt	24	20-27	18	15-20
Alternator Mounting Strap Bolt	38	31-41	28	23-30
Alternator Pivot Bolt or Nut	38	27-47	28	20-35

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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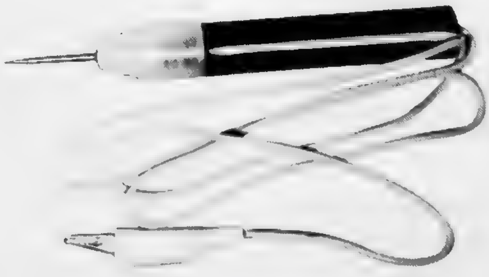
Special Tools



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CONTINUITY
LIGHT

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EIGHT-CYLINDER CHARGING SYSTEM

GENERAL

The Motorcraft charging system is a negative ground system consisting of three main components: an alternator, a regulator and a battery. It is used on all eight-cylinder engines.

Available alternators are rated at 40 and 60 amperes.

COMPONENTS

Alternator

The alternator (fig. 1E-18) is belt-driven by the engine. Its major components are the front and rear housings, the stationary stator windings, the rotating field windings (rotor), and six rectifying diodes. Current is passed to the rotating field through two brushes mounted in the rear housing and two slip rings attached to the rotor.

Voltage Regulator

The regulator is an electro-mechanical device (non-solid state) and nonadjustable. It has two major components: the field relay and the voltage limiter. The field relay, which connects the voltage limiter into the system, is energized by the ignition switch. This prevents battery drain when the ignition is OFF. The voltage limiter is a vibrating type which regulates current applied to the field and maintains charging voltage within prescribed limits to keep the battery properly charged.

OPERATION

General

Charging of the battery is accomplished by supplying current directly from the alternator output terminal (heavy red wire) to the battery, using the starter solenoid as a junction point. The positive battery cable joins the heavy red wire at the solenoid. The alternator is grounded to the engine to complete the return circuit to the negative side of the battery. The amount of charge the battery receives depends upon the state of charge and internal condition of the battery, proper operation of the voltage regulator and the amount of current being consumed by electrical loads such as heater blower motor, lamps, and rear window defogger.

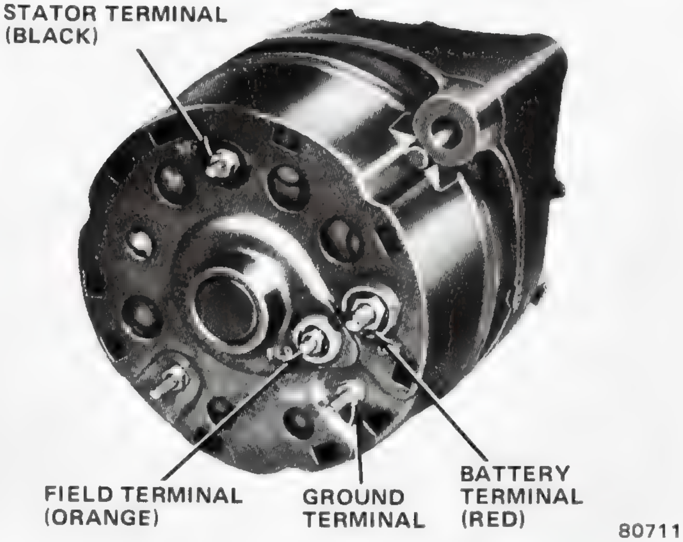


Fig. 1E-18 Motorcraft Alternator

Energizing the System

When the ignition switch is turned to the ON position, current flows from the ignition switch through the alternator indicator bulb (lighting the indicator) and a 15-ohm resistance wire to the regulator I-terminal (fig. 1E-19). From the I-terminal, current flows through the upper contacts of the voltage limiter to the regulator F-terminal. Current passes from the regulator F-terminal to the alternator FLD terminal. An insulated brush is connected to the FLD terminal and passes current from the regulator to a slip ring attached to one end of the rotor windings. After passing through the rotor windings, current passes through a second slip ring which contacts a grounded brush.

Voltage Output

The field (FLD) circuit provides current to the rotor windings to create a magnetic field. The strength of this field is determined by the amount of current supplied by

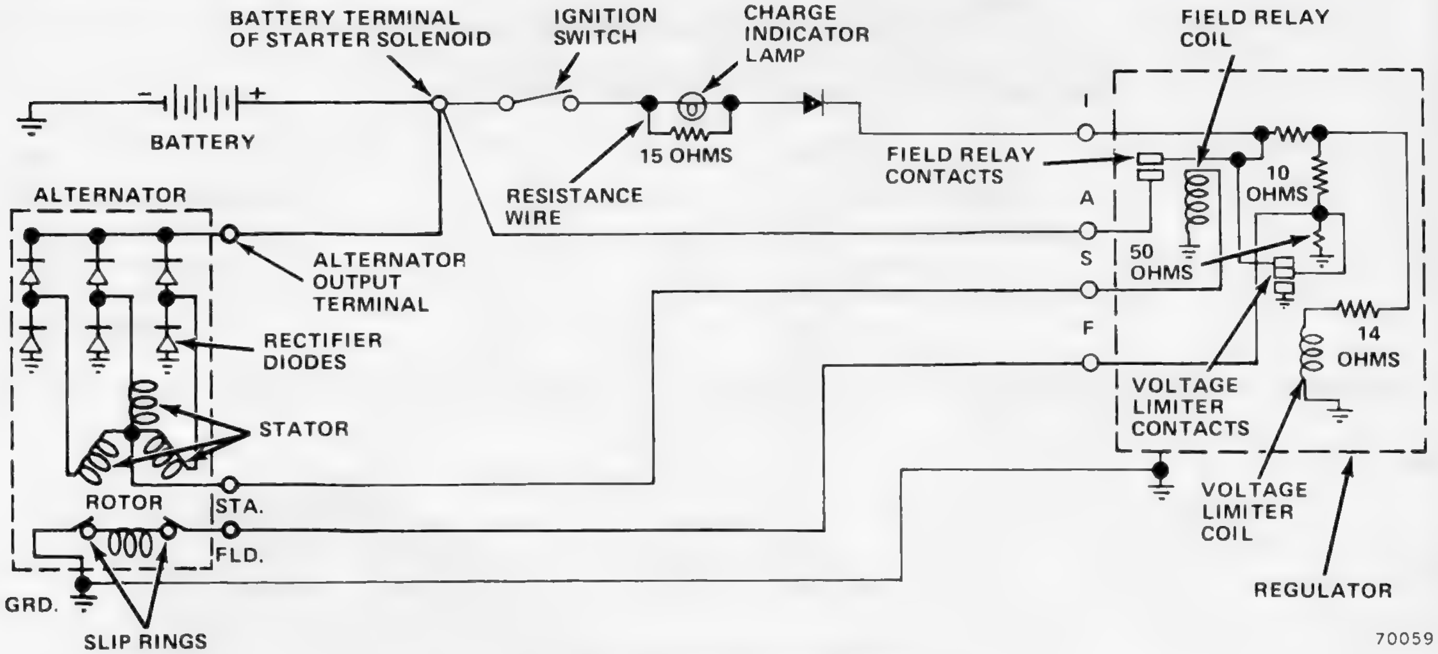


Fig. 1E-19 Charging System Schematic

the regulator (see Regulator). When the engine is started, the rotor is rotated. The rotor magnetic field acts on the windings of the stator to produce alternating current through electro-magnetic induction.

The stator is wye-wound around the stator core. One end of each winding is connected to a common neutral junction. The other end of each winding is connected to a pair of diodes. The diodes serve to change the three-phase alternating current produced in the stator windings into direct current required for the car electrical system. This is accomplished by the characteristic of the diodes to flow current in one direction only. The positive diodes pass current to the alternator BAT terminal while the negative diodes pass current flowing in the opposite direction directly to ground. In this way, the alternating current is changed to direct current and is available at the alternator output terminal.

Regulator

When the rotor starts turning and output reaches about 3 volts at the alternator STA terminal, current applied through the regulator S-terminal closes the field relay. With the field relay closed, current flows through the regulator A-terminal, which puts equal voltage on both sides of the indicator lamp bulb, stopping current flow and causing the lamp to go out. Current from the A-terminal also flows through the relay contacts and limiter upper contacts to the rotor. The voltage limiter now begins metering current to the rotor field coil to maintain desired output voltage.

The voltage regulator operates through the limiter upper contacts when alternator speed is low or when the system is under a heavy load. Output voltage is controlled through the upper contacts which vibrate open and closed. When closed, the upper contacts pass the maximum allowable current (about 3 amps) to the field. When open, field current passes through the 10-ohm resistor, which produces a decrease in field current and output voltage. When alternator speed is high or the system is under a light load, voltage attempts to increase and the regulator then operates on the voltage limiter lower contacts. The increase in voltage causes current to pass through the 14-ohm resistor to the voltage limiter pull-in coil (fig. 1E-21). The pull-in coil is energized and pulls down the limiter armature, closing the lower contacts. With the lower contacts closed, field current passes directly to ground which causes the rotor field to collapse and voltage output decreases. The decrease in voltage causes the lower contacts to open which again applies the field circuit to the 10 ohm resistor.

The voltage limiter operates on the upper contacts, the lower contacts, or between contacts. The upper contacts allow maximum field current to pass to the rotor. The lower contacts allow no field current to pass to the rotor. When the voltage limiter is between contacts, field current is reduced by the 10-ohm resistor. The contacts vibrate open and closed many times per second, maintaining accurate voltage regulation.

TROUBLESHOOTING

The following procedures will lead to the location and correction of charging system defect in the shortest time.

To avoid damage to the charging system components, always observe the following precautions:

- Do not polarize the alternator
- Do not short across or ground any of the terminals in the charging circuit except as specifically instructed

- Make sure the alternator and battery have the same polarity
- When connecting a charger or a booster battery to the car, connect negative to negative and positive to positive

Trouble in the charging system will show up as one or more of the following conditions:

- Faulty indicator lamp operation
- Undercharged battery, evidenced by slow cranking and low specific gravity readings
- Overcharged battery, evidenced by excessive water usage

Before making any electrical checks, perform a visual inspection of all charging system components and wiring.

Visual Inspection

NOTE: *A visual inspection is not a substitute for instrument checks. Before evaluating the charging system, perform a hydrometer check of the battery. Refer to Chapter 1D—Batteries.*

Check for clean and tight cable connections at the battery posts, engine block and starter solenoid. Check for cleanliness (no corrosion) and tight wire connections at the alternator, starter motor solenoid, and the alternator voltage regulator. Inspect all wiring for cracked or broken insulation. Be sure alternator mounting screws are tight and unit is properly grounded. Inspect the fluid level in the battery and add water if necessary. Check for loose alternator drive belt.

Alternator Noise

Alternator noise is usually caused by one of the following conditions:

- Loose mounting screws
- Loose or misaligned pulley
- Worn or dirty bearings
- Out-of-round or rough slip rings
- Defective brushes
- Shorted rectifier diode (indicated by high pitched whine)
- Bent rotor finger

Noise from the cooling system can also sound like alternator noise. Disconnect and plug the heater hoses to eliminate the possibility of the alternator bracket acting as a sounding board for heater core noises.

Indicator Lamp Diagnosis

For a complete diagnosis of faulty indicator operation, refer to Chapter 1L—Power Plant Instrumentation.

NOTE: *An indicator lamp which remains on until high engine rpm is reached is characteristic of an open resistance wire. The open generally occurs at the spliced end of the resistance wire.*

Overcharged-Undercharged Battery

For battery overcharged-undercharged diagnosis, refer to DARS Charts 1 and 2. Also refer to the Voltage Output Load Test and Voltage Output No-Load Test.

Output Voltage Quick Test

(1) Connect positive voltmeter lead to positive battery post and negative lead to negative post.

(2) Start engine. Apply load by turning heater or air conditioner blower to high speed and headlamps on high beam.

(3) Slowly increase speed to approximately 2000 rpm.

(4) Allow voltmeter to stabilize and note indication. Compare it to specifications in Output Voltage Chart.

Test Results

If voltage output is as specified, charging system is operating properly. If voltage is below specifications, perform Undercharge Troubleshooting Procedure. If voltage is above specifications, perform Overcharge Troubleshooting Procedure.

Voltage Output No-Load Test

Perform this test, together with the Voltage Output Load Test, whenever an overcharging or undercharging condition is suspected. Check belt tension, wire and cable connections, and battery condition before performing tests.

(1) Connect voltmeter positive lead to battery positive cable and negative lead to negative cable.

(2) Be sure that all electrical accessories are turned off, including radio and door-operated dome and courtesy lamps.

(3) Note battery voltage.

(4) Start engine and slowly increase speed to approximately 1500 rpm.

(5) Note voltmeter reading. Voltage should increase, but not more than 2 volts above voltage noted in step (3).

Test Results

If voltage does not increase, or if increase is within 2-volt limit, proceed to Output Load Test.

If the voltage increases exceeds 2 volts, proceed to Overcharge Troubleshooting Procedure.

Voltage Output Load Test

(1) Connect positive voltmeter lead to positive battery post and negative lead to negative post.

(2) Be sure that all electrical accessories are turned off, including radio and door-operated dome and courtesy lamps.

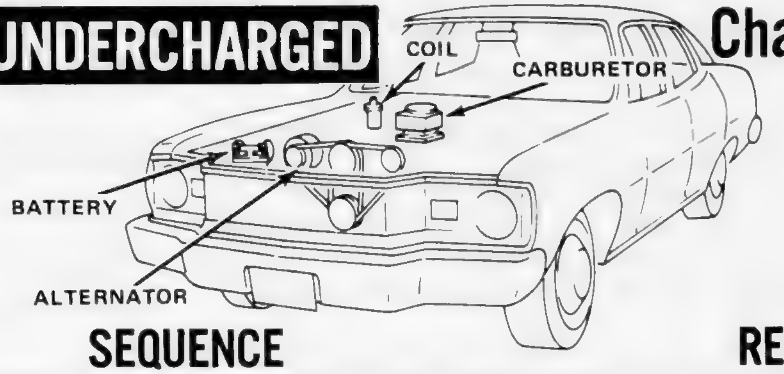
(3) Note battery voltage for use later in test.

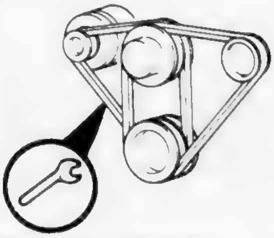
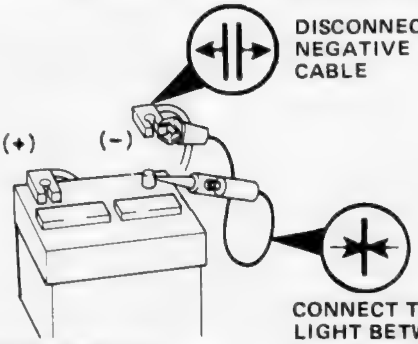
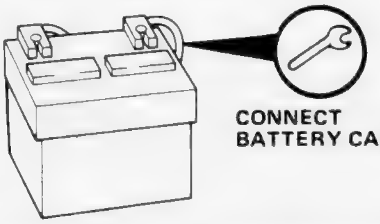
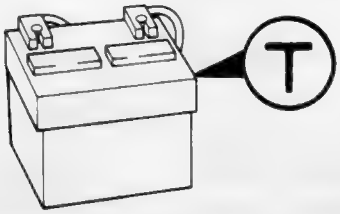
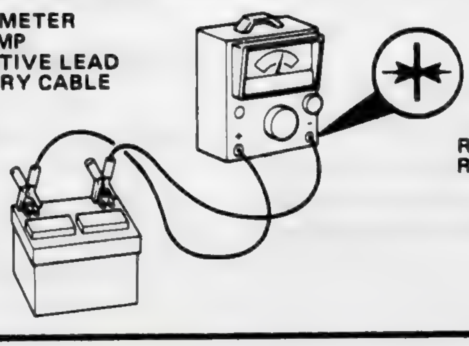
EIGHT-CYLINDER CHARGING SYSTEM DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: BATTERY UNDERCHARGED

Chart 1



STEP	SEQUENCE	RESULT
1	CHECK ALTERNATOR DRIVE BELT  ADJUST BELT TENSION TO 90-115 LBS. REPLACE IF NECESSARY DISCONNECT NEGATIVE CABLE  MAKE SURE NO ACCESSORIES ARE ON. IGNITION OFF. DOORS CLOSED. UNDER HOOD LIGHTS DISCONNECTED. CONNECT TEST LIGHT BETWEEN CABLE AND BATTERY POST TEST LIGHT ON → 2 TEST LIGHT OFF—NO DRAIN ON BATTERY → 3	2 3
2	 CONNECT BATTERY CABLE TRACE AND CORRECT CONTINOUS DRAIN ON BATTERY (AFTER CORRECTION REPEAT STEP 1 ABOVE) WITH TEST LIGHT TO ASSURE ELIMINATION OF BATTERY DRAIN →	STOP
3	TURN OFF ALL LIGHTS & ELECTRICAL COMPONENTS  PERFORM BATTERY TEST. RECHARGE OR REPLACE IF NECESSARY. →	4
4	CONNECT NEGATIVE LEAD OF VOLTMETER TO NEGATIVE BATTERY CABLE CLAMP (NOT BOLT OR NUT). CONNECT POSITIVE LEAD OF VOLTMETER TO POSITIVE BATTERY CABLE CLAMP (NOT BOLT OR NUT).  RECORD VOLTMETER READING →	5

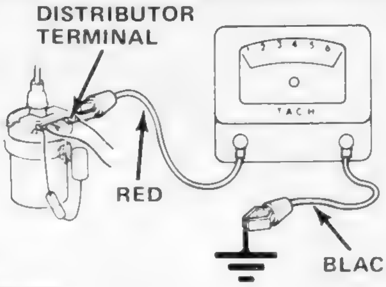
70105A

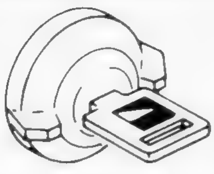
STEP **SEQUENCE** **RESULT**

5

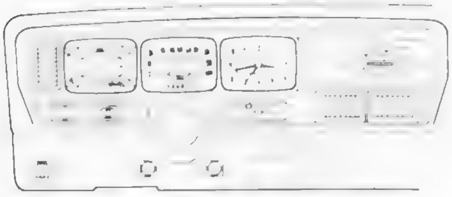
APPLY PARKING BRAKE AND PLACE TRANSMISSION IN NEUTRAL

CONNECT RED LEAD OF TACHOMETER TO DISTRIBUTOR TERMINAL OF THE COIL AND BLACK LEAD TO GOOD GROUND

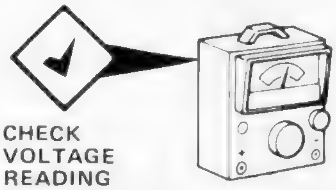




START ENGINE, BRING TO NORMAL OPERATING TEMPERATURE AND ADJUST ENGINE SPEED TO 2000 RPM



TURN SWITCHES ON

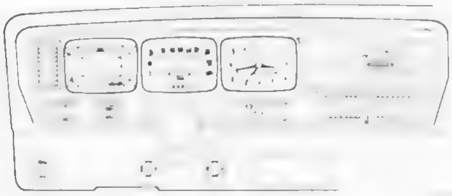


CHECK VOLTAGE READING AT BATTERY

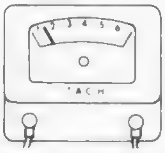
IF VOLTAGE READING IS LOWER THAN STEP 4 → **8**

IF VOLTAGE READING IS HIGHER THAN STEP 4 → **6**

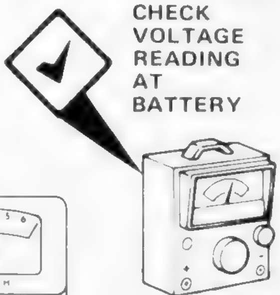
6



TURN SWITCHES OFF



ADJUST ENGINE SPEED TO 1500 RPM



CHECK VOLTAGE READING AT BATTERY

VOLTAGE LESS THAN 1V GREATER THAN READING TAKEN IN STEP 4 → **7**

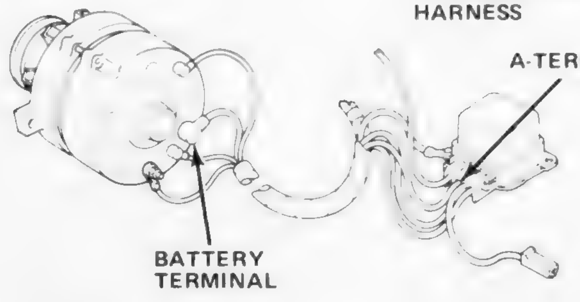
VOLTAGE GREATER THAN 2V ABOVE READING TAKEN IN STEP 4 → **11**

VOLTAGE BETWEEN 1 AND 2V GREATER THAN READING TAKEN IN STEP 4 → STOP

7

✓ CHECK FOR PRESENCE OF BATTERY VOLTAGE AT THE ALTERNATOR BAT TERMINAL AND THE REGULATOR PLUG A TERMINAL

IF BATTERY VOLTAGE NOT PRESENT, REPLACE ALTERNATOR WIRE HARNESS



OK → STOP

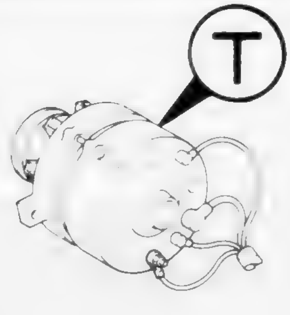
VOLTAGE WITHIN LIMITS

~~OK~~ → **8**

BATTERY VOLTAGE PRESENT AT ALTERNATOR AND REGULATOR TERMINALS AND VOLTAGE NOT WITHIN LIMITS

8

PERFORM ALTERNATOR FIELD CIRCUIT TEST



OK → **11**

ALTERNATOR OPERATING AT SATISFACTORY LEVEL

~~OK~~ → **9**

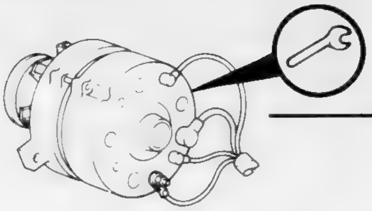
ALTERNATOR NOT OPERATING PROPERLY

70105B

STEP **SEQUENCE** **RESULT**

9

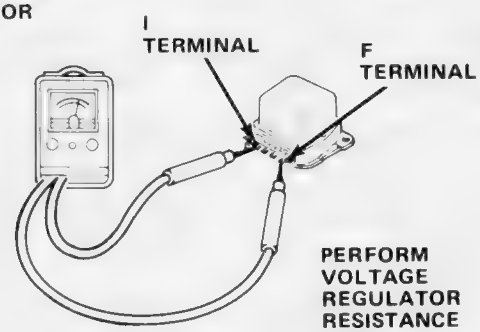
REPAIR OR OVERHAUL ALTERNATOR



→ **10**

10

IF A FIELD CIRCUIT GROUNDED CONDITION WAS FOUND TEST RESISTANCE OF REGULATOR



PERFORM VOLTAGE REGULATOR RESISTANCE TEST

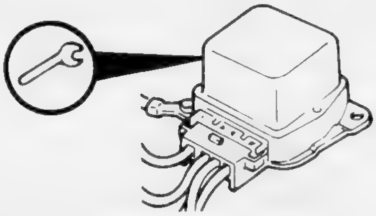
VOLTAGE REGULATOR RESISTANCE ZERO → STOP

VOLTAGE REGULATOR RESISTANCE 10 OHMS → **11**

11

REPLACE VOLTAGE REGULATOR

NOTE: WHEN REPLACING VOLTAGE REGULATOR, CHECK THE BATTERY, SOLENOID, VOLTAGE REGULATOR AND ALTERNATOR WIRING CIRCUIT TO INSURE THAT ALL TERMINALS ARE CLEAN AND ALL WIRES IN GOOD CONDITION.



→ STOP

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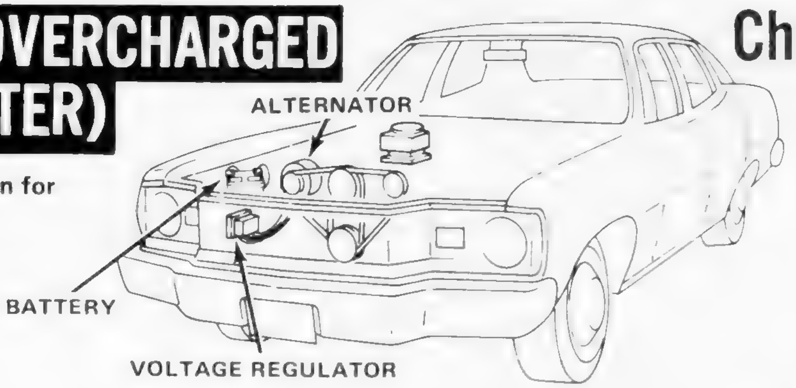
PROBLEM: BATTERY OVERCHARGED (USES TOO MUCH WATER)

Chart 2

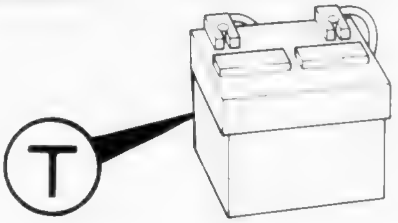
Note: Refer to Chapter A — General Information for details on how to use this DARS chart.



STEP **SEQUENCE** **RESULT**

1

PERFORM BATTERY HEAVY LOAD TEST PROCEDURE

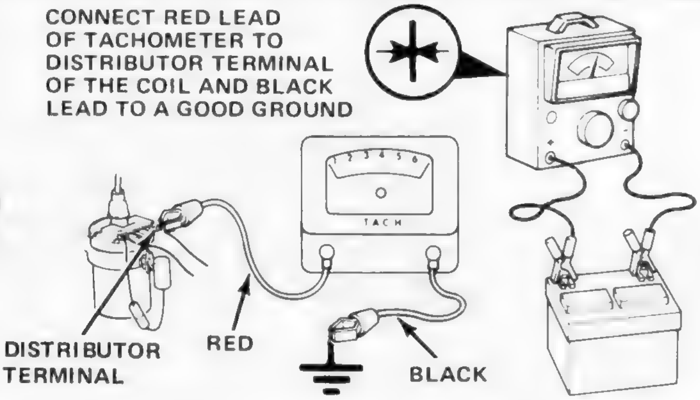


BATTERY NOT OK → REPLACE BATTERY → 2

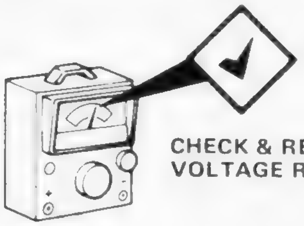
BATTERY OK → 2

2

CONNECT RED LEAD OF TACHOMETER TO DISTRIBUTOR TERMINAL OF THE COIL AND BLACK LEAD TO A GOOD GROUND



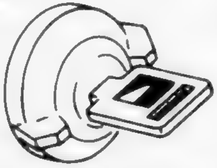
CONNECT NEGATIVE LEAD OF VOLTMETER TO NEGATIVE BATTERY CABLE CLAMP (NOT BOLT OR NUT). CONNECT POSITIVE LEAD OF VOLTMETER TO POSITIVE BATTERY CABLE CLAMP (NOT BOLT OR NUT).



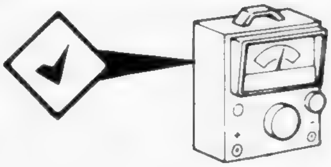
CHECK & RECORD VOLTAGE READING → 3

3

TURN OFF ALL ACCESSORIES



START ENGINE,BRING TO NORMAL OPERATING TEMPERATURE, AND ADJUST ENGINE SPEED TO 1500 RPM



WHEN NEEDLE ON VOLTMETER STOPS MOVING, RECORD VOLTAGE READING.

VOLTAGE READING LESS THAN 2V GREATER THAN READING TAKEN IN STEP 2 → STOP

VOLTAGE READING GREATER THAN 2V MORE THAN READING TAKEN IN STEP 2 → 4

4

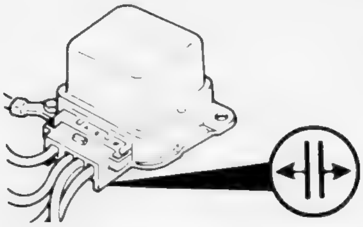
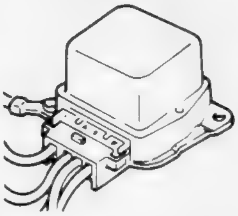
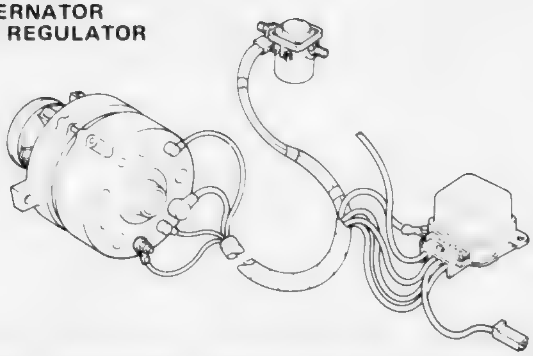
STOP ENGINE

CLEAN AND TIGHTEN CONNECTIONS SECURELY. REPEAT STEP 3

CHECK GROUND CONNECTION BETWEEN REGULATOR AND ALTERNATOR AND/OR REGULATOR TO ENGINE.

VOLTAGE READING OK → STOP

VOLTAGE READING STILL HIGH → 5

STEP	SEQUENCE	RESULT
5	DISCONNECT REGULATOR WIRING PLUG FROM REGULATOR.  REPEAT VOLTAGE CHECK IN STEP 3 VOLTAGE READING OK →	6
	VOLTAGE READING STILL HIGH →	7
6	REPLACE VOLTAGE REGULATOR  →	7
7	CHECK FOR SHORTED FIELD WINDINGS ON ALTERNATOR & CIRCUIT BETWEEN ALTERNATOR AND VOLTAGE REGULATOR  SHORTED → REPAIR SHORT →	STOP
	NOT SHORTED →	STOP

70105E

Output Voltage

Ambient Temperature In Degrees Fahrenheit	Acceptable Voltage Range
0 to 50	14.8 to 14.1
50 to 100	14.5 to 13.7
100 to 150	14.2 to 13.4
150 to 200	13.8 to 13.1

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(4) Start engine. Apply load by turning on heater or air conditioner blower to high speed and headlamps on high beam.

(5) Slowly increase speed to approximately 2000 rpm.

(6) Note voltmeter reading. It should increase at least 0.5 volt above that noted in step (3).

Test Results

If the voltage increase exceeds 0.5 volt, charging system is operating satisfactorily.

If the voltage increase is less than 0.5 volt, proceed to Undercharge Troubleshooting Procedure.

Undercharge Troubleshooting Procedure

(1) Use voltmeter to check for battery voltage at BAT terminal of alternator and A-terminal of regulator connector. If no voltage is indicated at either terminal, replace or repair alternator wire harness and repeat output test.

(2) Disconnect connector from voltage regulator.

NOTE: *Ignition must be in the OFF position.*

(3) Use ohmmeter to check for completed field circuit by connecting one lead of ohmmeter to F-terminal of regulator and other lead to ground (fig. 1E-20). Ohmmeter should indicate 4 to 250 ohms. Reading of less than 4 ohms indicates slip ring or brush shorted to ground or short in rotor windings. Reading of more than 250 ohms indicates sticking brushes, dirty slip rings or open winding in rotor.

(4) If grounded field circuit is indicated in step (2), voltage regulator may have been damaged by grounded field. Check regulator by connecting ohmmeter to regulator F- and I-terminals. Ohmmeter should indicate no resistance. If approximately 10 ohms are indicated, regulator must be replaced.

(5) Repeat output test after correcting grounded circuit problems in steps (2) and (3).

(6) Connect jumper wire between A- and F-terminals of regulator connector (fig. 1E-21) and repeat output test. If output voltage is as specified, replace regulator.

(7) Disconnect jumper wire installed in step (5) and leave regulator connector removed. Disconnect wire harness from FLD terminal of alternator and connect jumper wire between BAT and FLD terminals of alternator (fig. 1E-22). Repeat output test.

(8) If output is as specified, replace or repair alternator wire harness. If output is still below specification, alternator is faulty and must be tested and repaired.

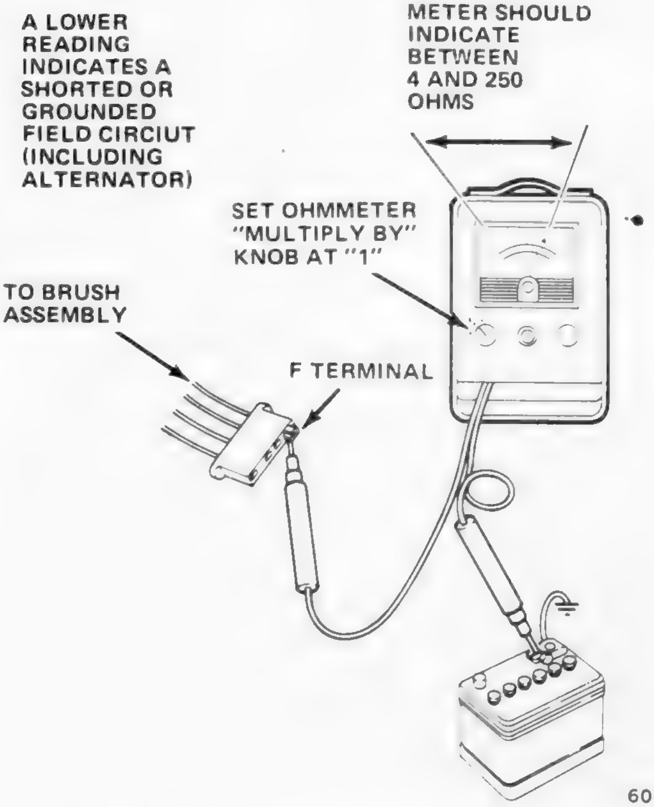

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Fig. 1E-20 Grounded Field Circuit Check

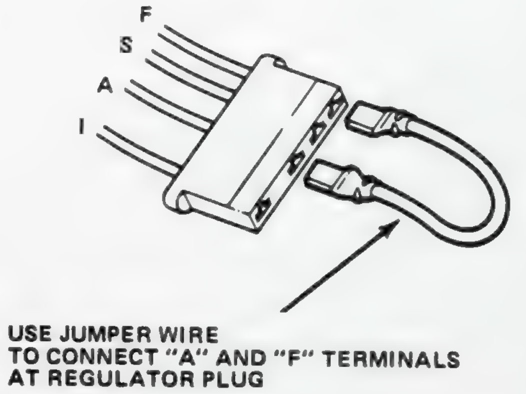

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Fig. 1E-21 Regulator Connector Jumper Wire Connections (Regulator Bypassed)

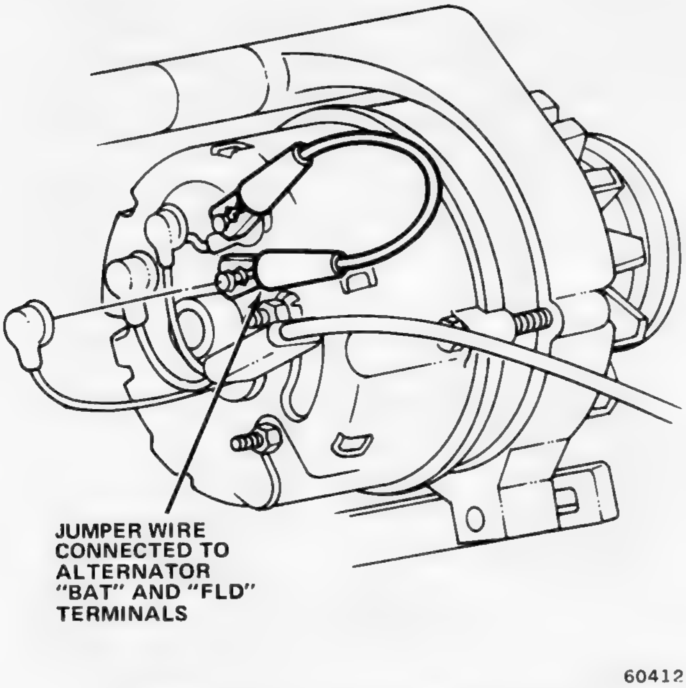


Fig. 1E-22 Alternator Jumper Wire Connections

Overcharge Troubleshooting Procedure

(1) Clean and tighten ground connections at alternator and regulator. Repeat output test.

(2) Disconnect regulator connector from regulator and repeat output test.

(a) If voltage is same as battery voltage with engine OFF, replace regulator.

(b) If voltage still remains over specification, alternator wire harness is shorted and must be replaced. Regulator must also be replaced.

TESTING—OFF CAR

Stator Ground and Negative Diode Test

(1) Set ohmmeter at 10 scale and calibrate meter.

(2) Touch one ohmmeter lead to STA terminal and other lead to GRD terminal.

(3) Check continuity in other direction by reversing leads.

A reading of approximately 60 ohms should be indicated in one direction and infinite (no needle movement) in the other direction.

NOTE: *Ohmmeter must be on 10 scale or incorrect indication will result.*

Test Results

An indication of 60 ohms or less in both directions may be due to:

- Defective negative diode
- Grounded positive diode plate
- Grounded alternator BAT terminal
- Grounded STA terminal
- Grounded stator winding (laminations grounded or windings grounded to front or rear housing)

An infinity indication in both directions (no needle movement) is caused by an open STA terminal connection.

Field Circuit Open or Ground Test

(1) Set ohmmeter at 1 scale and calibrate.

(2) Touch one ohmmeter lead to FLD terminal and other lead to GRD terminal.

(3) Spin pulley and note ohmmeter indication. It should indicate between 3.5 and 250 ohms and fluctuate while rotor is turning.

Test Results

An indication lower than 3.5 ohms may be due to:

- Grounded positive brush
- Grounded field terminal
- Defective rotor

An indication higher than 250 ohms may be due to:

- Worn out or hung brushes
- Open brush lead
- Defective rotor

Rotor Short-to-Ground Test

To perform this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. The test may be performed with an ohmmeter set to the 1000 scale or with a 110-volt test lamp.

Hold one test lead to rotor shaft and touch other lead to one slip ring (fig. 1E-23). Repeat with other slip ring. In each case, the ohmmeter should indicate infinity (no needle movement) or the test lamp should not light.

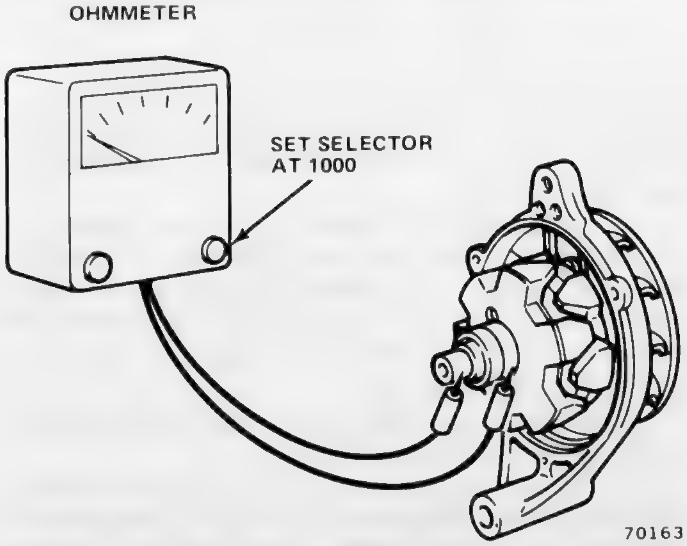


Fig. 1E-23 Rotor Short-to-Ground Test

Test Results

If ohmmeter indicates other than infinity or test lamp lights, a short to ground exists. Check soldered connections at slip rings to be sure they are secure and not grounding against rotor shaft, or that excess solder is not grounding rotor coil. Replace rotor if damaged.

Rotor Open Test

To perform this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. The test may be performed with an ohmmeter set to the 1 scale or with a 110-volt test lamp.

Touch one test lead to one slip ring and other test lead to other slip ring (fig. 1E-24). Ohmmeter should read 3.5 to 4.5 ohms or test lamp should light.

Test Results

If ohmmeter reading is infinite or test lamp fails to light, the rotor winding is open.

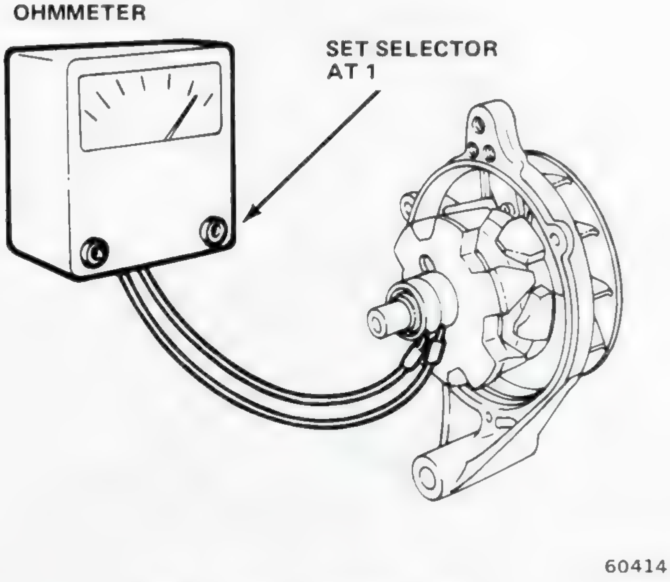


Fig. 1E-24 Rotor Open Test

Rotor Internal Short Test

To perform this test, remove rotor and front housing assembly from stator and rear housing assembly. Refer to Disassembly for procedure. This test is performed with a 12-volt battery and an ammeter.

Connect battery and ammeter in series with slip rings (fig. 1E-25). The field current at 12 volts and 80°F should be between 2.7 and 3.4 amps.

Test Results

Any ammeter reading above 3.4 amps indicates shorted windings.

NOTE: *The winding resistance and ammeter readings will vary slightly with winding temperature changes. A reading below the specified value indicates excessive resistance. An alternate method is to check the resistance of the field by connecting an ohmmeter to the two slip rings. If the resistance reading is below 3.5 ohms at 80°F, the winding is shorted. If resistance is above 4.5 ohms at 80°F, the winding has excessive resistance.*

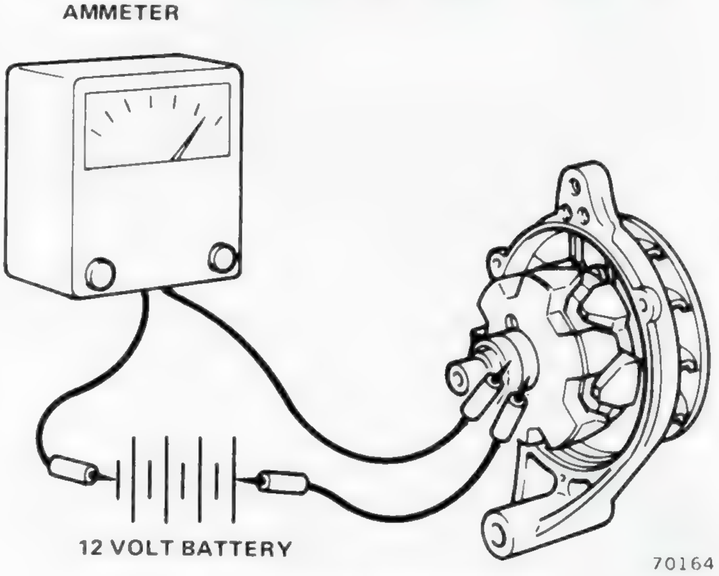


Fig. 1E-25 Rotor Internal Short Test

Stator Short-to-Ground Test

To perform this test, remove stator and rear housing assembly from rotor and front housing assembly. Remove stator leads from the rectifier terminals. Refer to Disassembly for procedures. The test may be performed with an ohmmeter set to the 1000 scale or with a 110-volt test lamp.

Touch one test lead to bare metal surface of stator core and other test lead to end of one stator lead (1E-26). Because all three stator windings are soldered together, it is not necessary to test all three leads. Ohmmeter should indicate infinity (no needle movement) or test lamp should not light.

Test Results

If ohmmeter indicates other than infinity or test lamp lights, stator is grounded and must be replaced.

Stator Continuity Test

To perform this test, remove stator and rear housing assembly from the rotor and front housing assembly. Remove stator leads from the rectifier terminals. Refer to Disassembly for procedures. An ohmmeter set to the 1 scale is used to perform the tests.

Touch ohmmeter leads to two stator leads and note ohmmeter reading (fig. 1E-27). Test each pair of stator leads in this manner. Equal readings should be obtained for each pair.

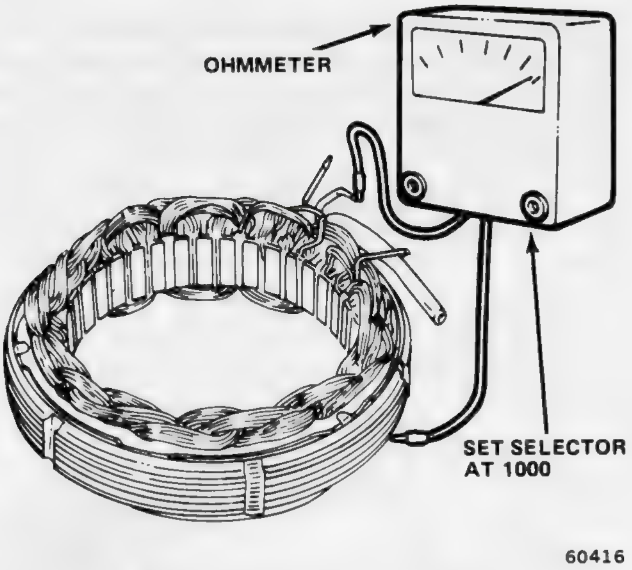


Fig. 1E-26 Stator Short-to-Ground Test

Test Results

An infinity reading (no needle movement) indicates an open winding. If a break is found, make necessary repairs and repeat test. If an open still exists, replace stator.

A reading of more than 1 ohm indicates a bad solder joint. Check the neutral junction splice.

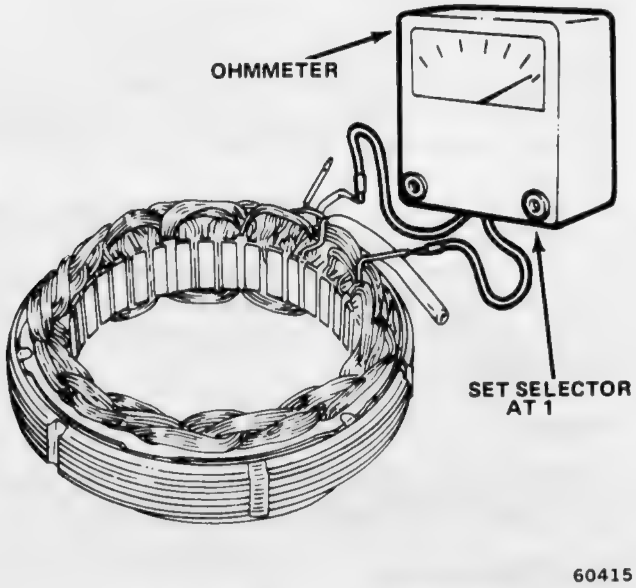


Fig. 1E-27 Stator Continuity Test

Stator Internal Short Circuit Test

An internal short (for instance, between adjacent windings) is difficult to locate without laboratory test equipment. If all other electrical checks are normal and alternator fails to supply rated output, shorted stator windings are indicated.

Rectifier Diode Test

(1) Remove rectifier assembly from rear housing.

(2) Set ohmmeter at 10 scale and calibrate.

(3) Test negative diodes by touching one ohmmeter lead to ground terminal and other lead to each stator lead terminals (fig. 1E-28). Reverse leads to check diodes in other direction.

(4) Test positive diodes by touching one lead to rectifier battery terminal and other lead to each stator lead terminal (fig. 1E-29). Reverse leads to check diodes in other direction.

All diodes should show continuity (approximately 60 ohms) in one direction and no continuity (infinity) in the other direction.

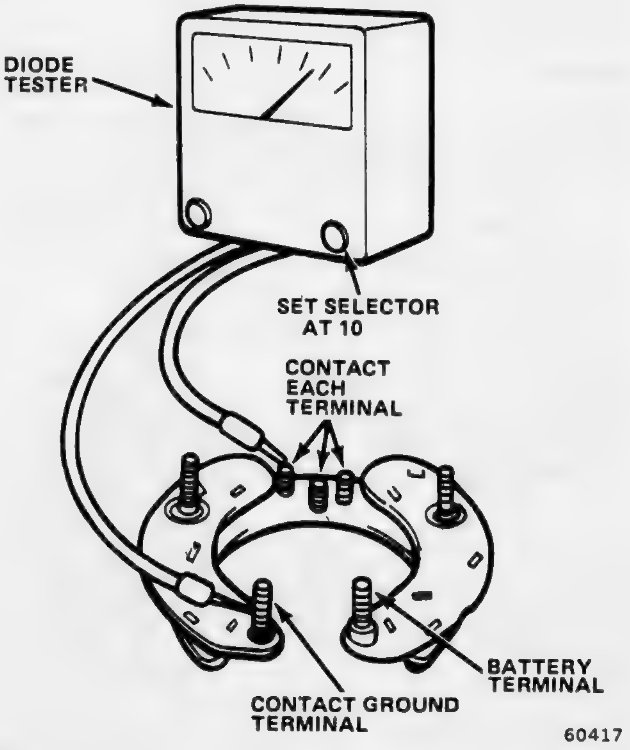


Fig. 1E-28 Testing Negative Diodes

NOTE: *Ohmmeter must be set on 10 scale or incorrect indications will result.*

Test Results

If continuity is observed in both directions, the diode(s) is shorted.

If no continuity is observed in both directions, the diode(s) is open.

Replace rectifier assembly if open or shorted diodes are found.

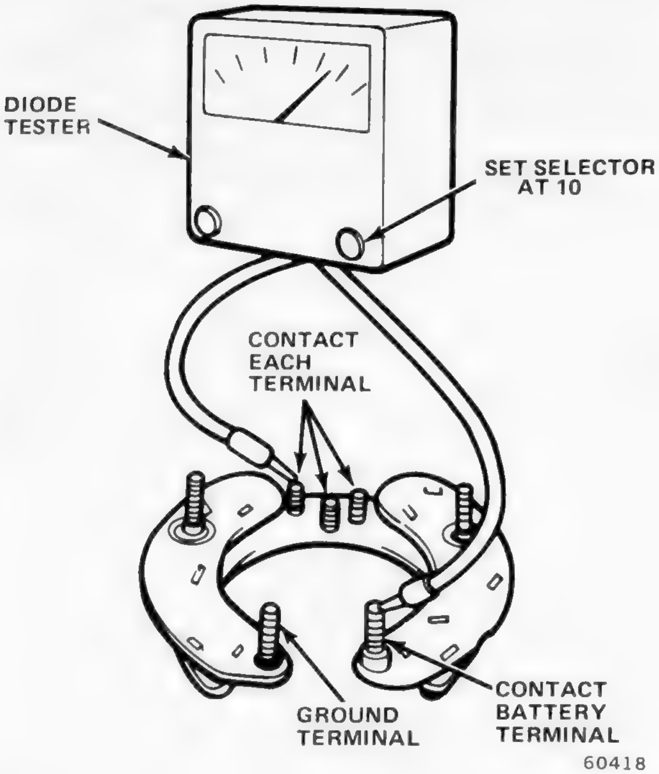


Fig. 1E-29 Testing Positive Diodes

REGULATOR REPLACEMENT

Removal

(1) Disconnect harness connector from regulator by twisting flat-bladed screwdriver between raised portion of connector and regulator housing.

(2) Remove attaching screws and remove regulator.

Installation

(1) Position regulator and install attaching screws. Screws must be cadmium or zinc plated.

(2) Check harness connector for corrosion. File or sand terminals as necessary.

(3) Attach connector securely to regulator.

ALTERNATOR REPLACEMENT

Removal

(1) Disconnect battery negative cable.
(2) Loosen alternator mounting bracket screws.
(3) Remove alternator adjusting screw.
(4) Remove alternator drive belt(s).
(5) Disconnect wire harness from rear of alternator.
(6) Remove alternator pivot screw and remove alternator.

Installation

(1) Install alternator and pivot screw. Do not tighten pivot screw.
(2) Install adjustment screw but do not tighten.
(3) Install drive belt(s).
(4) Tighten mounting bracket screws.
(5) Tighten drive belt to specified tension.
(6) Tighten pivot screw and adjusting screw.
(7) Connect wire harness to alternator.
(8) Connect battery negative cable.

ALTERNATOR OVERHAUL

Disassembly

NOTE: *Refer to figure 1E-30 for parts identification.*

(1) Scribe both end housings and stator for aid in assembly.

(2) Remove three housing through-screws.

(3) Separate front housing and rotor from stator and rear housing.

(4) Remove all nuts and insulators from rear housing and remove rear housing from stator and rectifier assembly.

(5) Remove brush holder mounting screws and remove brush holder, brushes, brush springs, insulator and terminal.

(6) If replacement is necessary, press rear bearing from rear housing, supporting housing close to bearing boss. Press bearing out from inside. Use 7/16-inch deep socket or similar tool.

(7) If rectifier assembly or stator is being replaced, use 100-watt soldering iron to unsolder stator leads from rectifier printed-circuit board terminals.

NOTE: *Production alternators have two types of rectifier assemblies. One has a circuit board spaced away from exposed diodes and the other has a circuit board with built-in diodes. These assemblies are interchangeable. Replacement rectifiers are only of the exposed-diode type. Refer to figure 1E-31 and figure 1E-32 for identification.*

(8) Disconnect stator netural lead from rectifier assembly with exposed diodes by turning stator terminal clockwise 1/4-turn to unlock.

(9) Disconnect stator neutral lead from rectifier assembly with built-in diodes by pressing stator terminal straight out of rectifier.

CAUTION: *On rectifier assemblies with built-in diodes, do not twist stator terminal during removal as rectifier serrations may be damaged. Do not remove ground terminal screw unless it or insulator must be replaced.*

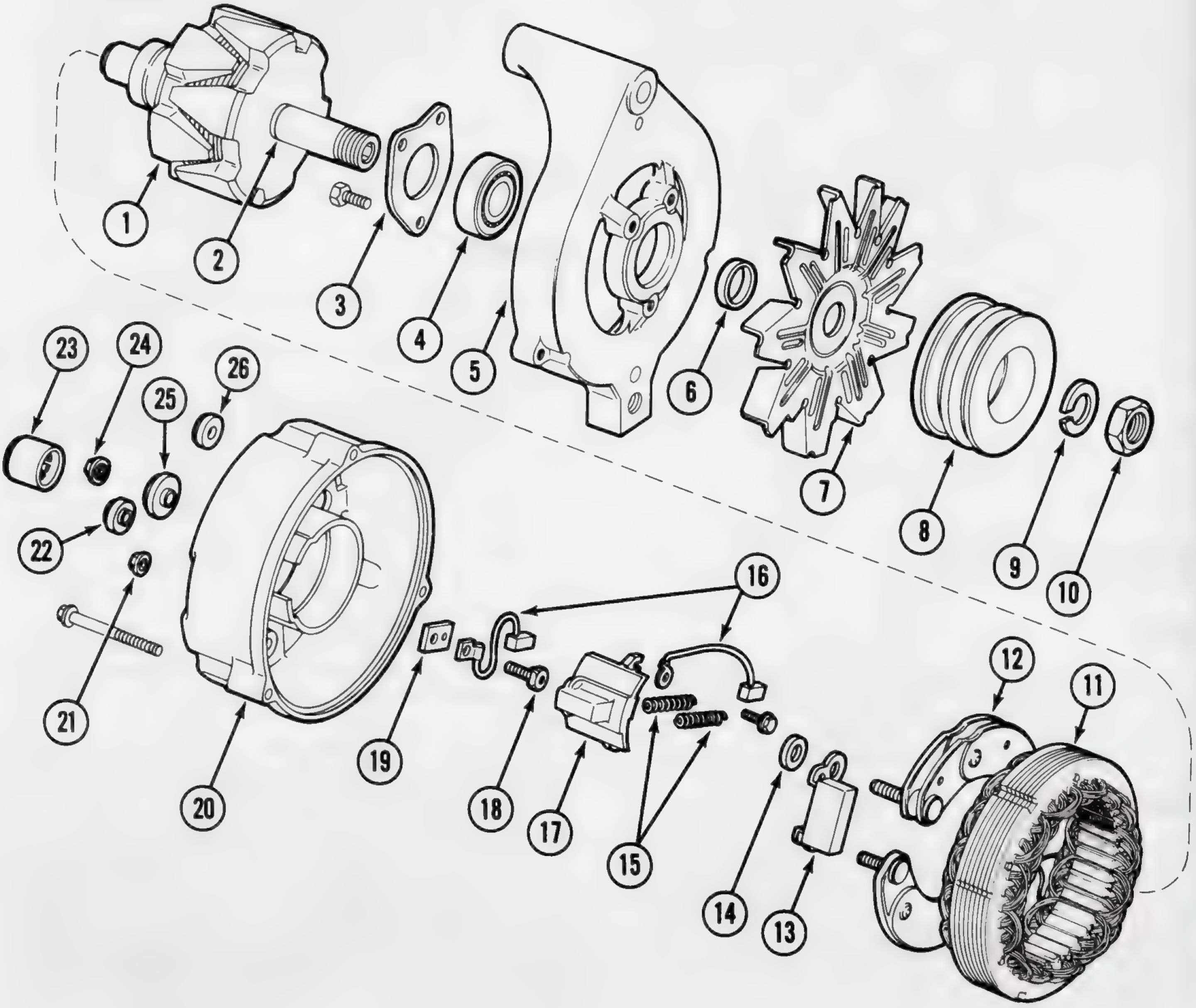
(10) Separate rectifier assembly from stator.

(11) Clamp front housing in vise. Use Pulley Removal and Installation Tool J-21501 to remove drive pulley nut (fig. 1E-33).

(12) Remove lockwasher, pulley, fan, fan spacer, front housing and rotor stop from rotor shaft.

(13) Remove front end bearing retainer screws and remove retainer. If bearing is damaged or has lost its lubricant, support housing close to bearing boss and press out bearing.

(14) Test stator, rectifier and rotor.



1. ROTOR
2. STOP RING
3. FRONT BEARING RETAINER
4. FRONT BEARING
5. FRONT HOUSING
6. FRONT BEARING SPACER
7. FAN
8. PULLEY
9. LOCKWASHER
10. NUT
11. STATOR
12. RECTIFIER ASSEMBLY
13. RADIO NOISE SUPPRESSION CAPACITOR
14. CAPACITOR INSULATOR
15. BRUSH SPRING
16. BRUSH SET
17. BRUSH HOLDER
18. BRUSH TERMINAL SCREW
19. BRUSH TERMINAL INSULATOR
20. REAR HOUSING
21. GRO TERMINAL NUT
22. FIELD INSULATOR (ORANGE)
23. REAR BEARING
24. BAT TERMINAL NUT
25. BATTERY TERMINAL INSULATOR (RED)
26. STATOR INSULATOR (BLACK)

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Fig. 1E-30 Motorcraft Alternator—Exploded View

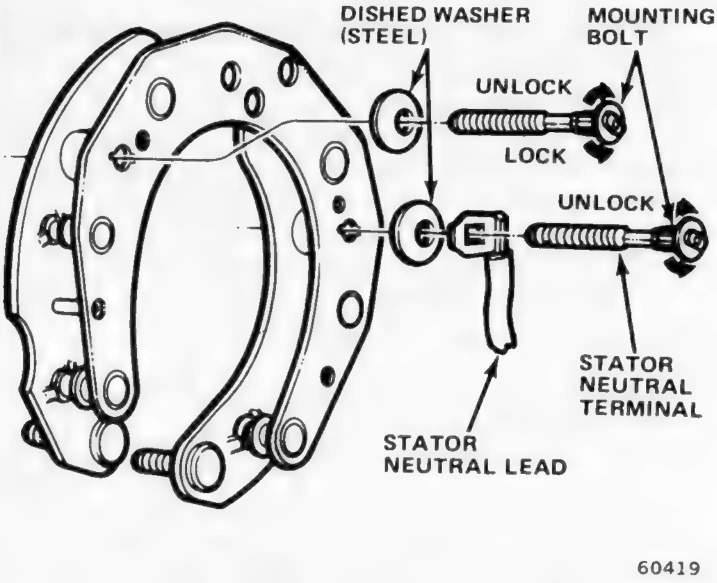


Fig. 1E-31 Rectifier Assembly with Exposed Diodes

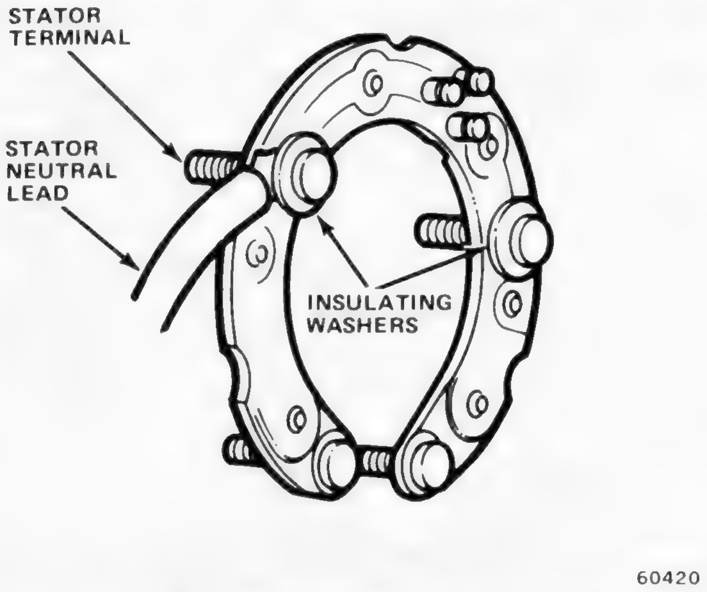


Fig. 1E-32 Rectifier Assembly with Built-In Diodes

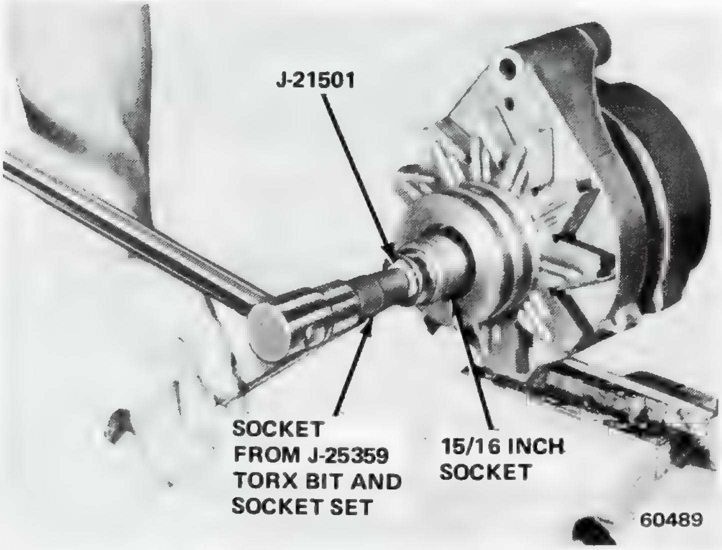


Fig. 1E-33 Pulley Removal and Installation

Cleaning and Inspection

(1) Clean rotor, stator and bearings with clean cloth. Do not clean with solvent.

(2) Rotate front bearing on drive end of rotor shaft. Check for scraping noise, looseness or roughness. Look for excessive lubricant leakage. Replace bearing if any of these conditions exist.

(3) Inspect rotor shaft rear bearing surface for roughness or severe chatter marks. Replace rotor assembly if shaft is not smooth.

(4) Place rear bearing on slip ring end of rotor shaft and rotate bearing. Make same check for noise, looseness or roughness as was made for front bearing. Inspect bearing rollers and cage for damage. Replace bearing if damaged or if lubricant is lost or contaminated.

(5) Check pulley and fan for excessive looseness on rotor shaft. Replace any pulley or fan that is loose or bent out of shape.

(6) Check both front and rear housings for cracks, particularly webbed areas and at mounting boss. Replace damaged or cracked housings.

(7) Check all wire leads on both stator and rotor assemblies for loose or broken soldered connections and for burned insulation. Resolder poor connections. Replace parts that show signs of burned insulation.

(8) Check slip rings for nicks and surface roughness. Remove nicks and scratches by turning down the slip rings. Do not go beyond minimum diameter of 1.22 inches. If rings are badly damaged, replace rotor assembly.

(9) Replace brushes if worn shorter than 5/16 inch.

Assembly

(1) Press front bearing into front housing bearing boss (put pressure on outer race only), and install bearing retainer.

(2) If stop ring on rotor drive shaft was damaged, install replacement stop ring. Push stop ring on shaft and into groove. **Do not open ring with snap ring pliers** as permanent damage will result.

(3) Position rotor stop on drive shaft with recessed side against stop ring.

NOTE: *Rotor stop is black and larger in diameter than fan spacer.*

(4) Position front housing, fan spacer, fan, pulley and lock washer on rotor shaft and install drive pulley nut.

NOTE: *Do not use an impact wrench to tighten pulley nut. Diodes may be damaged.*

(5) Clamp front housing in vise and install drive pulley using tool J-21501 (fig. 1E-33). Tighten drive pulley nut to 60 to 100 foot-pounds (81 to 136 Nm) torque.

(6) If rear housing bearing was removed, support housing near bearing boss and press in replacement bearing flush with outer housing.

(7) Place brush springs, brushes, brush terminal and terminal insulator in brush holder and hold brushes in position by inserting wooden or plastic toothpick in brush holder (fig. 1E-34).

NOTE: *Do not use wire, as it may chip the brush.*

(8) Position brush holder assembly in rear housing and install mounting screws.

(9) Wrap three stator winding leads around circuit board terminals.

(10) Install stator neutral lead on rectifier with exposed diodes by inserting stator terminal through neutral lead, dished washer and rectifier. Turn stator terminal counterclockwise 1/4-turn to lock.

(11) Install stator neutral lead on rectifier with built-in diodes by inserting stator terminal through neutral lead, insulating washer and rectifier. Align serrations of stator terminal and rectifier hole and press terminal into rectifier.

(12) Install radio noise suppression capacitor on rectifier terminals (fig. 1E-35).

(13) Install BAT terminal insulator and STA terminal insulator (fig. 1E-35).

(14) Position stator and rectifier assembly in rear housing.

(15) Position STA (black), BAT (red), and FLD (orange) insulators on terminal screws, and install retaining nuts.

(16) Position rear housing and stator assembly over rotor and align scribe marks made during disassembly.

(17) Seat machined portion of stator core into step in both end housings.

(18) Install housing through-screws.

(19) Remove brush-retaining toothpick and put daub of waterproof cement over hole to seal it.

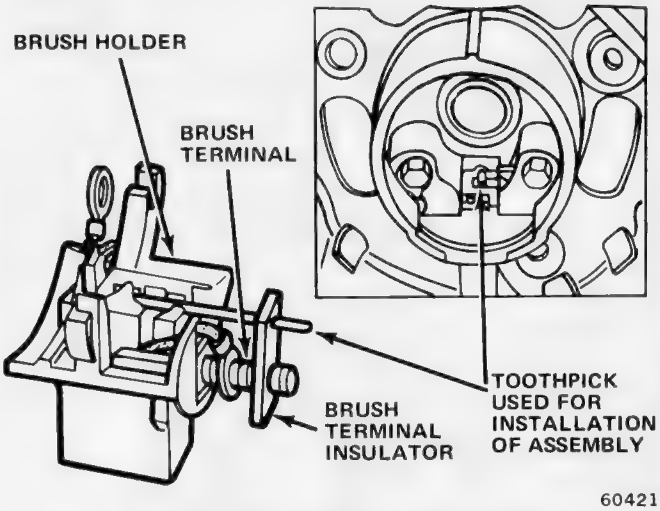
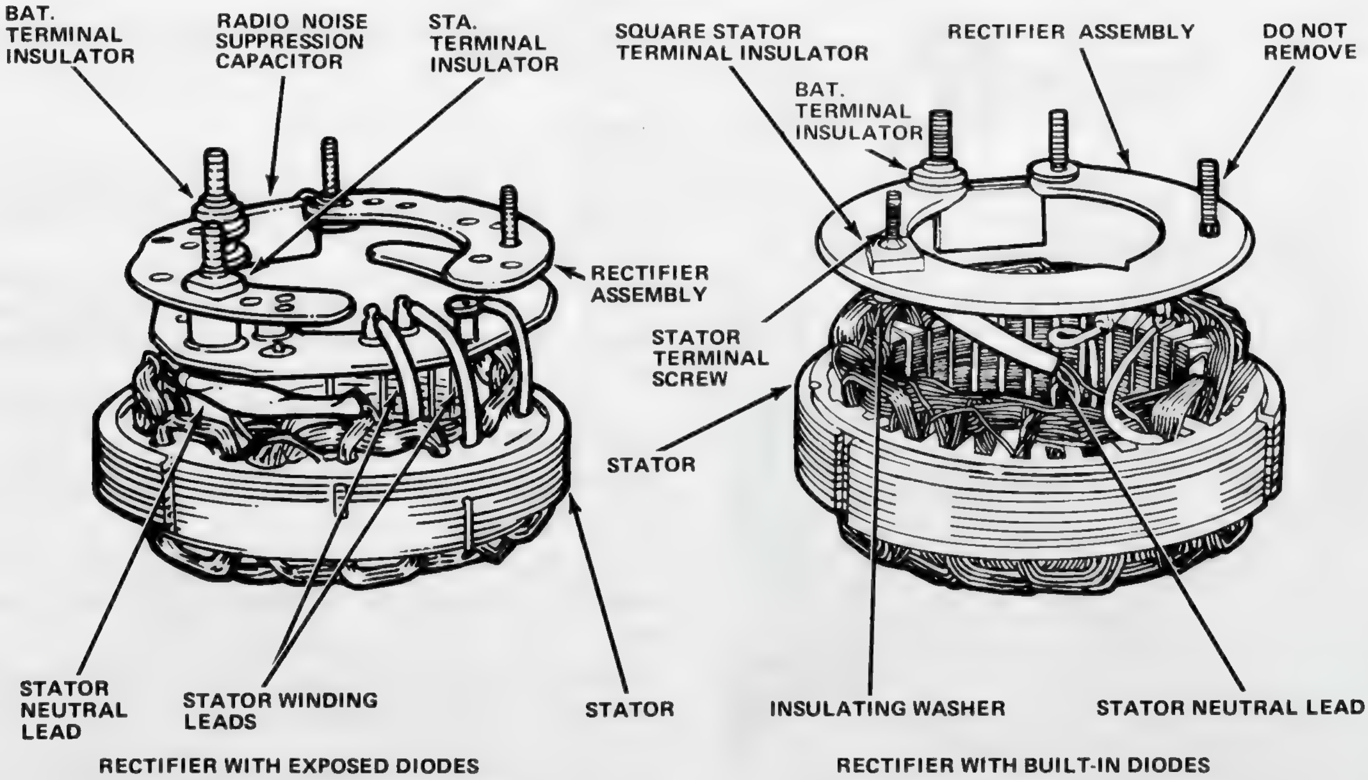


Fig. 1E-34 Brush Holder Assembly Installation



RECTIFIER WITH EXPOSED DIODES

RECTIFIER WITH BUILT-IN DIODES

Fig. 1E-35 Stator and Rectifier Assemblies

DRIVE BELT ADJUSTMENT

Before attempting an adjustment, inspect belt for general condition. If it is severely cracked or oil-soaked, it should be replaced.

Install Belt Strand Tension Gauge J-23600 on the longest accessible span, midway between pulleys (fig. 1E-36).

NOTE: *When using the gauge on a notched belt, the middle finger of the gauge should be in the notched cavity of the belt.*

If drive belt requires adjustment, refer to Chapter 1C—Cooling for procedures.

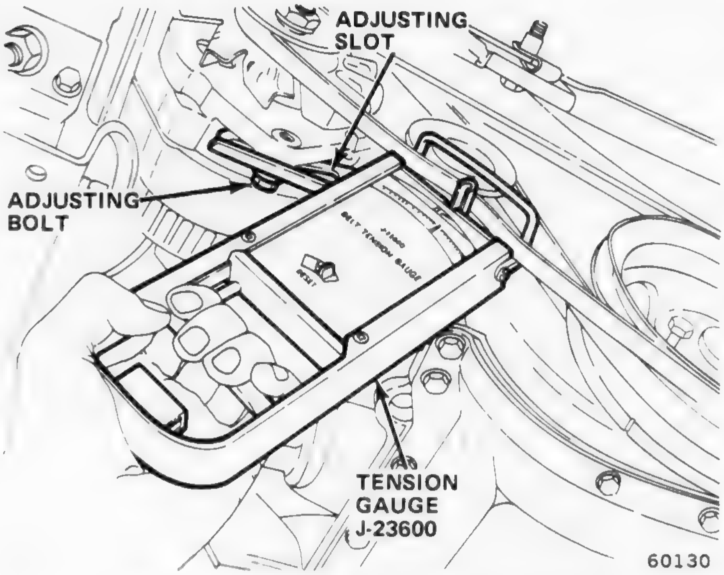


Fig. 1E-36 Checking Belt Tension—Typical

SPECIFICATIONS

Eight-Cylinder Charging System Specifications

Alternator – Eight-Cylinder Engine

Make	Motorcraft
Rating	
Standard	40 amps
Optional	60 amps
Field Current	2.5 to 3.0 amps
Rotation (Viewing Drive End)	Clockwise
Pulley Size	2.62 inches (6.65 cm)
Belt Tension	125-155 pounds, set-to 90-115 pounds, recheck (57-70 kg, set-to 41-52 kg, recheck)

Voltage Regulator – Eight-Cylinder Engine

Make	Motorcraft
Type	Electro-Mechanical
Adjustment	None

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Torque Specifications—Eight-Cylinder

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Alternator Adjusting Bolt	24	20-27	18	15-20
Alternator Mounting Strap Bolt	38	31-41	28	23-30
Alternator Pivot Mounting Bolt	45	41-48	33	30-35

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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Output Voltage Specifications

Ambient Temperature In Degrees Fahrenheit	Acceptable Voltage Range
0 to 50	14.8 to 14.1
50 to 100	14.5 to 13.7
100 to 150	14.2 to 13.4
150 to 200	13.8 to 13.1

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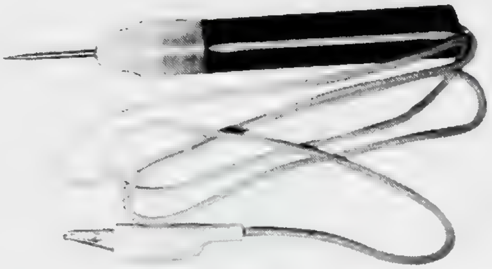
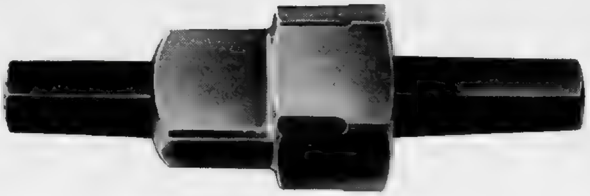
Special Tools



J-21008
CONTINUITY
LIGHT



J-21501
MOTOR CRAFT PULLEY
REMOVAL/INSTALLATION
TOOL

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STARTING SYSTEM

1F

SECTION INDEX

GENERAL

The starting system used on all AMC cars consists of a positive engagement starter motor, a starter relay, a starter switch (integral with the ignition switch), starter circuits protected by fusible links and the car's battery. Cars equipped with automatic transmission also have a neutral start switch. The starter motor uses a moveable pole shoe and appropriate linkage to engage the drive mechanism. Inside the drive assembly, an overrunning clutch prevents the starter motor from being driven by the ring gear.

During the 1977 model year, a revised starter motor was put into production. This revised motor is carryover for the 1978 model year. Briefly, the revisions included a simplified brush guide and spring assembly, revised drive yoke clamp and relocation of the input terminal onto the end plate at the brush end.

Three different starter motors are listed in the Specifications chart at the end of this chapter. The small-diameter motor is used on four-cylinder engines. The standard performance large-diameter motor is used on all six-cylinder engines and on 304 CID eight-cylinder engines. The high-performance motor is used on 360 CID eight-cylinder engines. The performance level of the two large-diameter motors is determined by the cross-sectional area of the field coils.

COMPONENTS

Starter Motor

Identification

At the time of manufacture, the starter motor identification code is stamped on the frame adjacent to the American Motors Part Number. The date is decoded as follows:

- Year (7—1977, 8—1978)
- Month (A—Jan., B—Feb.)
- Week (A—first week in month, B—second week)

Field Coils

Four field coils are used. Each is wrapped around an iron pole shoe which acts to concentrate the magnetic field created when current flows through the field coil. Three of the field coils have fixed pole shoes, while the fourth coil has a moveable pole shoe. This fourth coil, mounted at the top of the starter motor, has an additional, smaller coil wrapped inside. This is called the hold-in coil.

Drive Assembly

A pinion gear, driven by the starter motor armature, is slid into mesh with the engine ring gear when the starter is activated. The sliding motion is accomplished by the action of the moveable pole shoe and its drive yoke (fig. 1F-1). As long as the ignition key is held in the START position, the drive pinion remains in mesh with the engine ring gear. An overrunning clutch in the drive assembly permits the starter motor to drive the engine ring gear. After the engine starts, it prevents the engine from driving the starter motor before the key is returned to the RUN position.

Starter Solenoid

Two different starter solenoids are used, one with manual transmissions and the other with automatic transmissions. The solenoids differ in the method of grounding the solenoid pull-in coil.

The ground circuit for the solenoid pull-in coil is completed through the solenoid mounting bracket on manual transmission equipped cars.

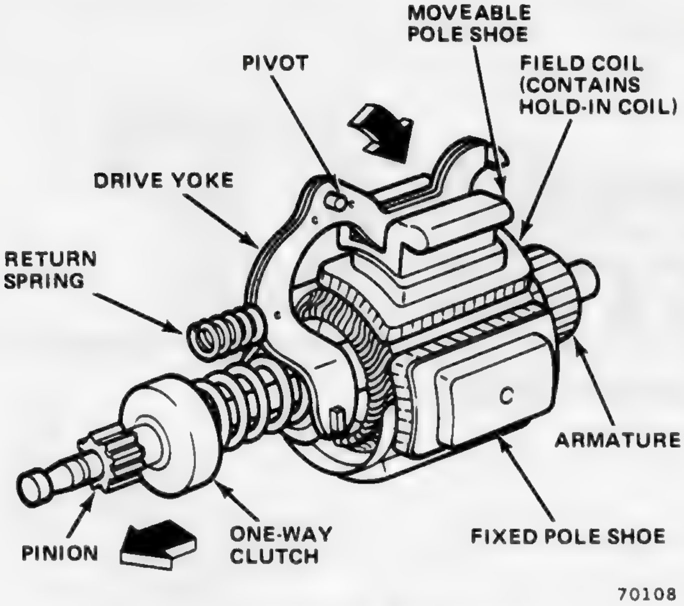

Fig. 1F-1 Moveable Pole Shoe Operation

On cars equipped with an automatic transmission, the pull-in coil grounds through an additional terminal on the solenoid. A wire connected to this terminal passes current to the neutral safety switch located on the transmission. The pull-in coil ground circuit is completed at the neutral safety switch only when the transmission gear selector is placed in NEUTRAL or PARK.

The starter solenoid is energized when battery voltage is applied to the S-terminal of the solenoid and the pull-in coil is grounded. When the solenoid coil is energized, the contact disc is pulled into the closed position. The disc strikes two contacts in the solenoid, completing the circuit between the battery and the starter motor.

All starter solenoids have a terminal marked I which connects to the ignition system. When the starter is in operation, the I-terminal furnishes battery voltage to the ignition coil. This bypasses the resistance wire that feeds the coil after start-up. Refer to Chapter 1G—Ignition System for further information.

NOTE: *Starter solenoids used in previous years (before solid-state ignition) look similar to solenoids presently used but are very different internally. Use of the wrong solenoid can damage the neutral safety switch. Check the part number stamped on the solenoid.*

Neutral Safety Switch

The neutral safety switch is a three-connector plunger switch mounted to the automatic transmission case. The outside terminals operate the back-up lamps, while the center terminal provides ground for the starter solenoid circuit. Ground is provided only when the transmission is in PARK or NEUTRAL positions.

Starter System Circuits

The starting system operates on two circuits, a low current circuit and a high current circuit (fig. 1F-2).

The low current circuit is the control circuit. It includes the connections and wires from the ignition switch to the S-terminal of the starter solenoid, and from the ground terminal of the starter solenoid to the neutral safety switch on automatic transmission cars.

The high current circuit runs from the battery through the starter solenoid to the starter motor to ground. This circuit uses heavy cables because of the heavy current draw of the starter motor.

Fusible Links

Two fusible links are used in the low current starting circuit (fig. 1F-2). Current is carried from the battery by cable to the starter solenoid battery terminal. From this terminal, current is distributed to all parts of the car. A 16-gauge fusible link joins the battery terminal to the main body harness. This fusible link protects the complete wiring system of the car. The second starter system fusible link carries current from the ignition switch into the solenoid S-terminal circuit. This 20-gauge fusible link protects the starter solenoid pull-in coil.

Fusible links are covered with a special non-flammable insulation. Each link is manufactured with a specific load rating and is intended for a specific circuit. Replacement links are listed in the Parts Catalog.

OPERATION

The starting circuit begins at the ignition switch (fig. 1F-2). The ignition switch supplies battery voltage to the starter solenoid S-terminal when the ignition key is in the START position. This voltage energizes the solenoid pull-in coil. The circuit between the battery and the starter motor is completed at the solenoid. The starter motor is energized and begins cranking the engine.

TROUBLESHOOTING

The Service Diagnosis chart may be used to trace the source of the problem when the starter cranks the engine slowly, will not crank the engine or has abnormal drive engagement.

If the starter motor cranking speed is normal and the engine does not start, the problem usually can be found in the fuel system or ignition system.

ON-CAR TESTING

Engine Will Not Crank

(1) Verify battery and cable condition as outlined in Chapter 1D—Batteries to assure correct cranking voltage.

(2) Inspect and tighten battery and starter cable connections at starter relay.

(3) Disconnect wire at solenoid S-terminal.

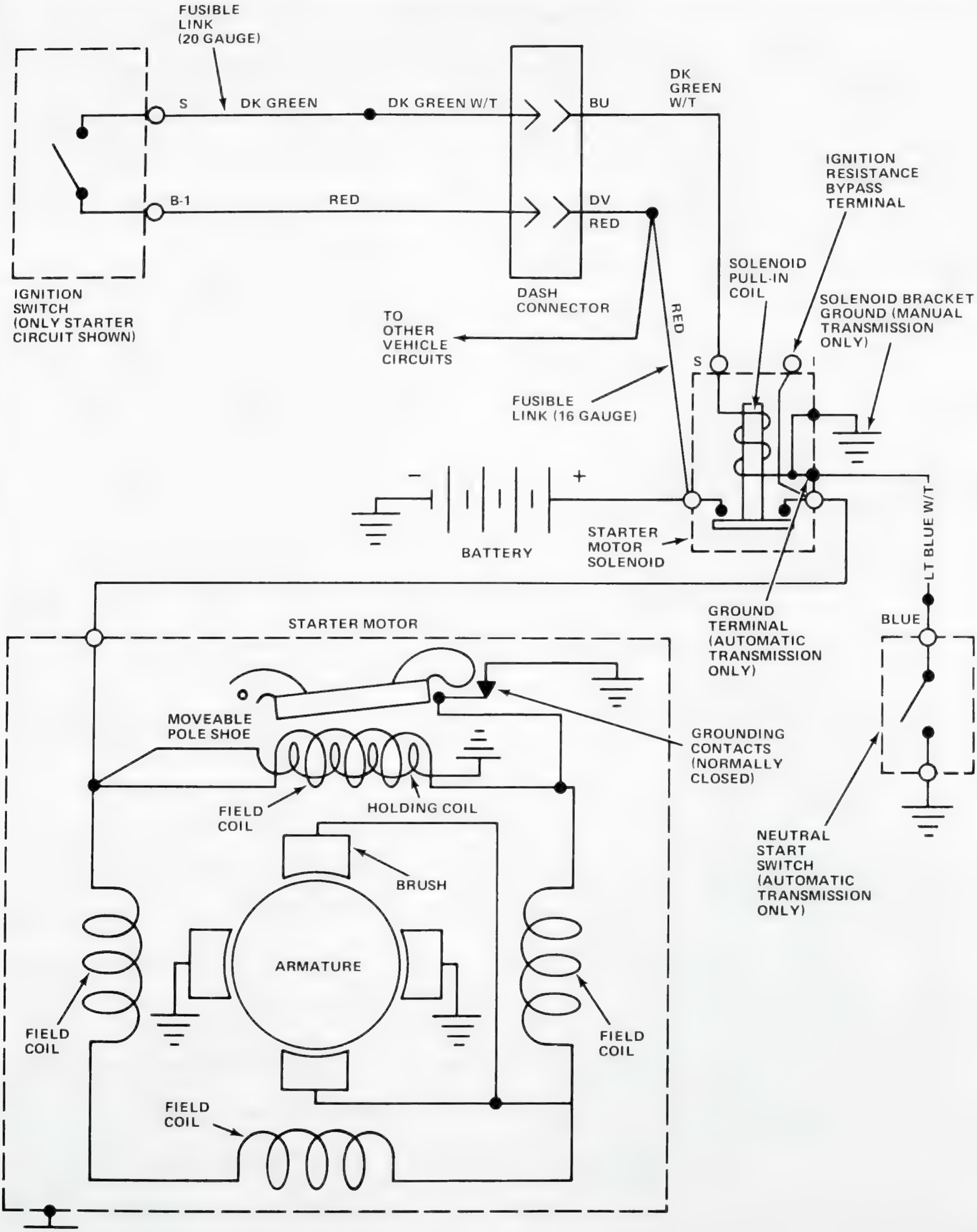

Fig. 1F-2 Starter System Schematic

Service Diagnosis

Condition	Possible Cause	Correction
STARTER CRANKS ENGINE SLOWLY	(1) Battery low or defective.	(1) Charge or replace battery.
	(2) Poor circuit between battery and starter motor.	(2) Clean and tighten, or replace cables.
	(3) Current draw low.	(3) Bench-test starter motor. Look for worn brushes and weak brush springs.
	(4) Current draw high.	(4) Bench-test starter. Check engine for functional drag or coolant in cylinders. Check ring gear clearance to starter motor.
STARTER WILL NOT CRANK ENGINE	(1) Battery low or defective.	(1) Charge or replace battery.
	(2) Faulty solenoid.	(2) Replace solenoid.
	(3) Damaged drive pinion gear or ring gear.	(3) Replace damaged gear(s).
	(4) Starter engagement weak.	(4) Bench-test starter.
	(5) Starter spins slowly and draws high current.	(5) Check drive yoke pull-down and point gap, check for worn end bushings, check ring gear clearance.
	(6) Engine siezed.	(6) Repair engine.
STARTER DRIVE WILL NOT ENGAGE (SOLENOID KNOWN TO BE GOOD)	(1) Defective point assembly.	(1) Repair or replace point assembly.
	(2) Poor point assembly ground.	(2) Repair connection at ground screw.
	(3) Defective pull-in coil.	(3) Replace field coil set.
STARTER DRIVE WILL NOT DISENGAGE	(1) Starter motor loose on bellhousing.	(1) Tighten mounting bolts.
	(2) Worn drive end bushing.	(2) Replace bushing.
	(3) Damaged ring gear teeth.	(3) Replace ring gear.
	(4) Drive yoke return spring broken or missing.	(4) Replace spring.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
STARTER MOTOR DRIVE DISENGAGES PREMATURELY	(1) Weak drive assembly thrust spring. (2) Weak hold-in coil.	(1) Replace drive assembly. (2) Replace field coil set.
LOW CURRENT DRAW	(1) Worn brushes. (2) Weak brush springs.	(1) Replace brushes. (2) Replace springs.

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CAUTION: *Place transmission in NEUTRAL or PARK position and apply parking brake before conducting solenoid test.*

(4) Connect jumper from battery positive post to solenoid S-terminal. If engine cranks, solenoid is not defective.

(5) If engine does not crank, connect another jumper wire from battery negative terminal to solenoid mount bracket (manual transmission) or ground terminal (autoatic transmission). Make certain good connection is made. If solenoid can now be made to operate, solenoid was not properly grounded. Remove rust or corrosion and attach solenoid to inner fender with cadmium-plated screws (manual) or check neutral safety switch (automatic).

(6) If engine does not crank, remove jumper wires and connect heavy jumper cable between battery positive terminal and starter motor terminal of solenoid. If engine cranks, solenoid is defective and must be replaced. If engine does not crank, check starter motor.

Starter Motor Solenoid Pull-In Winding Test

This test determines if the solenoid pull-in winding is shorted or open.

(1) Remove S-terminal wire from solenoid.

(2) Connect ohmmeter leads (fig. 1F-3).

(3) If solenoid fails any one of ohmmeter checks, replace solenoid.

Solenoid Ground Test

A poor solenoid ground can be determined with an ohmmeter.

(1) Connect one ohmmeter lead to battery negative terminal and other lead to sheet metal adjacent to solenoid. Note resistance.

(2) Move lead to solenoid S-terminal. Note resistance.

(3) If resistance increases more than 5 ohms, solenoid has poor ground.

Starter Cable and Ground Cable Tests (Voltage Drop)

The voltage drop tests will determine if there is excessive resistance in the high current circuit. When performing these tests, it is important that the voltmeter be connected to the terminals that the cables are connected to instead of to the cables. For example, when checking between battery and solenoid, touch the voltmeter probes to the battery post and the solenoid threaded stud.

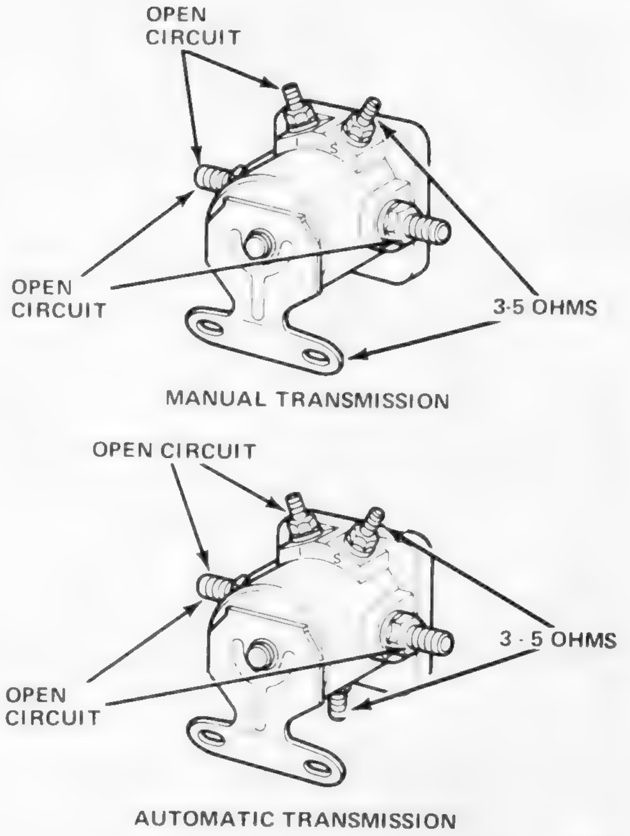


Fig. 1F-3 Ohmmeter Check of Starter Solenoid

Before Performing Tests

(1) Remove coil secondary wire from distributor and ground coil wire.

(2) Place transmission in NEUTRAL or PARK and apply parking brake.

(3) Be sure battery is fully charged.

Test Procedure

Follow the steps as outlined in the Starter Voltage Drop Tests DARS Chart.

STARTING SYSTEM DIAGNOSIS AND REPAIR SIMPLICATION (DARS) CHARTS

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

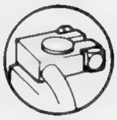
STARTER VOLTAGE DROP TESTS

Chart 1

STEP **SEQUENCE** **RESULT**

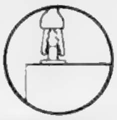
1

STARTER DRAW TEST



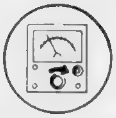
- CLEAN AND CONNECT BATTERY CABLES

- REMOVE COIL WIRE FROM DISTRIBUTOR AND CONNECT TO GROUND



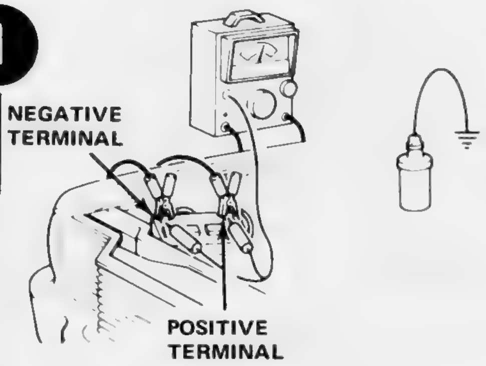
- CONNECT HEAVY LOAD TESTER

- CRANK ENGINE AND NOTE VOLTMETER READING
- TURN KEY OFF



- TURN LOAD CONTROL UNTIL VOLTMETER SHOWS SAME VOLTAGE AS WHEN CRANKING

- READ AMMETER. NOTE READING FOR USE IN LATER STEPS



OK 6 CYL. – 150-180 AMPS
8 CYL. – 160-210 AMPS → STOP

~~OK~~ 6 CYL. – ABOVE 180 AMPS
8 CYL. – ABOVE 210 AMPS

- BATTERY CABLES AND SOLENOID NOT TESTED → 2

OR

- BATTERY CABLE AND SOLENOID REPAIRS COMPLETED —

REPAIR STARTER → STOP

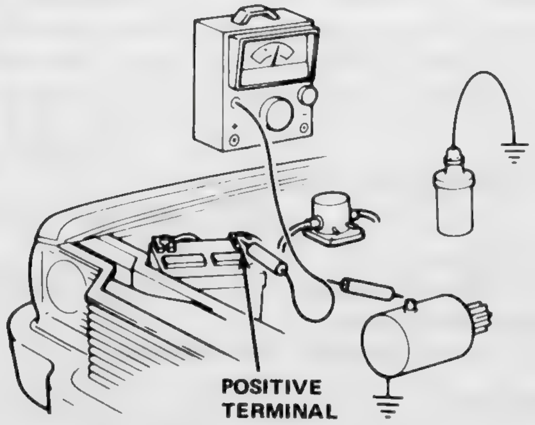
2

VOLTAGE DROP TEST

- GROUND COIL WIRE
- CONNECT VOLTMETER
- CRANK ENGINE
- READ VOLTMETER
- NOTE AMMETER READING FROM STEP 1

MAXIMUM VOLTAGE DROP BY STARTER DRAW AMPERAGE

AMPS	150-210	215-295	300-420	425-600
VOLTS	0.5 V	0.7 V	1.0 V	1.5 V



OK → 5

VOLTAGE AT OR BELOW MAXIMUM

~~OK~~ → 3

VOLTAGE ABOVE MAXIMUM

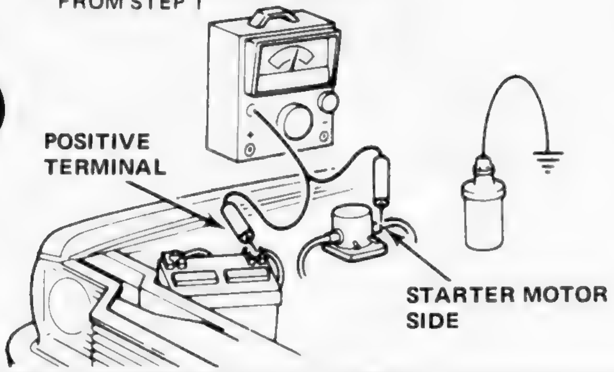
70066A

STEP **SEQUENCE** **RESULT**

3

VOLTAGE DROP TEST

- GROUND COIL WIRE
- CONNECT VOLTMETER
- CRANK ENGINE
- READ VOLTMETER
- NOTE AMMETER READING FROM STEP 1



MAXIMUM VOLTAGE DROP BY STARTER DRAW AMPERAGE				
AMPS	150-210	215-295	300-420	425-500
VOLTS	0.3 V	0.5 V	0.6 V	0.9 V

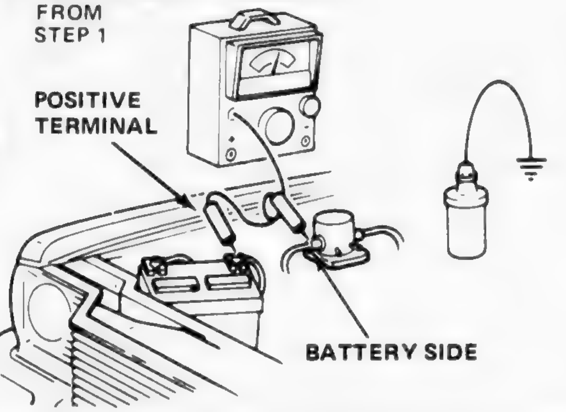
OK — VOLTAGE AT OR BELOW MAXIMUM — REPAIR SOLENOID-TO-STARTER CABLE → **5**

NOT OK — VOLTAGE ABOVE MAXIMUM → **4**

4

VOLTAGE DROP TEST

- GROUND COIL WIRE
- CONNECT VOLTMETER
- CRANK ENGINE
- READ VOLTMETER
- NOTE AMMETER READING FROM STEP 1



MAXIMUM VOLTAGE DROP BY STARTER DRAW AMPERAGE				
AMPS	150-210	215-295	300-420	425-600
VOLTS	0.2V	0.3V	0.4V	0.5V

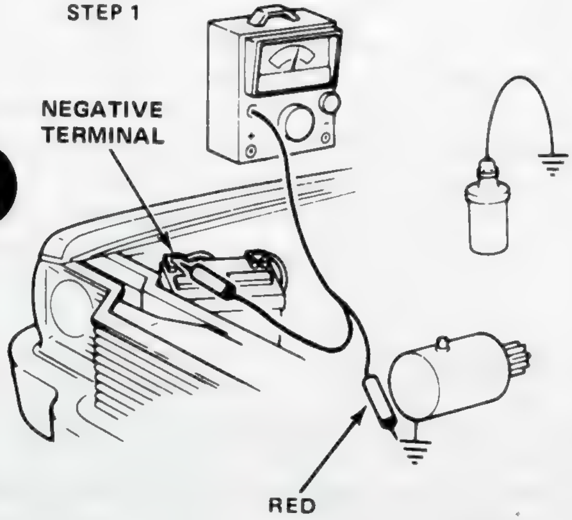
OK — VOLTAGE AT OR BELOW MAXIMUM — REPAIR SOLENOID → **5**

NOT OK — VOLTAGE ABOVE MAXIMUM — REPAIR BATTERY-TO-SOLENOID CABLE → **5**

5

VOLTAGE DROP TEST

- GROUND COIL WIRE
- CONNECT VOLTMETER
- CRANK ENGINE
- READ VOLTMETER
- NOTE AMMETER READING FROM STEP 1



MAXIMUM VOLTAGE DROP BY STARTER DRAW AMPERAGE				
AMPS	150-210	215-295	300-420	425-600
VOLTS	0.2V	0.3V	0.4V	0.5V

OK — VOLTAGE AT OR BELOW MAXIMUM

- REPAIRS TO SOLENOID OR CABLES PERFORMED IN A PREVIOUS STEP → **1**
- REPAIRS TO SOLENOID OR CABLES NOT REQUIRED IN A PREVIOUS STEP — REPAIR STARTER → STOP

NOT OK — VOLTAGE ABOVE MAXIMUM — REPAIR ENGINE-TO-BATTERY CABLE → **1**

70066B

Current Draw Test

(1) Before performing current draw test, be sure battery is fully charged as described in Chapter 1D—Batteries.

NOTE: *The lower the available voltage, the higher the amperage draw.*

(2) Disconnect and ground ignition coil secondary wire.

(3) Connect remote control starter switch between positive battery terminal and S-terminal of starter solenoid.

(4) Connect battery-starter tester leads as shown in figure 1F-4. Operate remote control starter switch and read voltage indicated on voltmeter while starter is cranking engine.

NOTE: *Do not operate for more than 15 seconds.*

(5) Turn remote control starter switch OFF.

(6) Turn load control knob toward INCREASE (clockwise) until voltmeter reading is exactly same as it was when starter was cranking engine.

Read the current draw on the ammeter scale. This is the current being used by the starter under full-load conditions. If the current draw is not within 180 to 220 amperes at room temperature, remove the starter motor from the engine for bench testing.

NOTE: *Do not consider the initial amperage draw that is required to begin engine cranking. A very hot or very cold engine may draw 400 to 600 amperes for the first few revolutions. Take an amperage draw reading after the starter has obtained its maximum rpm.*

Neutral Safety Switch Test

Remove wiring connector from switch and test for continuity between center terminal pin and transmission case. Continuity should exist only when transmission is in PARK or NEUTRAL.

NOTE: *Check linkage adjustment before replacing switch.*

OFF-CAR TESTING

No-Load Test

The starter motor no-load test will indicate such faults as open or shorted windings, worn bushings (rubbing armature) or bent armature shaft.

NOTE: *The tester load control knob must be in the DECREASE (extreme counterclockwise) position.*

(1) Operate starter with test equipment connected as shown in figure 1F-5. Note voltage reading.

(2) Determine exact starter rpm using mechanical tachometer (not shown).

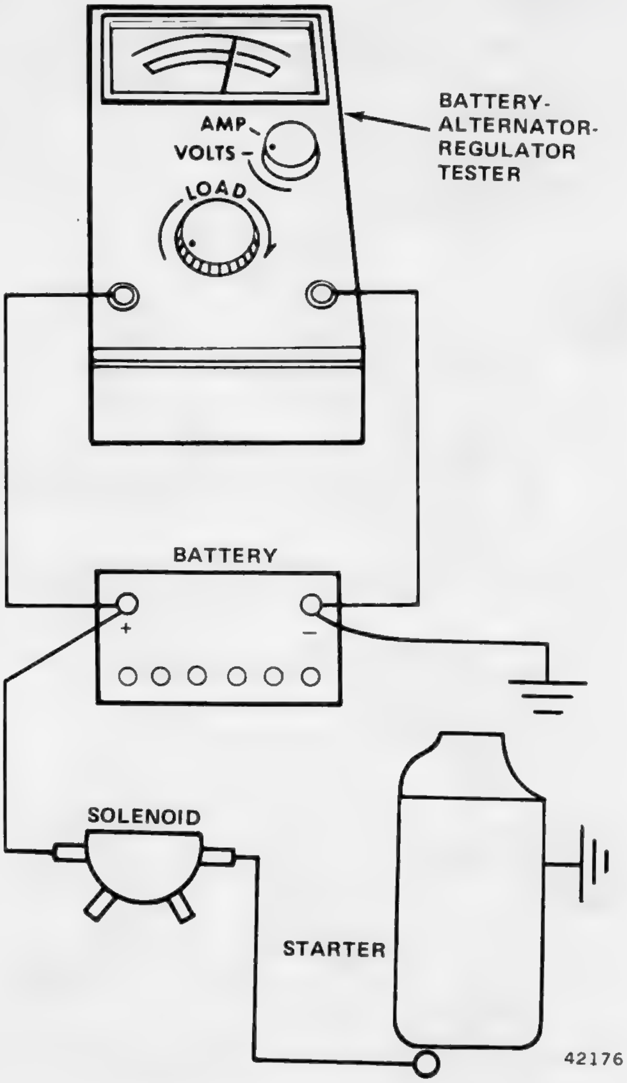


Fig. 1F-4 Starter Motor Current Draw Test

NOTE: *To connect a mechanical tachometer, remove the seal from the end of the drive end housing and clean the grease from the end of the armature shaft.*

(3) Disconnect starter from battery.

(4) Turn load control knob toward INCREASE (clockwise) until voltmeter reading is exactly same as it was with starter connected to battery.

If the ammeter reading at no-load speed is below specifications, the starter has high electrical resistance and should be repaired or replaced.

If the ammeter reading is higher than specified and the starter rpm is less than minimum rpm specification, disassemble, clean, inspect and test the starter.

Hold-In Coil Resistance Test

This test determines resistance of the windings of the hold-in coil.

(1) Insert piece of paper between contact points to act as insulator (fig. 1F-6).

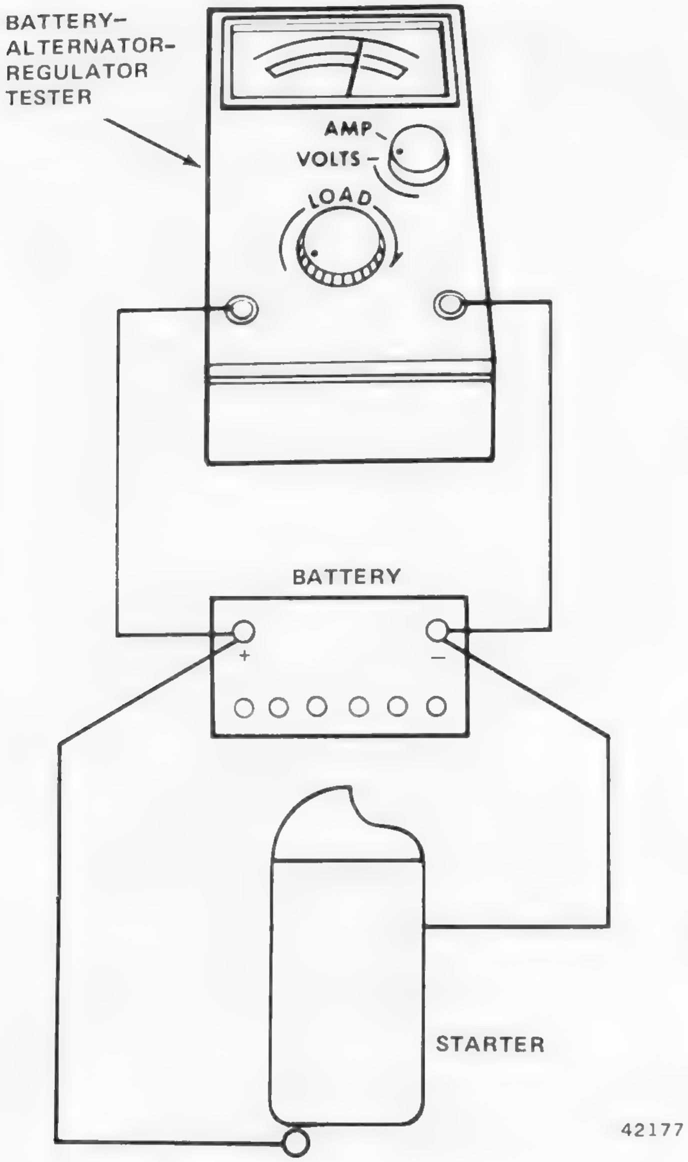


Fig. 1F-5 Starter Motor No-Load Test

(2) Use ohmmeter to check resistance between terminal and starter frame.

Resistance should be between 2.0 and 3.5 ohms. If resistance is outside specifications, replace field coil assembly.

Solenoid Point Connection Test

This test determines the quality of the solder joint at the contacts. Use ohmmeter to test resistance through solder joint (fig. 1F-7). If resistance is above zero ohms, joint has excessive resistance. Repair by resoldering joint with 600 watt soldering iron.

Insulated Brush Connection Test

This test determines the quality of the solder joint between the insulated brush braided wire and the field coils. Use ohmmeter to test resistance through solder joint by touching probes to brush and to copper bus bar (fig. 1F-8). If resistance is above zero ohms, joint has excessive resistance. Repair by resoldering joint with 600 watt soldering iron.

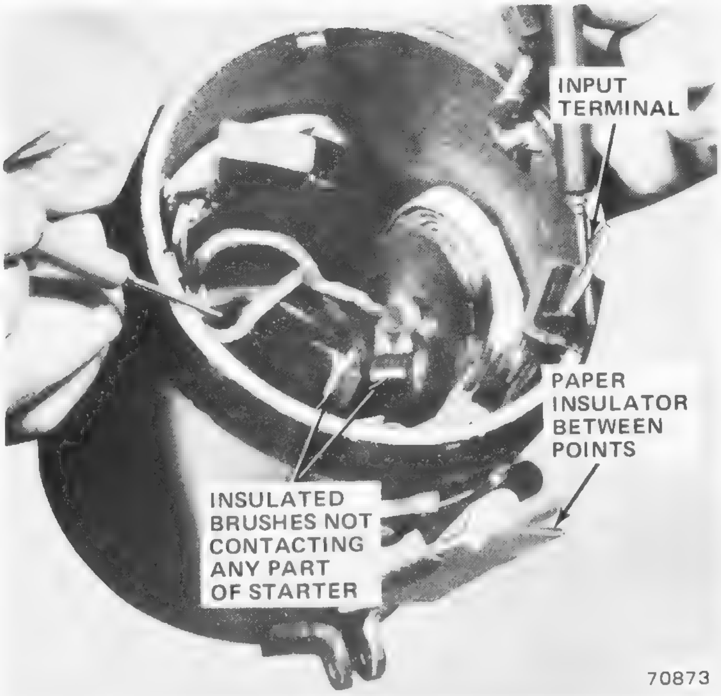


Fig. 1F-6 Hold-In Coil Resistance Test

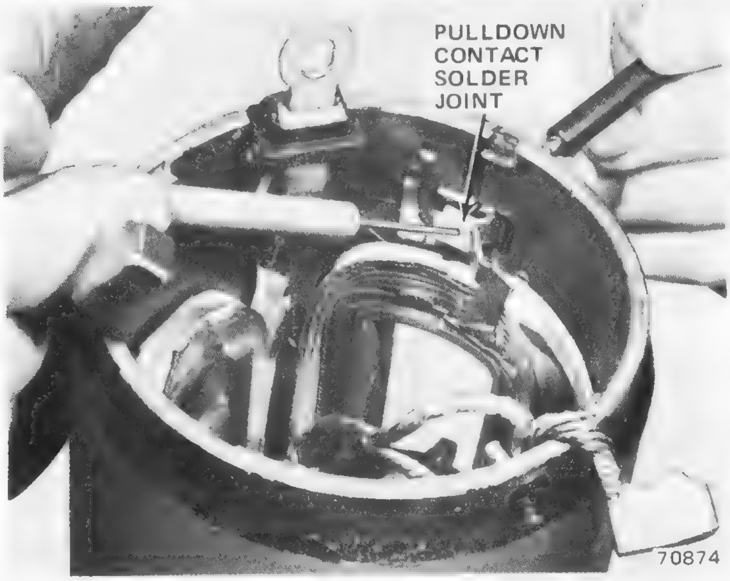


Fig. 1F-7 Solenoid Point Connection Test

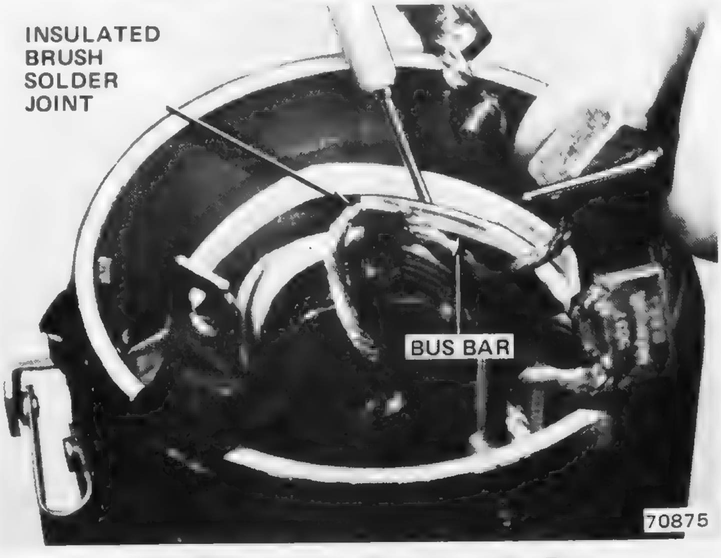


Fig. 1F-8 Insulated Brush Connection Test

Terminal-to-Brush Continuity Test

This test checks all field coil solder joints.

(1) Insert piece of paper between contact points to act as insulator (fig. 1F-9).

(2) Touch ohmmeter probes to terminal and to insulated brush.

If resistance is above zero ohms, check all solder joints to determine which one has excessive resistance. Repair faulty joint(s) by resoldering with a 600 watt soldering iron.

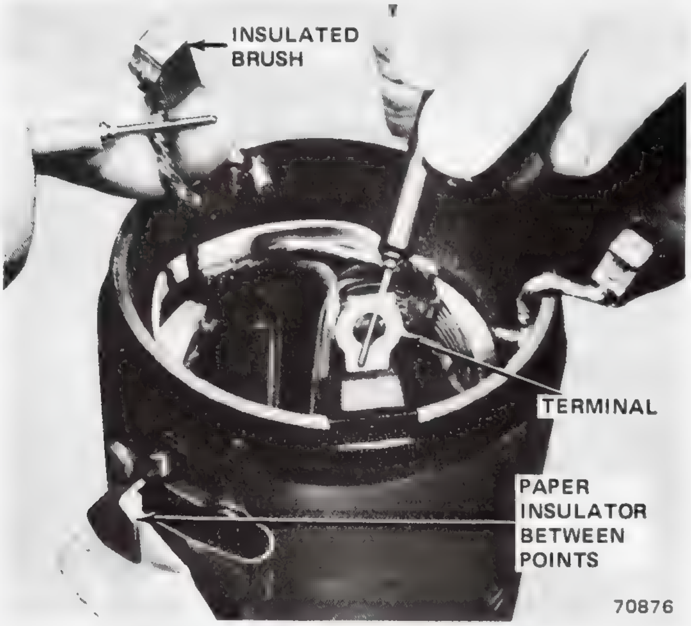


Fig. 1F-9 Terminal-To-Brush Continuity Test

Terminal Bracket Insulation Test

This test determines if the terminal bracket is properly insulated from the end cap. Use ohmmeter to test continuity between bracket and cap (Fig. 1F-10). If resistance is less than infinity, insulator is faulty. Repair by replacing end cap.

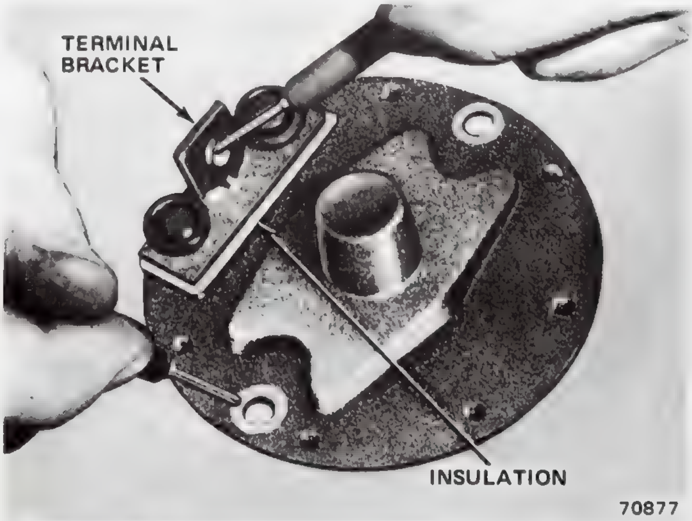


Fig. 1F-10 Terminal Bracket Insulation Test

Armature Tests

Test the armature for grounds, shorts and balance whenever the starter motor is overhauled. Follow the test equipment manufacturer's procedure or the following.

Armature Ground Test

(1) Place armature in growler jaws and turn power switch to TEST position (fig. 1F-11).

(2) Touch one test lead to armature core, touch other lead to each commutator bar one at a time and observe test light. Test light should not glow. If test light glows on any bar, armature is grounded and must be replaced.

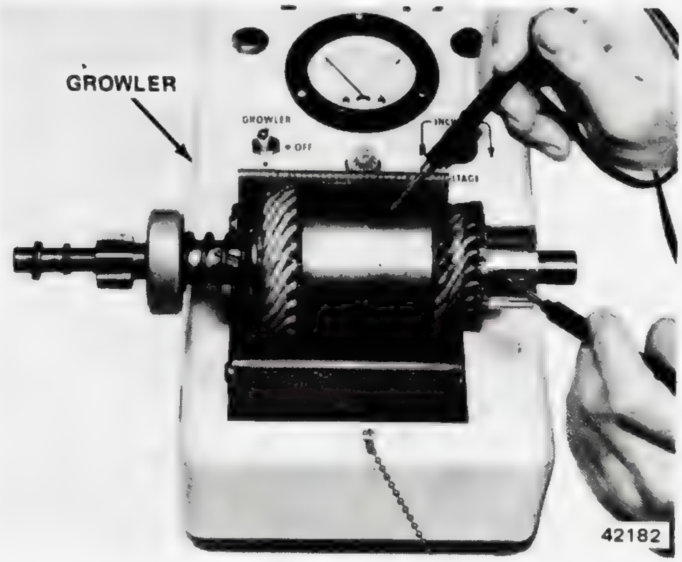


Fig. 1F-11 Armature Ground Test

Armature Short Test

CAUTION: *Never operate the growler in the growler test position without an armature in the jaws.*

(1) Place armature in growler jaws and turn power switch to GROWLER position (fig. 1F-12).

(2) Hold steel blade parallel with and touching armature core. Slowly rotate armature one or more revolutions in growler jaws. If steel blade vibrates at any area of core, area is shorted and armature must be replaced.

Armature Balance Test

(1) Place armature in growler jaws and turn power switch to GROWLER position (fig. 1F-13).

(2) Place contact fingers of meter test cable across adjacent commutator bars at side of commutator.

(3) Adjust voltage control until needle is at highest reading on scale.

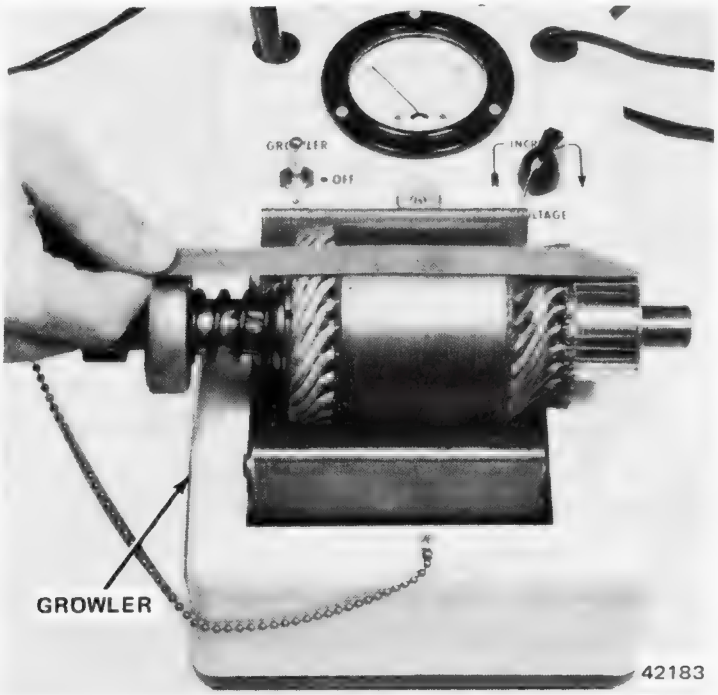


Fig. 1F-12 Armature Short Test

(4) Test each commutator bar with adjacent bar until all bars have been checked. Zero reading indicates open circuit in particular pair.

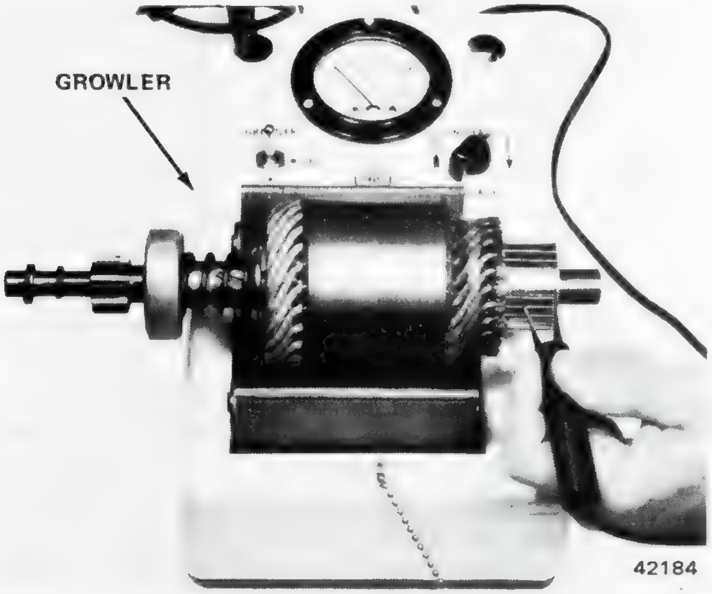


Fig. 1F-13 Armature Balance Test

STARTER MOTOR REPLACEMENT

Removal

(1) Disconnect cable from starter motor terminal.

(2) Remove attaching screws and remove starter motor from bellhousing.

Installation

(1) Position starter motor to bellhousing.

NOTE: *Make sure mounting surfaces are free of burrs and debris.*

(2) Install mounting screws and tighten to 18 foot-pounds torque on six- and eight-cylinder engines. On four-cylinder engines, tighten smaller screw (10 mm) to 33 foot-pounds (45 Nm) torque and larger screw (12 mm) to 54 foot-pounds (73 Nm) torque.

(3) Clean terminal stud on starter motor and terminal end of cable.

(4) Install cable to terminal. Install lockwasher and nut and tighten to 55 inch-pounds (6 Nm) torque.

STARTER MOTOR OVERHAUL

Disassembly

(1) Remove drive yoke cover clamp and cover (fig. 1F-14).

(2) Remove through-screws and remove brush end plate.

(3) Remove brush springs. Pull brushes from brush holder. Remove brush holder from frame.

(4) Remove drive end housing and drive yoke return spring.

(5) Remove pivot pin and starter drive yoke.

(6) Remove drive assembly and armature.

Cleaning and Inspection

(1) Use brush or air to clean starter frame, field coils, armature, drive assembly and drive end housing.

(2) Wash all other parts in solvent and dry parts.

NOTE: *Do not wash clutch or drive assembly.*

(3) Inspect armature windings for broken or burned insulation and unsoldered connections.

(4) Inspect armature for open circuits and grounds.

(5) Clean commutator with No. 400 or finer sandpaper. **Never use emery cloth to clean commutator.**

(6) If armature commutator is worn, out-of-round (0.005 inch or more), or has insulation protruding from between contacts, turn down on lathe.

(7) Inspect armature shaft and bushings for scoring and excessive wear.

(8) Inspect drive assembly pinion gear for damage. If engine has repeated starter motor pinion failures, inspect for:

- Proper ring gear location. Inspect for missing or improper parts or misaligned bellhousing.
- Wobbling ring gear. Maximum allowable runout is 0.030 inch. Inspect for broken welds or broken flex plate.
- Foreign object such as converter balance weight in bellhousing.

NOTE: *Inspect the entire circumference of the ring gear for damage when the teeth of the drive assembly pinion gear are damaged. A normal wear pattern will be found in two places on four-cylinder engine ring gears,*

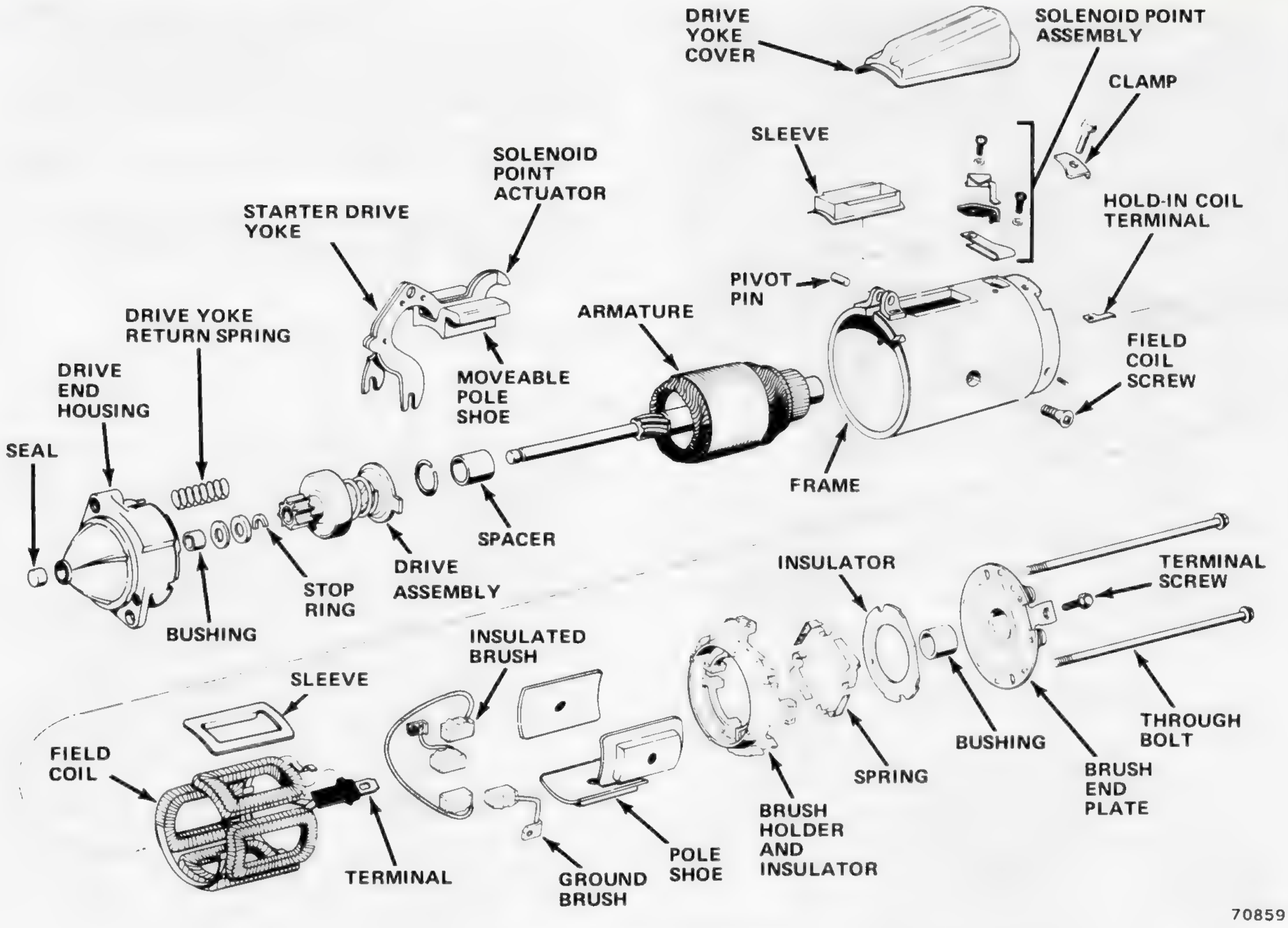


Fig. 1F-14 Parts Identification

three places on six-cylinder engine ring gears and four places on eight-cylinder engine ring gears. The normal wear pattern extends approximately two inches along the circumference of the ring gear.

(9) Inspect drive assembly clutch by grasping and rotating pinion gear. Gear should rotate freely in clockwise direction and lock in opposite direction.

(10) Inspect for broken brush springs. Replace springs that are discolored from heat. Replace brushes if worn to 1/4-inch in length.

(11) Inspect field coils for burned or broken insulation and for broken or loose connections. Check field brush connections and lead insulation.

Field Coil Replacement

Remove armature and brush holder before starting this procedure.

(1) Remove field coil screws using arbor press and tool J-22516.

(2) Cut field coil lead strap as close as possible to contact-to-field coil joint.

CAUTION: *Do not cut solenoid point contact.*

(3) Cut hold-in coil lead at terminal strip.

(4) Straighten tabs of pull-down coil sleeve. Remove sleeve and flange.

(5) Remove field coil assembly from frame.

(6) Clean and tin surfaces of contact tab and field coil strap that are to be soldered.

(7) Install replacement field coil assembly in frame using original pole shoes and screws. Apply drop of Loctite 222 or equivalent to screw threads. Tighten screws using arbor press and tool J-22516.

(8) Install pull-down coil sleeve and flange. Have helper hold coil and sleeve assembly against frame while bending retaining tabs.

(9) Wrap hold-in coil lead around terminal strip and solder. Cut off excess lead.

(10) Solder field coil lead strap to contact strap. Use 500-600 watt soldering iron and rosin-core solder.

Solenoid Contact Assembly Replacement

Remove armature and brush holder before starting this procedure.

(1) Cut upper contact as close as possible to contact-to-field coil joint.

CAUTION: *Do not cut field coil lead strap.*

(2) Unsolder hold-in coil lead from terminal strip.

(3) Remove field coil screws using arbor press and tool J-22516.

(4) Cut rivets inside frame with chisel. Remove contact assembly.

(5) Position replacement lower (movable) contact on frame (fig. 1F-15). Position hold-in coil terminal strip inside frame. Install *copper* rivet through contact, frame and terminal. Upset rivet.

NOTE: *Be sure holes for second rivet are aligned before upsetting copper rivet.*

(6) Install plastic insulator, upper contact and fiber washer to remaining hole in frame. Install *aluminum* rivet and upset.

NOTE: *Be sure upper contact is positioned on shoulder of plastic insulator before upsetting rivet.*

(7) Install field coil assembly and screws. Apply drop of Loctite 222, or equivalent, to each screw.

(8) Solder hold-in coil lead to terminal strip.

(9) Solder field coil lead strap to upper contact. Use 500-600 watt soldering iron and rosin-core solder.

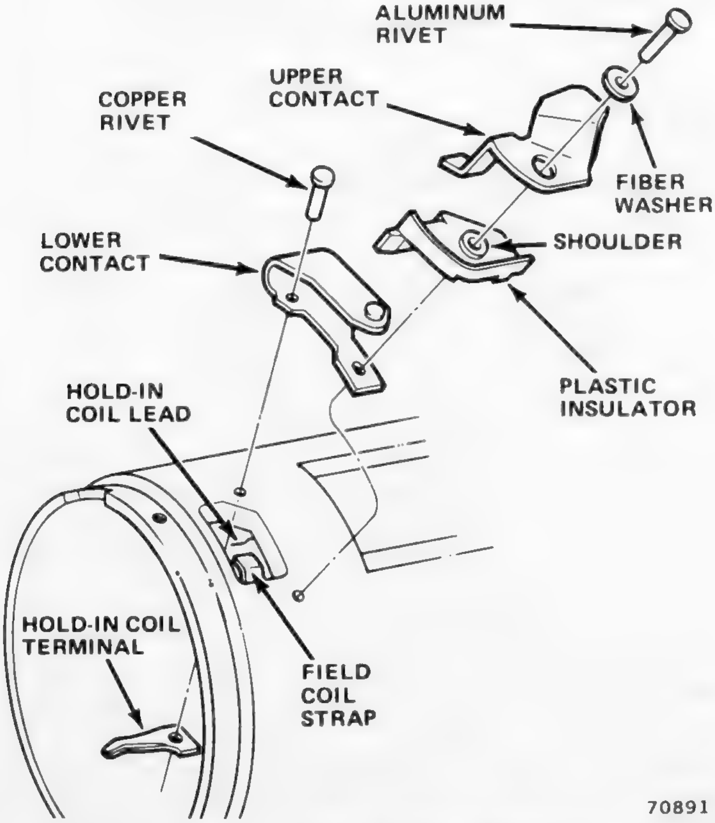


Fig. 1F-15 Solenoid Contact Replacement

Bushing Replacement

Drive End Bushing

(1) Support drive end housing and remove original bushing and seal.

(2) Install replacement bushing using armature and pinion as bushing driver. **Do not** install drive end housing seal at this time.

Commutator End Bushing

(1) Remove original bushing by threading through bushing cavity with suitable size tap. Secure tap in vise and separate bushing from end plate.

(2) Drive replacement bushing into end plate until seated, using suitable socket or bushing driver.

Drive Assembly Replacement

(1) Pry stop ring off and remove starter drive from armature shaft.

(2) Apply few drops of 10W-30 motor oil to armature shaft and end bushings. Replacement drive assembly is prelubricated.

(3) Apply thin coating of Dow Corning 33 Silicone Lubricant, or equivalent, on armature shaft splines.

(4) When installing drive assembly, check snap ring for tight fit on shaft. Slide drive assembly over shaft and install stop ring and original retainer.

Assembly

(1) Insert armature into frame. Install drive yoke and pivot pin. Drive yoke must engage lugs on drive assembly.

(2) Insert drive yoke return spring into recess in drive housing. Install housing to frame.

(3) Install brush holder. Be sure depression in holder aligns with rubber boot on terminal.

(4) Insert brushes into brush holder. Refer to figure 1F-16 for proper wire routing. Install brush springs.

(5) Install end plate. Align hole in terminal with hole in terminal bracket.

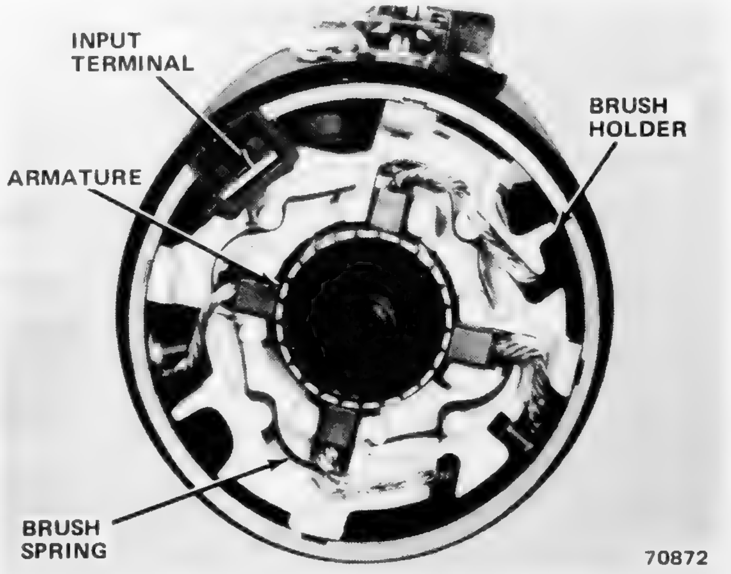


Fig. 1F-16 Brush Wire Routing

(6) Install through-screws.

(7) Install drive yoke cover and clamp.

NEUTRAL SAFETY SWITCH REPLACEMENT

(1) Disconnect wiring connector and remove switch from transmission. Allow fluid to drain into container.

(2) Move selector lever to PARK and NEUTRAL positions. Inspect switch operating lever fingers to ensure that they are properly centered in switch opening.

(3) Install switch and seal in transmission case. Tighten switch to 24 foot-pounds (6 Nm) torque.

(4) Test switch continuity.

(5) Correct transmission fluid level as required.

SPECIFICATIONS

Starter Motor Specifications

Type	Standard Performance		High Performance
Usage	**2-Liter**	**232, 258, 304 CID**	**360 CID**
Frame Diameter	4 inches	4 1/2 inches	4 1/2 inches
Brush Length	0.5 inches	0.5 inches	0.5 inches
Wear Limit	0.25 inches	0.25 inches	0.25 inches
No Load Test (Free Speed)			
Volts	12	12	12
Amps	69	67	77
Min. RPM	6709	7380	8900
Max. RPM	10,843	9356	9600
Contact Point Clearance	0.100 - 0.020 inch (0.060 preferred)	0.100 - 0.020 inch (0.060 preferred)	0.100 - 0.020 inch (0.060 preferred)

80253

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Neutral Safety Switch	33	—	24	—
Starter Motor to Bell Housing				
4-Cylinder				
10 mm	45	38-52	33	28-38
12 mm	73	62-84	54	46-62
6- and 8-Cylinder	24	18-34	18	13-25
Starter Solenoid Terminal Nuts	6	4.5-8	55 in-lbs.	40-70 in-lbs.

All Torque Values given in foot-pounds with dry fits unless otherwise specified.

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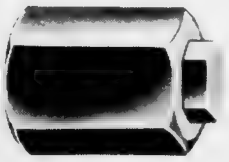
Special Tools



J-22516
STARTER POLE
SCREW WRENCH

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NOTES

NOTES

IGNITION SYSTEM 1G

SECTION INDEX

MECHANICAL IGNITION

GENERAL

The Bosch mechanical, point-type ignition system is used only on the four-cylinder engine. The purpose of the ignition system is to ignite the fuel/air mixture in the combustion chambers. This is accomplished by a high voltage spark provided by the ignition coil. The distributor causes the sparks to occur at the correct instant (timing) and directs each spark to the correct spark plug.

COMPONENTS

Ignition Coil

The ignition coil is an oil-filled, hermetically sealed unit (standard construction). The coil has two windings on a soft iron core. The primary winding consists of several hundred turns of heavy wire. The secondary winding consists of thousands of turns of fine wire.

The coil transforms battery voltage in the primary winding to high voltage in the secondary winding. Thousands of volts are necessary for a satisfactory spark.

The ignition coil does not require special service other than keeping the terminals and connections clean and tight.

A suspected defective coil should be tested on the car. A coil may break down at operating temperature. Perform tests according to instructions of the test equipment manufacturer.

Distributor

The distributor consists of three groups of components working together to deliver high voltage to the correct spark plug at the correct time (fig. 1G-1).

Points and Condenser

The points form an electric switch which is operated by a cam on the distributor shaft. When the points are closed (touching), current flows through the coil primary, creating a magnetic field. When the points open, the magnetic field collapses and induces high voltage in the secondary windings of the coil. The distributor cam has one lobe for each cylinder. Because the distributor is mechanically linked to the crankshaft, the points are opened at the precise time each piston is at its proper firing position.

While the points are opening, but are still close together, the current has enough momentum to spark across the gap. This is prevented by the condenser, which offers an alternate but temporary path. By the time the condenser has absorbed the current surge, the points have opened a gap too great for the current to jump. The condenser releases the absorbed current which flows back toward the coil. This gives an added boost to secondary voltage.

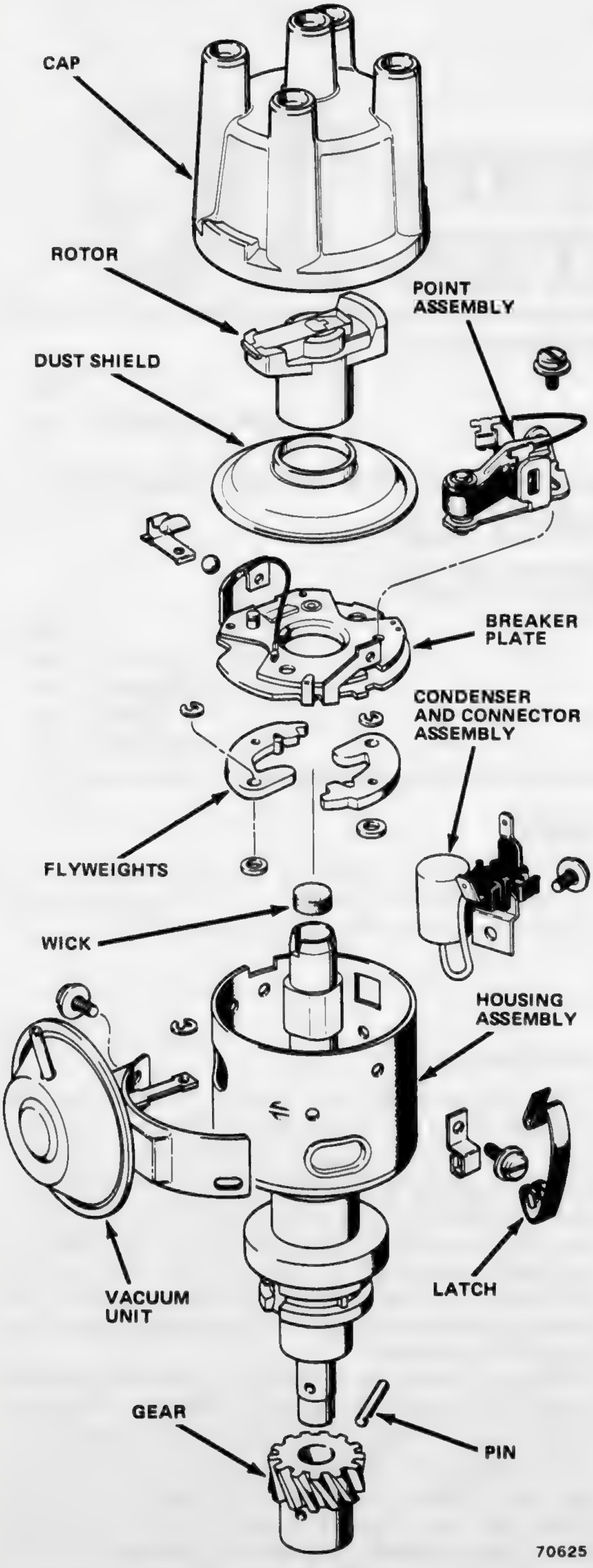

Fig. 1G-1 Mechanical Distributor Components

Spark Advance

Efficient engine operation requires that each spark occur at the correct instant. Varying engine speed or engine load requires that the spark occur earlier or later than normal.

Centrifugal advance is controlled by engine speed. Flyweights connected to the distributor shaft are thrown outward by centrifugal force. Higher rpm throws the weights further out. Calibrated-rate springs are used to control this movement. The outward motion of the centrifugal weights causes the rotor and cam to be rotated on the distributor shaft several degress in the direction of normal rotation. This is referred to as *centrifugal spark advance.*

When the engine is running under light load, the carburetor throttle plates restrict airflow. This causes a relatively lean mixture to enter the combustion chambers. Ignition must occur earlier, because the lean mixture takes longer to burn. The vacuum spark advance unit is used to accomplish this. When carburetor ported vacuum is high, the vacuum unit rotates the breaker plate several degrees opposite to the direction the distributor is turning. This causes the cam to operate the points earlier. This is known as *vacuum spark advance.* Under low vacuum conditions, such as full throttle acceleration, a spring in the vacuum unit pushes the breaker plate back to a position of no advance.

Cap and Rotor

The distributor cap has five towers. The central tower receives the high voltage from the coil. This voltage flows through a button in the cap, into a spring contact on the rotor. The rotor tip moves past a contact in the cap corresponding to the cylinder to be fired just as the coil output voltage reaches the rotor. In this way, each spark plug receives its voltage in turn.

Ignition System Bypass

During normal operation, a resistance wire reduces coil supply voltage to protect the points. Low temperature starting is improved by supplying full battery voltage to the coil. Ignition bypass is accomplished by the I-terminal on the starter solenoid. This bypass terminal is energized only while the starting circuit is in operation. After start-up, the bypass function ceases, and the ignition coil again receives reduced voltage through the resistance wire.

Ignition Wires and Spark Plugs

These components are of conventional design. Maintenance procedures are included in Chapter 1A—General Service and Diagnosis.

OPERATION

The ignition system is activated by turning the ignition switch ON (fig. 1G-2). Battery voltage is directed through a resistance wire to the coil. This resistance wire is bypassed for maximum voltage during starter operation. The coil circuit is completed and broken by the action of the distributor points. Each time the points are opened, a high voltage surge leaves the coil and flows to the distributor cap where it is directed by the rotor to the proper spark plug. The timing of the sparks is constantly monitored and changed by vacuum and centrifugal advance mechanisms.

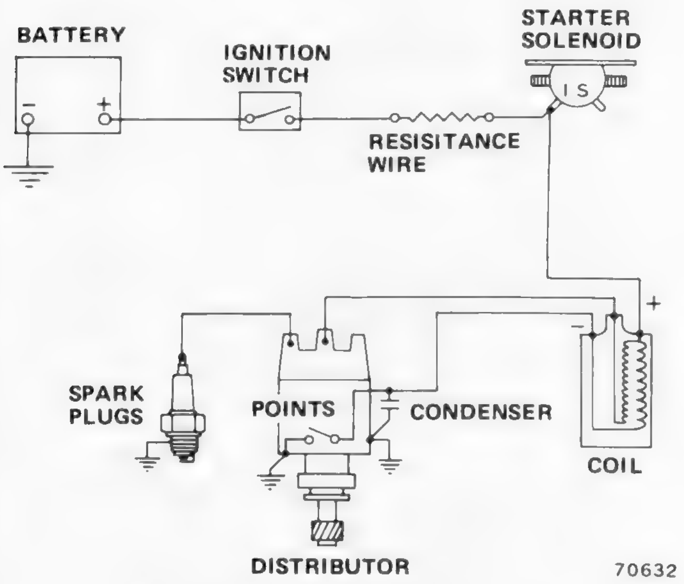

Fig. 1G-2 Ignition System Schematic

TROUBLESHOOTING

Ignition system problems are caused by a failure in the primary circuit or in the secondary circuit, incorrect timing or incorrect advance. Circuit failures may be caused by shorts, loose primary connections, loose or corroded secondary terminals, faulty insulation, defective rotor or cap, defective points or incorrect dwell, fouled or worn spark plugs.

To determine an ignition fault other than spark knock, refer to the Service Diagnosis Chart.

Engine Spark Knock (Ping)

Spark knock can be attributed to a number of factors. The most common are climatic factors such as temperature, air density and humidity.

- **High Underhood Temperature**

Underhood temperature is increased by the use of air conditioning (especially during long periods of idling), overloading (trailer pulling, operating in too high a gear), and the installation of accessories that restrict airflow.

- **Air Density**

Air density increases as barometric pressure rises or as temperature drops. A denser than normal mixture of air and fuel drawn into the cylinder has the same effect as raising the compression ratio, increasing the possibility of spark knock.

- **Humidity**

Low humidity increases the tendency to spark knock. High humidity decreases spark knock.

- **Fuel Octane Rating**

All engines are designed to operate on unleaded fuels. Fuels of equivalent octane rating may vary in their knocking characteristics in a given engine. It may be necessary to reduce initial timing (not more than 2 degrees from specifications) or select an alternate source of fuel.

- **Ignition Timing**

Check ignition timing to be sure it is set within specifications.

NOTE: *The white paint mark on the timing degree scale represents the specified setting at idle speed, not TDC (Top Dead Center).*

- **Combustion Chamber Deposits**

An excessive build-up of deposits in the combustion chamber may be caused by not using recommended fuels and lubricants, prolonged engine idling or continuous low speed operation. These deposits may be reduced by the occasional use of Carburetor and Combustion Area Cleaner 8992352 or its equivalent, or by operating the car at turnpike speeds.

- **Distributor Advance Mechanism**

Check the centrifugal and vacuum advance units to be sure they are operating freely.

TESTING

Excessive voltage drop in the primary circuit will reduce the secondary output of the coil, resulting in hard starting, poor performance and reduced fuel economy. The input (primary) voltage to output (secondary) voltage ratio is approximately 2000:1. A one volt drop in the primary circuit reduces voltage at the spark plugs by 2000 volts.

Primary Circuit Current Flow Test

(1) Inspect primary wiring for loose or corroded terminals, worn insulation or broken wires.

(2) Connect ammeter in series between ignition coil positive (input) terminal and yellow ignition feed wire (fig. 1G-3).

(3) Remove secondary (high voltage) lead from coil and ground to engine.

(4) Turn ignition switch ON.

(5) Use remote control starter switch to crank engine until distributor points are closed.

(6) Ammeter should indicate 3 to 3.5 amps.

Service Diagnosis

Condition	Possible Cause	Correction
ENGINE FAILS TO START (NO SPARK AT PLUGS)	(1) No voltage to ignition system.	(1) Check battery, ignition switch and wiring. Repair as needed.
	(2) Primary wiring connector not fully engaged.	(2) Make sure connector is clean and firmly seated.
	(3) Coil open or shorted.	(3) Test coil. Replace if faulty.
	(4) Cracked distributor cap.	(4) Replace cap.
	(5) Defective rotor.	(5) Replace rotor.
ENGINE BACKFIRES BUT FAILS TO START	(1) Incorrect ignition timing.	(1) Check timing. Adjust as needed.
	(2) Moisture in distributor cap.	(2) Dry cap and rotor.
	(3) Distributor cap faulty (shorting out).	(3) Check cap for loose terminals, cracks and dirt. Clean or replace as needed.
	(4) Wires not in correct firing order.	(4) Reconnect in proper firing order.
ENGINE DOES NOT OPERATE SMOOTHLY AND/OR ENGINE MISFIRES AT HIGH SPEED	(1) Spark plugs fouled or faulty.	(1) Clean and regap plugs. Replace if needed.
	(2) Spark plug cables faulty.	(2) Check cables. Replace if needed.
	(3) Spark advance system(s) faulty.	(3) Check operation of advance system(s). Repair as needed.
EXCESSIVE FUEL CONSUMPTION	(1) Incorrect ignition timing.	(1) Check timing. Adjust as needed.
	(2) Spark advance system(s) faulty.	(2) Check operation of advance system(s). Repair as needed.
ERRATIC TIMING ADVANCE	(1) Faulty vacuum advance assembly.	(1) Check operation of advance diaphragm and replace if needed.
BASIC TIMING NOT AFFECTED BY VACUUM (DISCONNECTED)	(1) Advance diaphragm defective.	(1) Replace vacuum advance unit.
	(2) Misadjusted, weak or damaged mechanical advance springs.	(2) Readjust or replace springs as needed.
	(3) Worn distributor shaft bushings.	(3) Check for worn bushings. Replace distributor.

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(7) If reading is less than 3 amps, connect jumper wire from coil negative terminal to ground. This jumper bypasses ground through distibutor. If ammeter reading increases to at least 3 amps with jumper wire installed, check for poor ground through distributor points.

(8) If ammeter reading does not increase to at least 3 amps with jumper installed to coil negative terminal, resistance is excessive between battery and coil positive terminal. If reading is above 3.5 amps, resistance is too low.

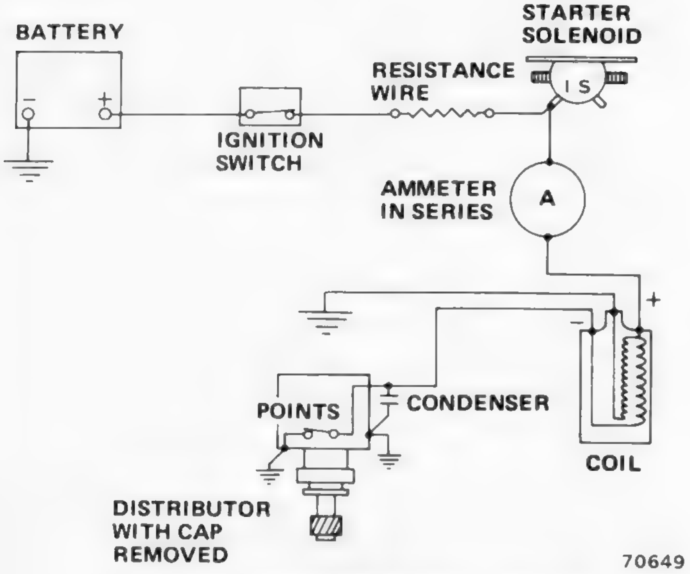

Fig. 1G-3 Primary Circuit Current Flow Test

Primary Circuit Resistance Test

Low primary resistance causes high current flow which leads to prematurely burned points. High primary resistance results in poor coil high-voltage output.

The three tests below determine resistance by measuring voltage drop. Voltage drop is the difference in potential between two ends of a resistance. The greater the resistance, the greater the voltage difference.

Test 1—Total System Voltage Drop

(1) Remove distributor cap.

(2) Connect voltmeter positive lead to battery positive post. Connect voltmeter negative lead to ignition coil positive post (fig. 1G-4).

(3) Turn ignition switch ON. With points closed, voltmeter should indicate approximately 5 volts.

(a) If voltmeter indicates over 7 volts, circuit resistance is too high. Proceed to test 2.

(b) If voltmeter indicates under 4 volts, circuit resistance is too low, or battery voltage is being applied between resistance wire and coil terminal. Refer to Ignition Primary Resistance Wire Test.

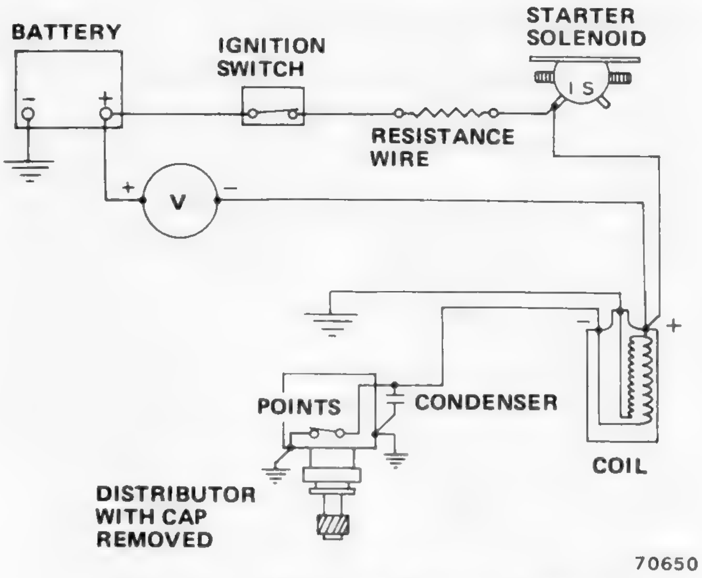

Fig. 1G-4 Total System Voltage Drop Test

Test 2—Ignition Switch Voltage Drop

This test determines the voltage drop between the battery and the output side of the ignition switch. The 5-amp gauge/ignition fuse is used as a test point.

(1) Remove distributor cap.

(2) Connect voltmeter positive lead to battery positive post (fig 1G-5).

(3) Insert voltmeter negative probe into test slot in 5-amp gauge/ignition fuse.

(4) Turn ignition switch ON. Be sure distributor points are closed.

(5) Maximum allowable voltage drop is 0.4 volt. If drop is more than 0.4 volt, perform Test 3.

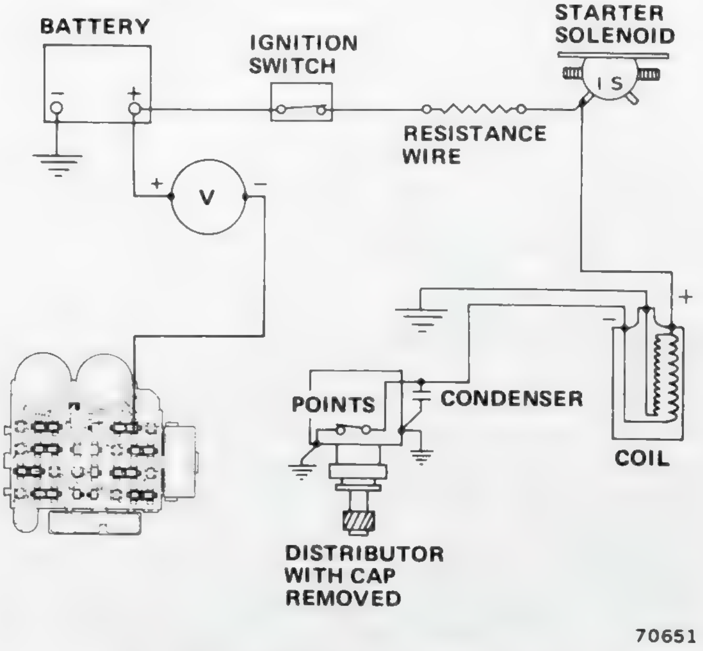

Fig. 1G-5 Ignition Switch Voltage Drop Test

Test 3—Ignition Switch Voltage Supply Test

This test determines if there is a resistance problem in the voltage supply to the ignition switch.

(1) Remove distributor cap. Be sure points are closed.

(2) Insert paper clip into dash connector DV cavity and attach voltmeter negative lead to paper clip (fig 1G-6).

(3) Connect voltmeter positive lead to battery positive cable.

(4) Turn ignition switch ON.

(5) Maximum allowable voltage drop is 0.2 volt. If voltage drop is greater than 0.2 volt, check for poor connection at dash connector.

(6) If voltage drop at dash connector is 0.2 volt or less (acceptable), but voltage drop at 5-amp fuse was above 0.4 volt (too high), connect jumper wire between terminals B-1 and I-1 of ignition switch and check voltage drop at 5-amp fuse. If voltage drop is now acceptable, replace ignition switch.

(7) If jumping ignition switch does not eliminate excessive voltage drop, replace instrument panel wiring harness.

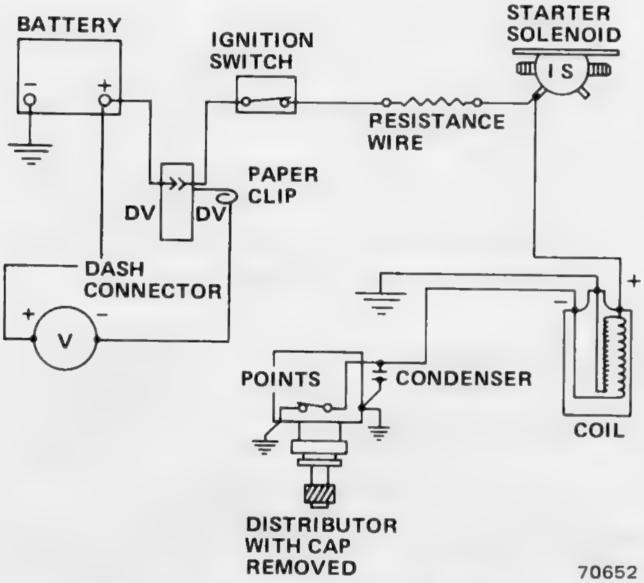

Fig. 1G-6 Ignition Switch Voltage Supply Test

Ignition Primary Resistance Wire Test

Resistance wire in the primary circuit is carefully calibrated to prevent excess current flow from prematurely burning out the ignition points. Do not cut or splice this wire, and do not replace with normal non-resistance wire.

Test the resistance wire with an ohmmeter. Most ohmmeter leads are not long enough to reach for this test. If an extension is added to the leads, calibrate the ohmmeter after adding the extensions.

(1) Connect one ohmmeter lead to positive coil terminal. Insert other lead test probe into test slot in 5-amp fuse (fig. 1G-7).

CAUTION: *The ignition switch must be OFF during this test or ohmmeter will be damaged.*

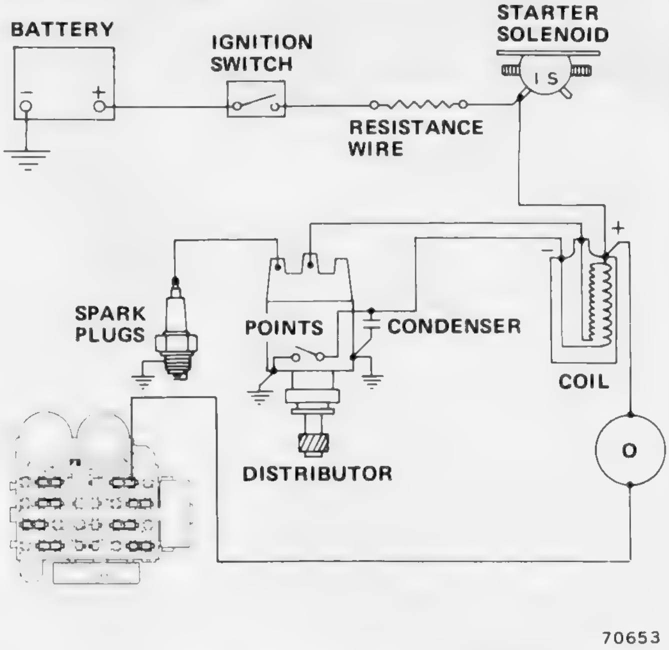

Fig. 1G-7 Primary Resistance Wire Test

(2) Read ohmmeter. Resistance should be 2 ohms.

Coil Tests

The coil can be tested on any conventional coil tester or with an ohmmeter. A coil tester is preferable as it will detect faults that an ohmmeter will not.

Primary Resistance Test

(1) Remove wires from negative and positive terminals of coil.

(2) Set ohmmeter to low scale and calibrate to zero.

(3) Connect ohmmeter to negative and positive terminals of coil. Resistance should be 1.60 to 1.80 ohms at 75°F.

Secondary Resistance Test

(1) Remove cable from center terminal of coil.

NOTE: *Ignition must be OFF.*

(2) Set ohmmeter to 1000 scale and calibrate to zero.

(3) Connect ohmmeter to brass contact in center terminal and to either primary terminal. Resistance should read 9,400 to 11,700 ohms at 75°F. A maximum of 15,000 ohms is acceptable if coil temperature is 200°F or more.

Current Flow Test

(1) Disconnect wire from coil positive terminal.

(2) Connect ammeter between coil positive terminal and disconnected wire.

(3) Disconnect wire from coil negative terminal.

(4) Connect jumper wire from coil negative terminal to known good ground.

(5) Turn ignition to ON position.

(6) Amperage should read approximately 7 amps, and should not exceed 10 amps. At temperatures above 75°F, current flow may be as low as 5 amps.

(7) Leave ammeter connected to coil positive terminal. Remove jumper wire from negative terminal. Connect wire to negative terminal. Current flow should be approximately 4 amps.

NOTE: *Points must be closed for current to flow.*

(8) Start engine. Normal current flow with engine running is 2 amps.

Coil Output Test

(1) Connect oscilloscope to engine.

(2) Start engine and observe secondary spark voltage.

(3) Remove one spark plug wire from distributor cap. Observe voltage on oscilloscope corresponding to disconnected plug wire. This voltage, referred to as open circuit voltage, should be 20,000 volts minimum.

DISTRIBUTOR REPLACEMENT

Removal

(1) Remove air cleaner.

(2) Remove distributor water shield and retaining screws.

(3) Unfasten distributor cap retaining clips. Remove distributor cap with high tension cables and position it out of way.

(4) Disconnect vacuum hose from distributor vacuum advance unit.

(5) Disconnect distributor primary wiring connector.

(6) Scribe mark on distributor housing in line with tip of rotor. Scribe mark on distributor housing near clamp and scribe matching mark on engine. Note position of rotor and distributor housing in relation to surrounding engine parts as reference points for installing distributor.

(7) Remove distributor holddown nut and clamp.

(8) Withdraw distributor carefully from engine.

Installation

(1) Clean distributor mounting area on drive housing.

(2) Install replacement distributor mounting gasket.

(3) Position distributor on engine. If engine was not rotated while distributor was removed:

(a) Align rotor tip with mark scribed on distributor housing during removal.

(b) Slide distributor down into housing. Align scribe mark on distributor with matching scribe mark on engine.

NOTE: *It may be necessary to move rotor and shaft slightly to start gear into mesh with camshaft gear, but rotor should align with scribe mark when distributor is down in place.*

(c) Install distributor holddown clamp, nut and lockwasher, but do not tighten.

(4) If engine was cranked while distributor was removed, establish timing as follows:

(a) Remove No. 1 spark plug. Hold finger over spark plug hole and rotate engine until compression pressure is felt. Slowly continue to rotate engine until timing mark on crankshaft pulley lines up with top dead center (0) mark on timing quadrant. **Always rotate engine in direction of normal rotation. Do not turn engine backward to align timing marks.**

(b) Turn distributor shaft until rotor tip points in direction of No. 1 terminal in distributor cap. This is indicated by manufacturer mark on edge of distributor housing. Turn rotor 1/8-turn clockwise past position of No. 1 terminal.

(c) Slide distributor down into engine and position distributor vacuum advance housing in approximately same location (in relation to surrounding engine parts) as when removed. Align scribe mark on distributor with matching scribe mark on engine.

(d) Install distributor holddown clamp, nut and lockwasher, but do not tighten.

(5) Install distributor cap (with ignition cables) on distributor housing, making sure tang on distributor housing aligns with slot in distributor cap and that cap fits on rim of distributor housing.

NOTE: *If distributor cap is incorrectly positioned on distributor housing, cap or rotor may be damaged when engine is cranked.*

(6) Connect distributor primary wiring connector.

(7) Connect timing light to No. 1 spark plug.

CAUTION: *Do not puncture high tension cables or boots to make contact. Use proper adapters.*

(8) Operate engine at 700 rpm and observe timing marks with timing light. Rotate distributor housing as needed to align timing mark on crankshaft pulley with correct mark on timing quadrant. When timing is correct, tighten distributor holddown nut and check timing to be sure it did not change.

(9) Disconnect timing light and connect vacuum hose to distributor vacuum advance unit.
(10) Install distributor water shield.
(11) Install air cleaner.

DISTRIBUTOR COMPONENT REPLACEMENT

Ignition Points

Replace points at intervals outlined in Mechanical Maintenance schedule. For adjustment procedures, refer to Chapter 1A—General Service and Diagnosis.

(1) Remove air cleaner.
(2) Remove distributor cap with ignition wires attached and move aside.
(3) Remove rotor by pulling straight off with even pressure.
(4) Remove dust shield.
(5) Unplug point lead from connector.

NOTE: *If condenser is to be replaced, do so now. Refer to Condenser below.*

(6) Remove retaining screw from point assembly.
(7) Remove point assembly from plate.
(8) Wipe distributor cam clean and inspect.
(9) Install replacement points. Be sure pivot pin is properly seated in pivot hole.
(10) Install retaining screw. Do not tighten.
(11) Rotate engine in direction of normal rotation until rubbing block is positioned on high point of cam lobe.
(12) Adjust gap to 0.45 mm (0.018 inch). Tighten retaining screw.
(13) Apply high temperature distributor cam lubricant to one lobe of cam. Bead of lubricant should be size of match head.
(14) Attach point assembly wire lead to connector.
(15) Install dust cover and rotor. Be sure rotor seats properly on shaft.
(16) Install distributor cap.
(17) Check dwell. Set timing to specifications. Refer to Chapter 1A—General Service and Diagnosis.
(18) Install air cleaner.

Condenser

The condenser is ordinarily replaced at the same time as the points. If the condenser must be replaced separately, follow this procedure.

(1) Remove air cleaner.
(2) Remove distributor cap with ignition wires attached. Position aside.
(3) Remove rotor and dust cover.
(4) Disconnect point lead from connector.
(5) Disconnect primary ignition lead from distributor connector.
(6) Remove retaining screw. Remove connector and condenser assembly.
(7) Install replacement connector and condenser assembly. Be sure rubber grommet is securely positioned in square hole of distributor wall.
(8) Connect primary ignition lead and ignition point lead.
(9) Install dust cover and rotor.
(10) Install distributor cap.
(11) Install air cleaner.

Vacuum Unit

(1) Remove air cleaner.
(2) Remove distributor cap with ignition wires attached. Position aside.
(3) Remove rotor and dust cover.
(4) Disconnect vacuum line from vacuum unit.
(5) Carefully remove retainer from vacuum unit drive pin. Do not allow retainer to fall into distributor.
(6) Remove retaining screws and remove vacuum unit by disengaging vacuum unit lever from drive pin.
(7) Install replacement vacuum unit. Engage lever with drive pin. Install retaining screws.
(8) Carefully install retainer to drive pin.
(9) Attach vacuum line to vacuum unit.
(10) Install dust cover and rotor.
(11) Install distributor cap.
(12) Install air cleaner.

SPECIFICATIONS

Coil Specifications

Ignition Coil	
Primary Resistance @ 75°F	1.60 to 1.80 ohms
Secondary Resistance @ 75°F	9400 to 11,700 ohms
Open Circuit Output	20 kv minimum
Spark Plug Required Voltage	5 to 16 kv

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Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	In-Use Recheck Torque	Service Set-To Torque	In-Use Recheck Torque
Distributor Clamp Nut	20	19-22	15	14-16

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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SOLID STATE IGNITION SYSTEM

GENERAL

The Solid State Ignition (SSI) system was introduced on certain Canadian models as a 1977 running change. This system is used on all six- and eight-cylinder engines in 1978. The new system is easily recognizable by the unique coil connector (fig. 1G-8). The new electronic control unit is unpainted metal and has unique connectors (fig. 1G-9). The new distributor has a metal vacuum unit (fig. 1G-10).

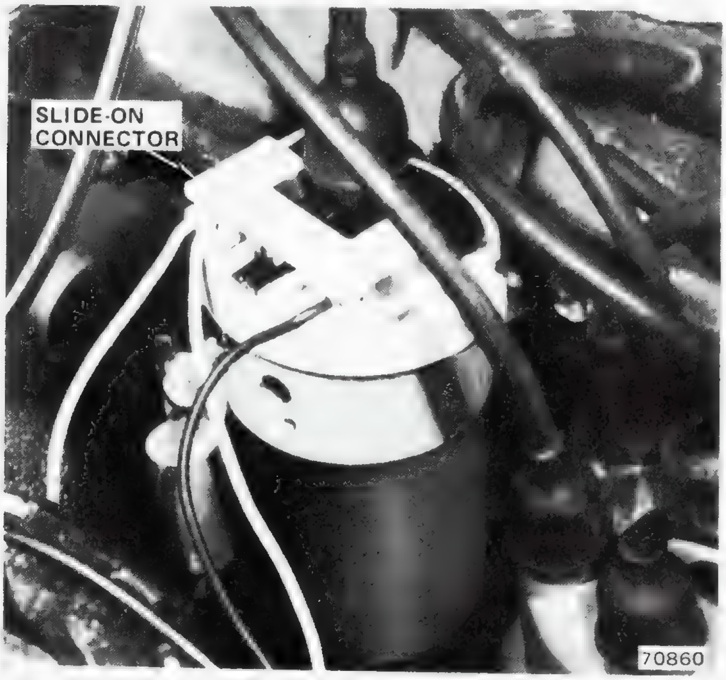

Fig. 1G-8 Coil Connector

COMPONENTS

The SSI system consists of these major components: ignition switch, electronic ignition control unit, ignition coil, primary resistance wire and bypass, distributor, ignition wires and spark plugs.

NOTE: *When disconnecting SSI system connectors, pull apart with firm, straight pull. Do not attempt to pry apart with screwdriver. When connecting, press together firmly to overcome hydraulic pressure of grease.*

Fig. 1G-9 Electronic Control Unit

Fig. 1G-10 Distributor Vacuum Unit

NOTE:. *If connector locking tabs weaken or break off, do not replace associated component. Bind connectors together with tape or harness tie strap to assure good electrical connection.*

Control Unit

The electronic control unit is a solid-state, moisture-resistant module. The component parts are permanently sealed in a potting material to resist vibration and environmental conditions. All connections are weatherproof. The control unit has built-in reverse polarity protection and transient voltage protection.

NOTE: *This unit is not repairable and must be serviced as a unit.*

Ignition Coil

The ignition coil is oil-filled and hermetically sealed (standard construction). The coil has two windings on a soft iron core. The primary winding consists of comparatively few turns of heavy wire. The secondary winding consists of many turns of fine wire.

The function of the ignition coil in the SSI system is to transform battery voltage in the primary winding to high voltage for the secondary system.

The ignition coil does not require special service other than keeping terminals and connectors clean and tight.

When an ignition coil is suspected of being defective, check it on the vehicle. A coil may break down after it has reached operating temperaure. *It is important that the coil be at operating temperature when tests are made.* Perform the tests following the instructions of the test equipment manufacturer.

Coil Connector

The coil terminals and coil connector are of unique design (fig. 1G-8). The connector is removed from the coil by grasping both sides and pulling connector away from coil (fig. 1G-11).

When a tachometer is required for engine testing or tune-up, connect tachometer using an alligator clamp as shown in figure 1G-12.

Resistance Wire

A wire having 1.35±0.05 ohms resistance is provided in the ignition feed to supply less than full battery voltage to the coil during running conditions. During starting, the resistance wire is bypassed and full battery voltage is applied to the coil. Bypass is accomplished by the I-terminal on the starter solenoid. The bypass terminal is energized only while the starting circuit is in operation.

Fig. 1G-11 Removing Coil Connector

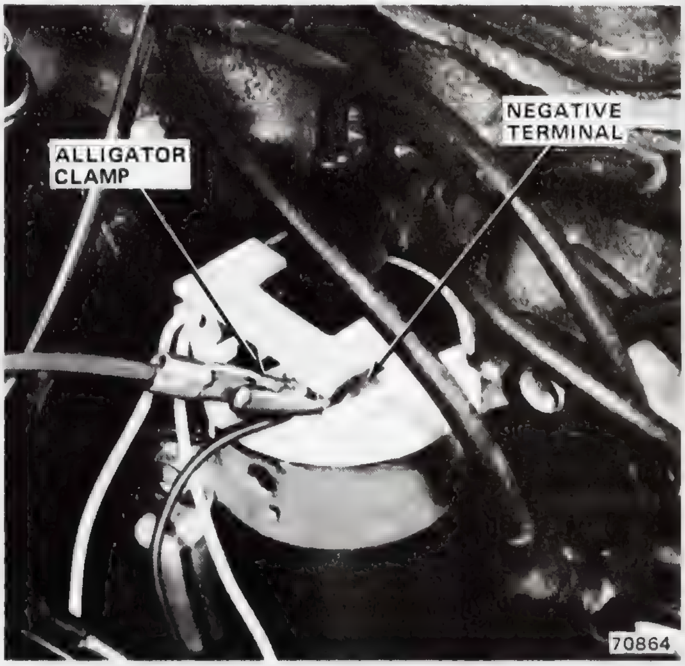

Fig. 1G-12 Tachometer Connection

Distributor

The distributor consists of three groups of components: sensor and trigger wheel, spark advance and cap and rotor.

Sensor and Trigger Wheel

Current flowing through the ignition coil creates a magnetic field in the primary windings. When the circuit is opened and current flow stops, the magnetic field collapses and induces high voltage in the secondary windings. The circuit is switched open and closed electronically by the control unit. The distributor sensor and trigger wheel provide the signal that operates the control unit.

The trigger wheel, mounted to the distributor shaft, has one tooth for each cylinder. The wheel is mounted so that the teeth rotate past the sensor one at a time.

The sensor, a coil of fine wire mounted to a permanent magnet, develops an electromagnetic field that is sensitive to the presence of ferrous metal. The sensor detects the trigger wheel teeth as they pass the sensor. When a trigger wheel tooth approaches the pole piece of the sensor, it reduces the reluctance of the magnetic field, increasing field strength. Field strength decreases as the tooth moves away from the pole piece. This build up and reduction of field strength generates an alternating current which is interpreted by the control unit. The control unit then opens and closes the coil primary circuit.

There are no contacting surfaces between the trigger wheel and sensor. Because there is no wear, dwell angle requires no adjustment. Dwell is determined electronically by the control unit. When the coil circuit is switched open, an electronic timer in the control unit keeps the circuit open only long enough for the spark to discharge. Then it automatically closes the coil primary circuit. The period of time the circuit is closed is referred to as *dwell*. Electronically-timed dwell is not adjustable.

Spark Advance

Efficient engine operation requires each spark to occur at the correct instant. Varying engine speed or engine load requires the spark to occur earlier or later than normal.

Centrifugal advance is controlled by engine speed. Flyweights connected to the distributor shaft are thrown outward by centrifugal force. Higher rpm throws the weights further out. Calibrated-rate springs are used to control this movement. The outward motion of the centrifugal weights causes the rotor and trigger wheel to be rotated on the distributor shaft several degrees in the direction of normal rotation. This is referred to as *centrifugal spark advance*.

When the engine is running under light load, the carburetor throttle plates restrict airflow, causing a relatively lean mixture to enter the combustion chambers. Ignition must occur earlier, because the lean mixture takes longer to burn. The vacuum spark advance unit is used to accomplish this. When carburetor ported vacuum is high, the vacuum unit rotates the sensor several degrees opposite to the direction the distributor is turning. This causes the sensor to detect trigger wheel teeth earlier. This is known as *vacuum spark advance*. Under low vacuum conditions, such as full throttle acceleration, a spring in the vacuum unit pushes the sensor back to a position of no advance.

Cap and Rotor

The central tower on the distributor cap receives the high voltage from the coil. This voltage flows through a button in the cap into a spring contact on the rotor. The rotor tip aligns with the contact in the cap corresponding to the cylinder to be fired just as the coil output voltage reaches the rotor. In this way, each spark plug receives its voltage in turn.

OPERATION

The control unit is activated when the ignition switch is in the START or RUN position (fig. 1G-13). The primary circuit is closed and the coil primary is energized. When the engine begins turning the distributor, the trigger wheel teeth rotate past the sensor. As each tooth aligns with the sensor, a high voltage surge leaves the coil and flows to the distributor cap. The rotor directs the high voltage to the proper spark plug. The timing of the sparks is constantly monitored and changed by the vacuum and centrifugal advance mechanisms.

TROUBLESHOOTING

For troubleshooting purposes, ignition problems are placed in three categories: full failure, intermittent failure and spark knock.

Full failure is always a no-spark situation. The engine will not start. If a full failure occurs when the engine is running, it will refuse to re-start.

Intermittent failure is temporary. The engine may refuse to start on the first try, but will eventually start. If an intermittent failure occurs when the engine is running, it may falter but continues to run. If it stalls, it will re-start and will continue to run.

Spark knock is not a failure mode. The engine will start and will continue to run. If not corrected, spark knock can do extensive damage to internal engine components.

Full Failure Diagnosis

The first step in diagnosing a failure is to identify which system—primary or secondary—is faulty.

The primary system consists of:

- Battery feed to ignition coil.
- Ignition coil primary winding.
- All wires connected to electronic control unit.
- Distributor

The secondary system consists of:

- Ignition coil secondary winding.
- All heavy wires installed in distributor cap.
- Distributor cap.
- Distributor rotor.
- Spark plugs.

NOTE: *When disconecting secondary wire from spark plug or distributor cap, twist the rubber boot slightly to break loose. Grasp the boot, not the wire, and pull off with steady, even pressure.*

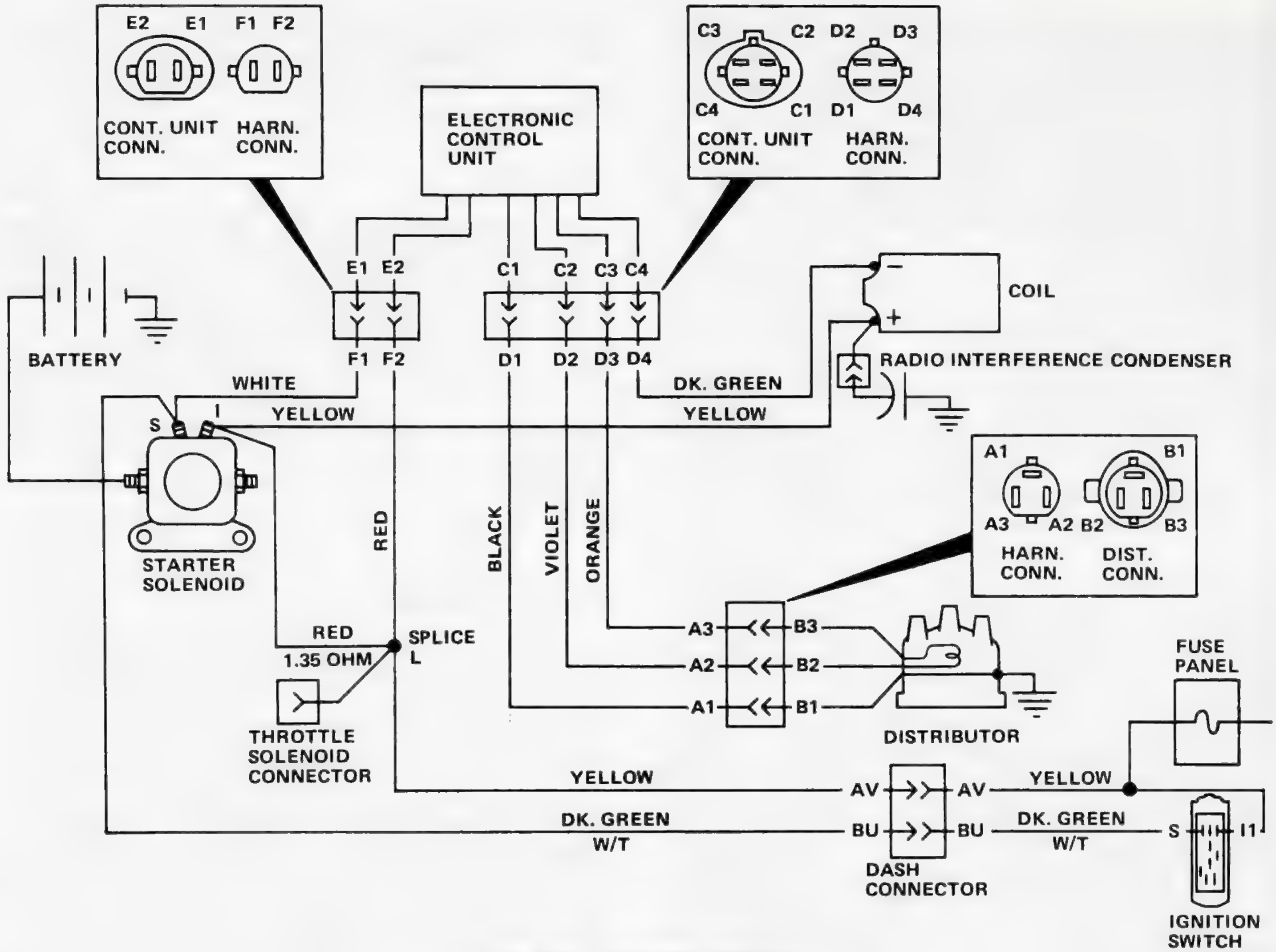

Fig. 1G-13 SSI System Schematic

Secondary Cicuit Check

(1) Disconnect coil wire from center tower of distributor cap. Use insulated pliers to hold wire approximately 1/2 inch from engine block or intake manifold.

(2) Crank engine and observe wire for spark.

(a) If no spark occurs, go to step (5).

(b) If spark occurs, go to step (3).

(3) Connect coil wire to distributor cap. Remove wire from one spark plug.

CAUTION: *Do not remove wires from plugs in cylinders 3 or 5 of a six-cylinder engine or cylinders 3 or 4 of an eight-cylinder engine when performing this test or sensor may be damaged.*

(4) Use insulated pliers to hold wire 1/2 inch from engine head while cranking engine. Observe spark.

(a) If spark occurs, check for fuel problems or incorrect timing.

(b) If no spark occurs, check for defective rotor or distributor cap, or defective spark plug wires.

(5) If no spark occurs at coil, test coil wire resistance. It should not exceed 10,000 ohms. Replace if required.

(6) Read notes that follow, then proceed to SSI System Diagnosis and Repair Simplification Charts.

NOTE: *The DARS charts are organized to permit testing each primary circuit separately and in the most logical order. When the problem is located, it is not necessary to perform further tests.*

NOTE: *If a particular component or circuit is suspected, locate the appropriate DARS Chart and follow the procedures outlined. If no particular component or circuit is suspected, begin with Chart 1 and proceed from chart to chart until the problem is located.*

NOTE: *Do not perform Chart 4 unless Chart 1 has been performed.*

Intermittent Failure Diagnosis

Intermittent failure may be caused by loose or corroded terminals, defective components, poor ground connections, or defective wiring. Refer to the Service Diagnosis Chart.

Service Diagnosis

Condition	Possible Cause	Correction
ENGINE FAILS TO START (NO SPARK AT PLUGS)	(1) No voltage to ignition system.	(1) Check battery, ignition switch and wiring. Repair as required.
	(2) Electronic Control Unit ground lead inside distributor open, loose or corroded.	(2) Clean, tighten or repair as required.
	(3) Primary wiring connectors not fully engaged.	(3) Clean and fully engage connectors.
	(4) Coil open or shorted.	(4) Test coil. Replace if faulty.
	(5) Electronic Control Unit defective.	(5) Replace Electronic Control Unit.
	(6) Cracked distributor cap.	(6) Replace cap.
	(7) Defective rotor.	(7) Replace rotor.
ENGINE BACKFIRES BUT FAILS TO START	(1) Incorrect ignition timing.	(1) Check timing. Adjust as required.
	(2) Moisture in distributor.	(2) Dry cap and rotor.
	(3) Distributor cap faulty.	(3) Check cap for loose terminals, cracks and dirt. Clean or replace as required.
	(4) Ignition wires not in correct firing order.	(4) Install in correct order.
ENGINE RUNS ONLY WITH KEY IN START POSITION	(1) Open in resistance wire or excessive resistance.	(1) Repair resistance wire.
ENGINE CONTINUES TO RUN WITH KEY OFF	(1) Defective starter solenoid.	(1) Replace solenoid.
	(2) Shorted diode in alternator indicator lamp circuit.	(2) Replace diode.
ENGINE DOES NOT OPERATE SMOOTHLY AND/OR ENGINE MISFIRES AT HIGH SPEED	(1) Spark plugs fouled or faulty.	(1) Clean and gap plugs. Replace as required.
	(2) Ignition cables faulty.	(2) Check cables. Replace as required.
	(3) Spark advance system(s) faulty.	(3) Check operation. Repair as required.
	(4) I-terminal shorted to starter terminal in solenoid.	(4) Replace solenoid.
	(5) Trigger wheel pin missing.	(5) Install pin.

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Service Diagnosis (Continued)

Condition	Possible Cause	Correction
ENGINE DOES NOT OPERATE SMOOTHLY (Continued)	(6) Distributor wires installed in wrong firing order.	(6) Install wires correctly.
EXCESSIVE FUEL CONSUMPTION	(1) Incorrect ignition timing.	(1) Check timing. Adjust as required.
	(2) Spark advance system(s) faulty.	(2) Check operation. Repair as required.
ERRATIC TIMING ADVANCE	(1) Faulty vacuum advance assembly.	(1) Check operation. Replace if required.
	(2) Centrifugal weights sticking.	(2) Remove dirt, corrosion.
TIMING NOT AFFECTED BY VACUUM	(1) Defective vacuum advance unit.	(1) Replace vacuum advance unit.
	(2) Advance unit adjusting screw too far counterclockwise.	(2) Turn screw clockwise to bring advance curve within specifications (Chapter 1A).
	(3) Sensor pivot corroded.	(3) Clean pivot.

70866B

Engine Spark Knock (Ping)

Spark knock can be attributed to a number of factors. The most common are climatic factors such as temperature, air density and humidity.

- **High Underhood Temperature**
  Underhood temperature is increased by the use of air conditioning (especially during long periods of idling), overloading (trailer pulling, operating in too high a gear) and the installation of accessories that restrict airflow.
- **Air Density**
  Air density increases as barometric pressure rises or as temperature drops. A denser than normal mixture of air and fuel drawn into the cylinder has the same effect as raising the the compression ratio, increasing the possibility of spark knock.
- **Humidity**
  Low humidity increases the tendency to spark knock. High humidity decreases spark knock.
- **Fuel Octane Rating**
  All engines are designed to operate on unleaded fuels. Fuels of equivalent research octane rating may vary in their knocking characteristics in a given engine. It may be necessary to reduce initial timing (not more than 2 degrees from specifications) or select an alternate source of fuel.
- **Ignition Timing**
  Check ignition timing to be sure it is set within specifications.

NOTE: *The white paint mark on the timing degree scale represents the specified spark setting at idle speed, not TDC (Top Dead Center).*

- **Combustion Chamber Deposits**
  An excessive build-up of deposits in the combustion chamber may be caused by not using recommended fuels and lubricants, prolonged engine idling or continuous low speed operation. These deposits may be reduced by the occasional use of Carburetor and Combustion Area Cleaner 8992352 or its equivalent, or by operating the car at turnpike speeds.
- **Distributor Advance Mechanism**
  Check the centrifugal and vacuum advance units to be sure they are operating freely.
- **Exhaust Manifold Heat Valve**
  If the heat valve sticks in the heat ON position, the intake manifold is heated excessively.

SSI SYSTEM DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

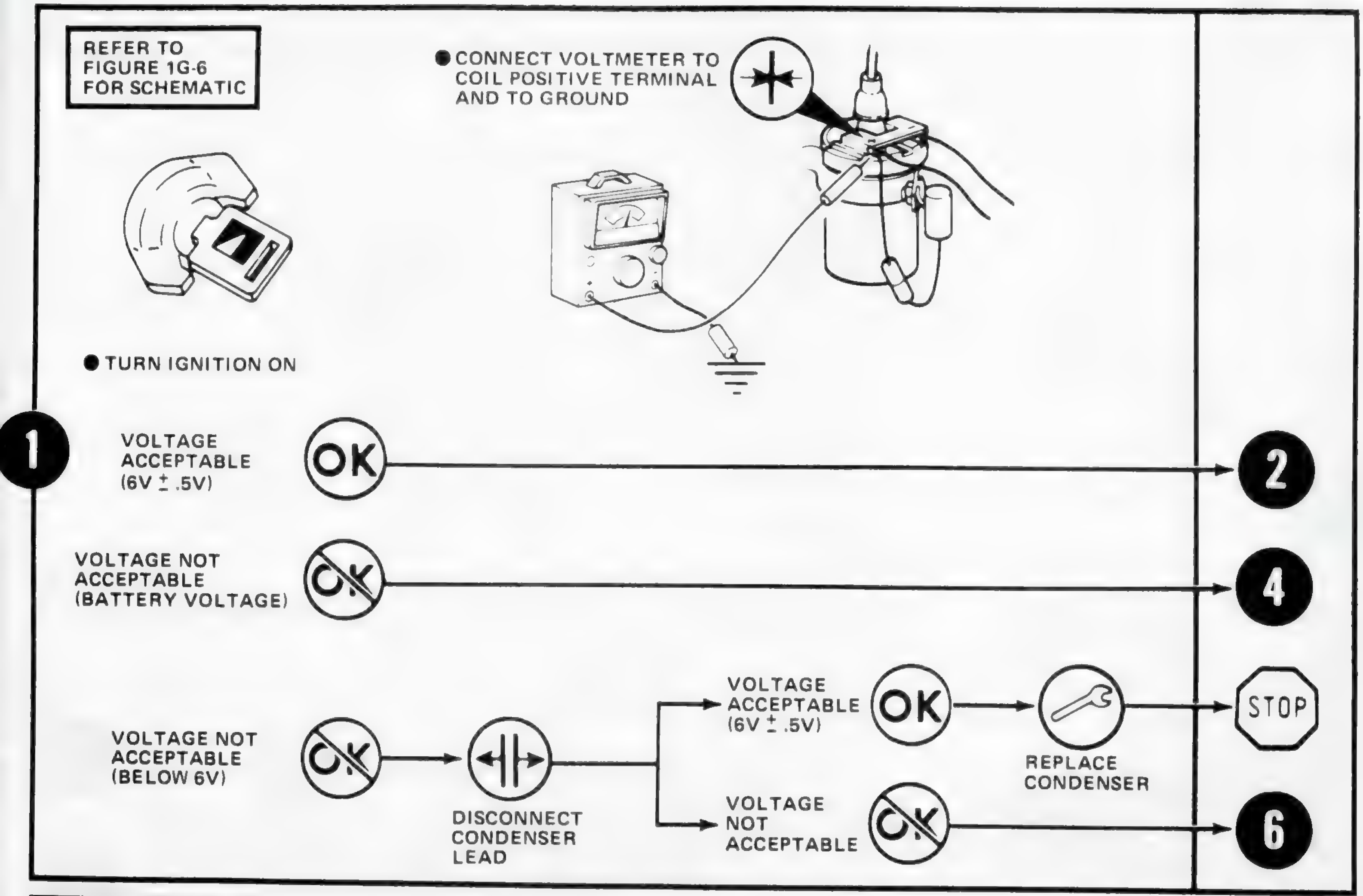
Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

IGNITION COIL PRIMARY CIRCUIT

FUNCTION: PROVIDES BATTERY FEED TO COIL AND COIL GROUND

Chart 1

STEP **SEQUENCE** **RESULT**



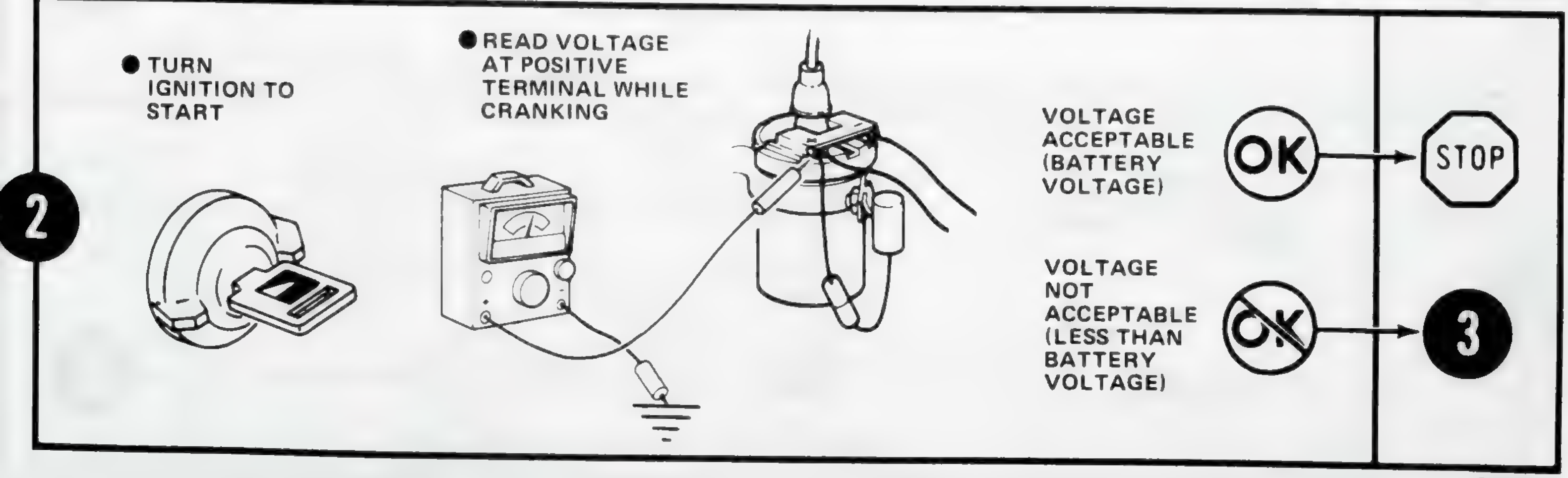


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Chart 1

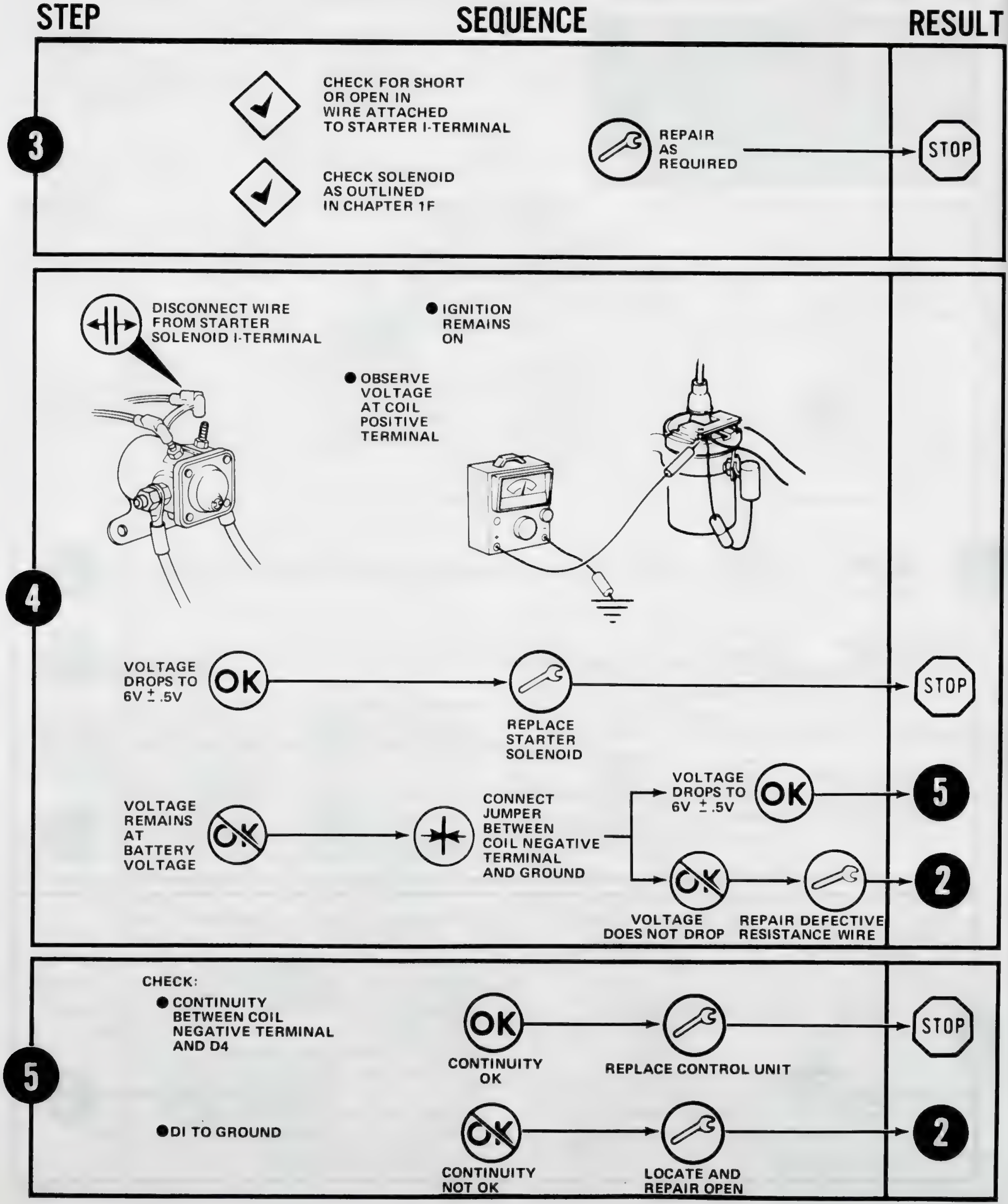

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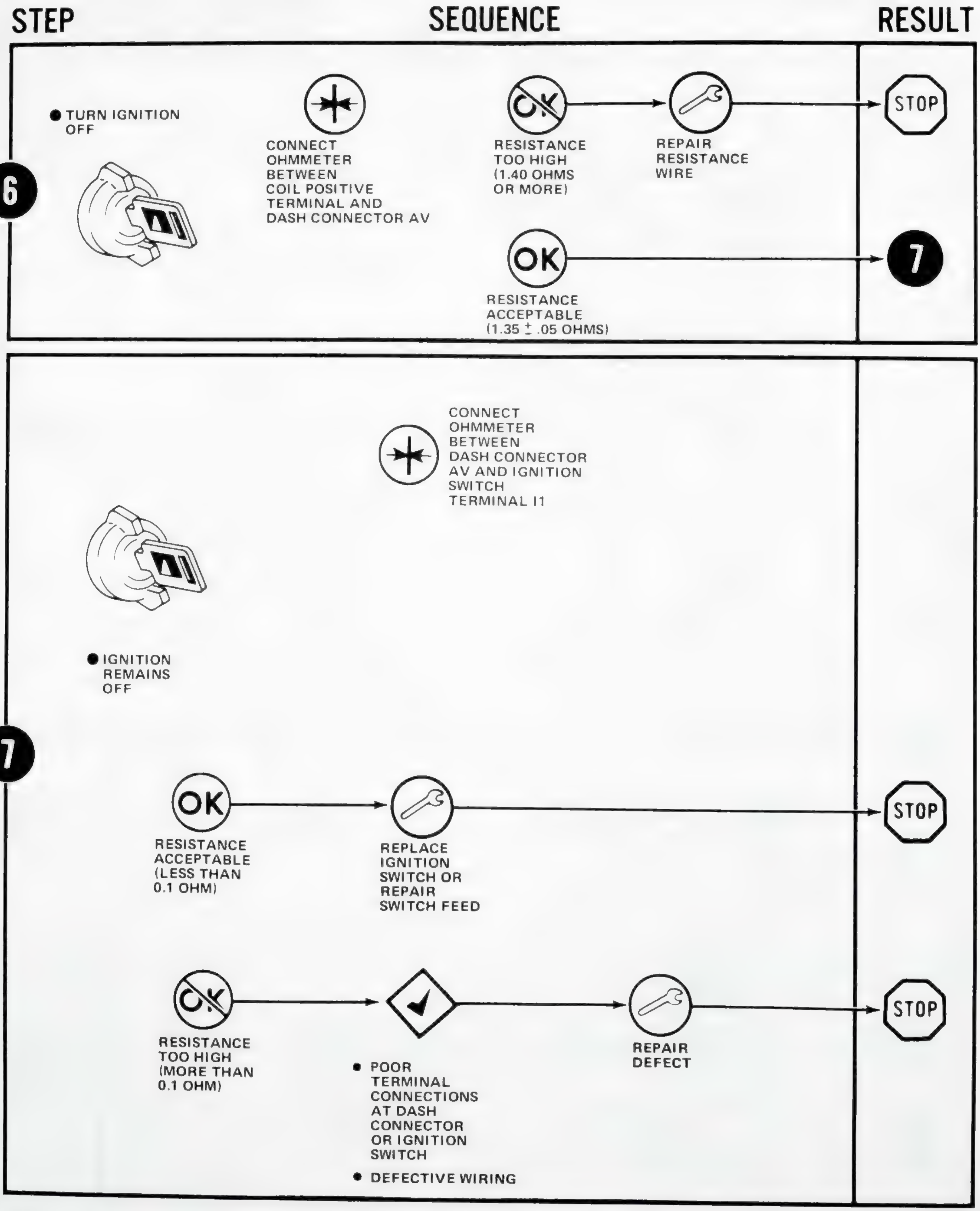
Chart 1



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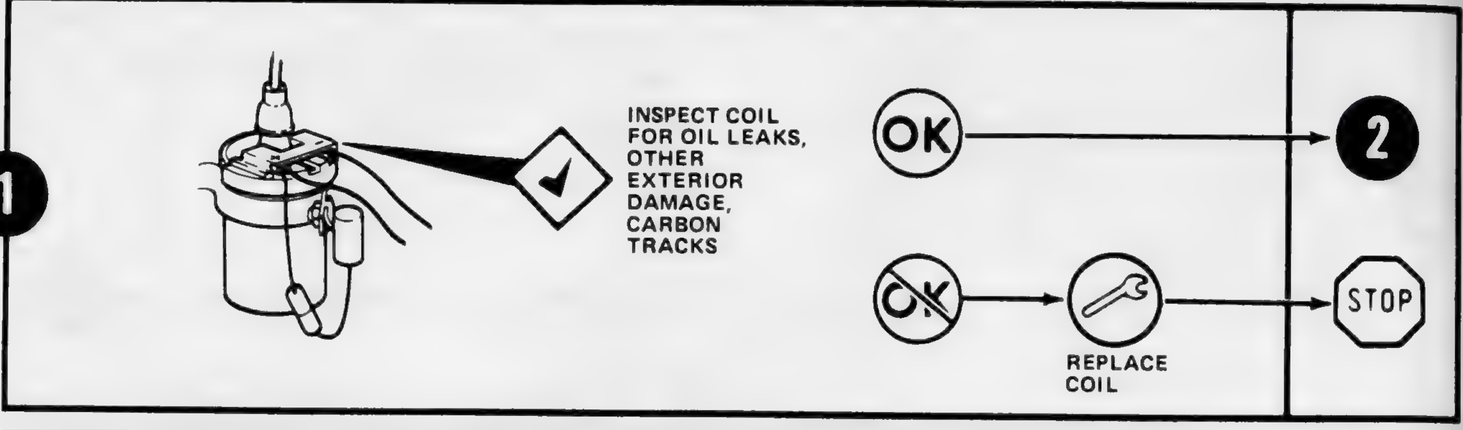
COIL TEST

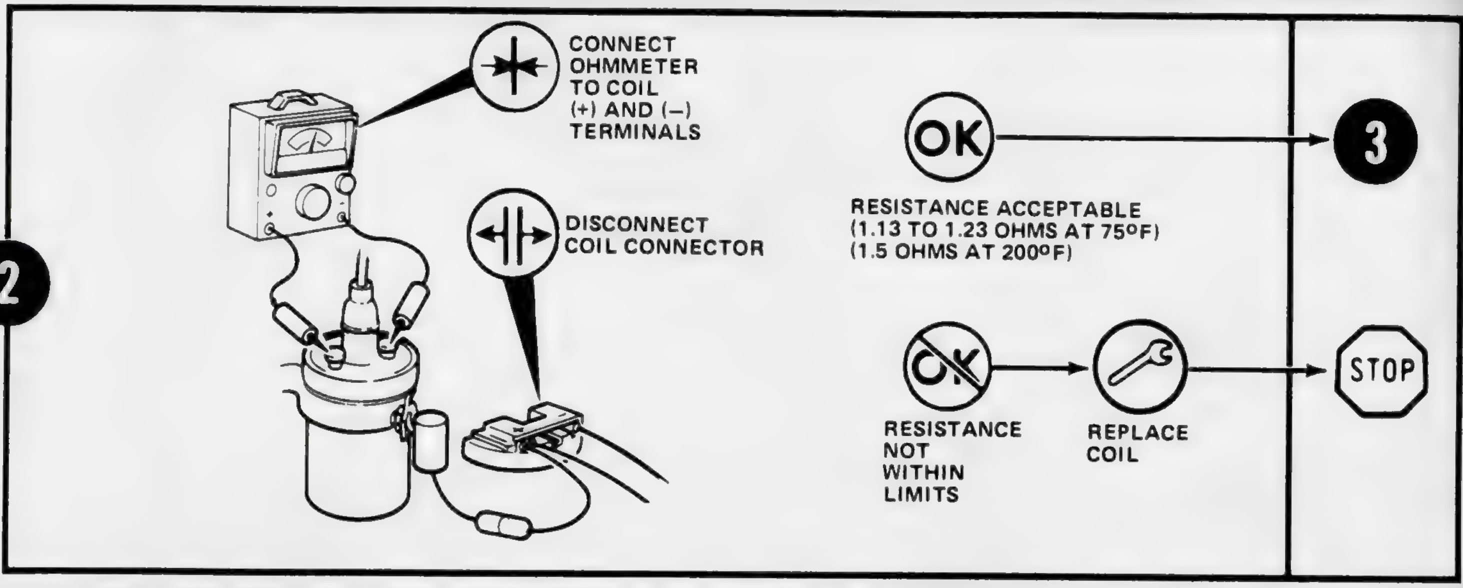
Chart 2

STEP **SEQUENCE** **RESULT**



INSPECT COIL FOR OIL LEAKS, OTHER EXTERIOR DAMAGE, CARBON TRACKS

REPLACE COIL



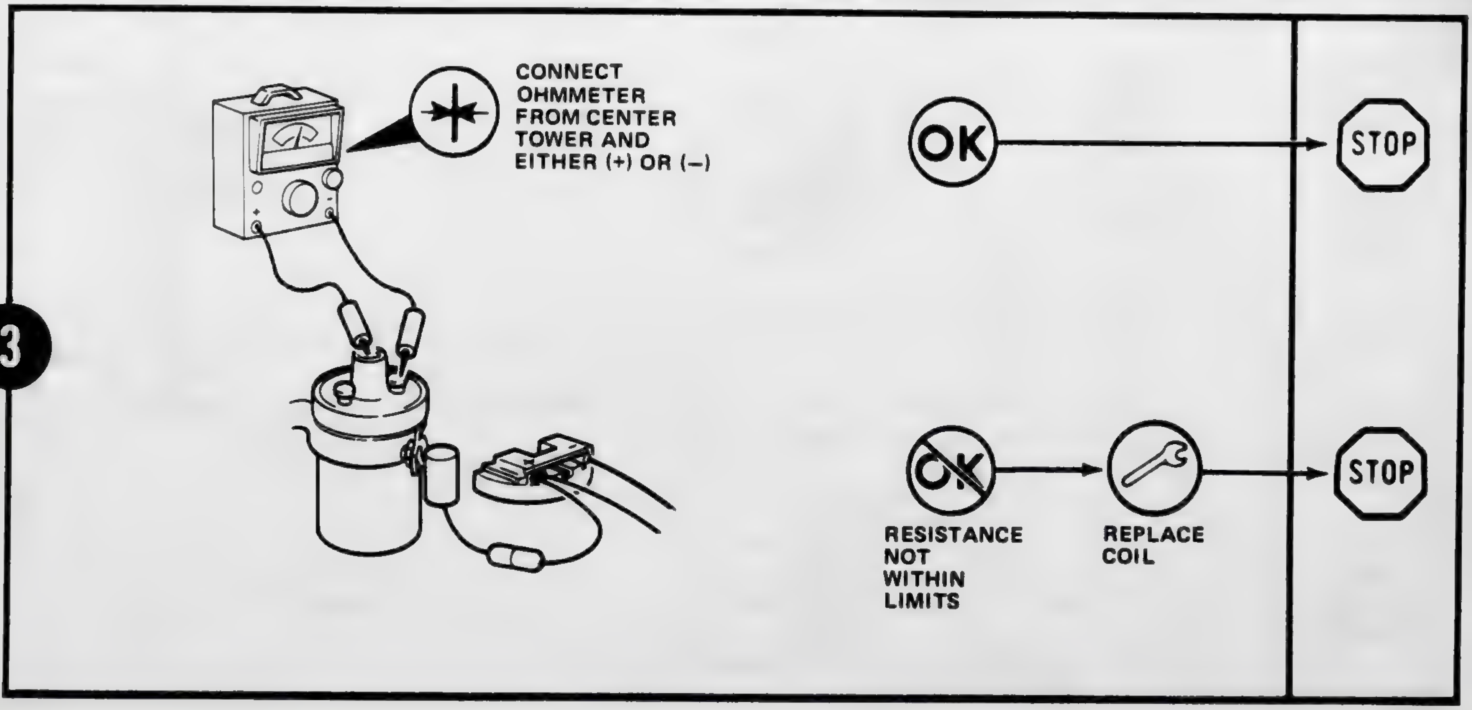
CONNECT OHMMETER TO COIL (+) AND (–) TERMINALS

DISCONNECT COIL CONNECTOR

RESISTANCE ACCEPTABLE
(1.13 TO 1.23 OHMS AT 75°F)
(1.5 OHMS AT 200°F)

RESISTANCE NOT WITHIN LIMITS

REPLACE COIL



CONNECT OHMMETER FROM CENTER TOWER AND EITHER (+) OR (–)

RESISTANCE NOT WITHIN LIMITS

REPLACE COIL

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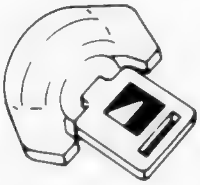
SENSOR CHECK AND CONTROL UNIT CHECK

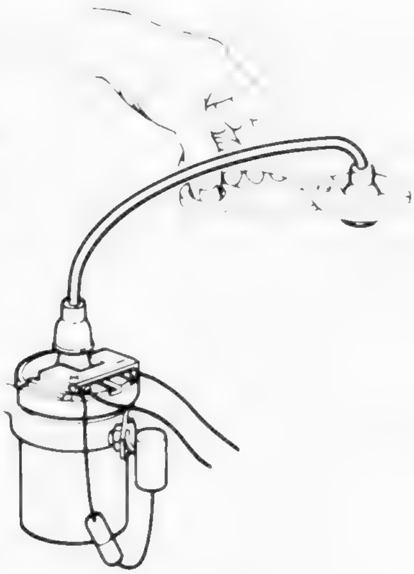
Chart 3

STEP **SEQUENCE** **RESULT**

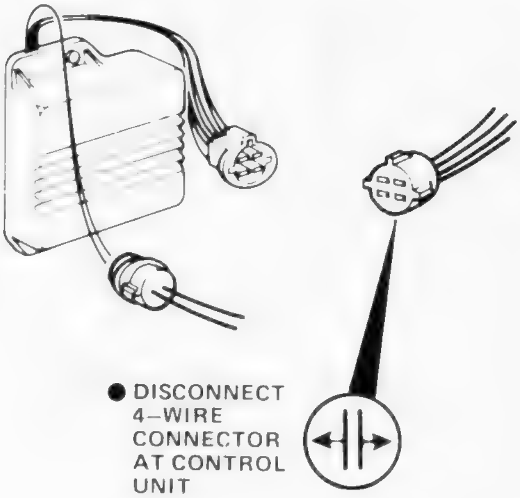
1



- TURN IGNITION ON



- DISCONNECT COIL WIRE FROM CENTER TOWER OF DISTRIBUTOR AND HOLD 1/2 - INCH FROM ENGINE WITH INSULATED PLIERS

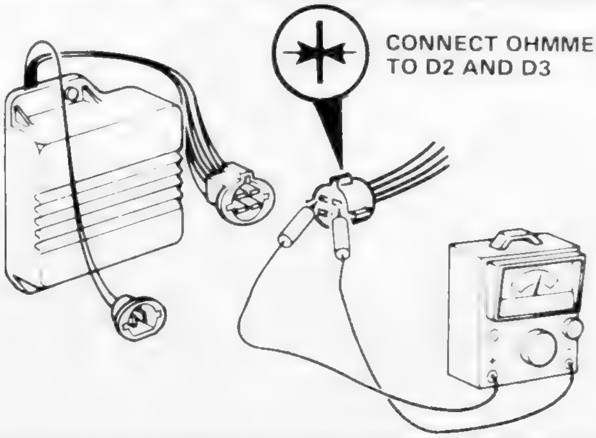


- DISCONNECT 4–WIRE CONNECTOR AT CONTROL UNIT

SPARK AT COIL WIRE (NORMAL) → 2

NO SPARK → 5

2



CONNECT OHMMETER TO D2 AND D3

OK → 6
OHMMETER INDICATES 400-800 OHMS (NORMAL)

~~OK~~ → 3
OHMMETER DOES NOT INDICATE 400 - 800 OHMS

3

- DISCONNECT AND RECONNECT 3 - WIRE CONNECTOR AT DISTRIBUTOR

OK OHMMETER NOW INDICATES 400 - 800 OHMS → 6

~~OK~~ OHMMETER REMAINS OUTSIDE 400 - 800 OHMS → DISCONNECT 3 - WIRE CONNECTOR AT DISTRIBUTOR → 4

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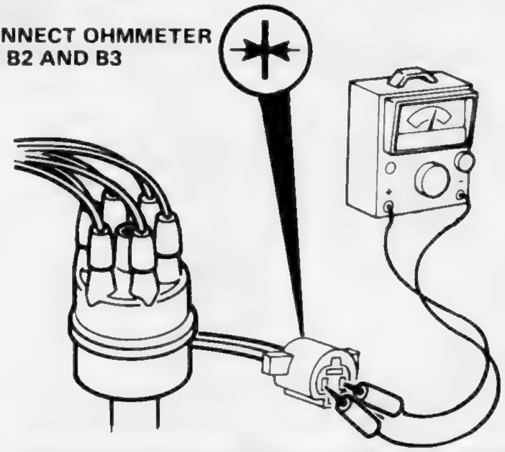
Chart 3

STEP **SEQUENCE** **RESULT**

4

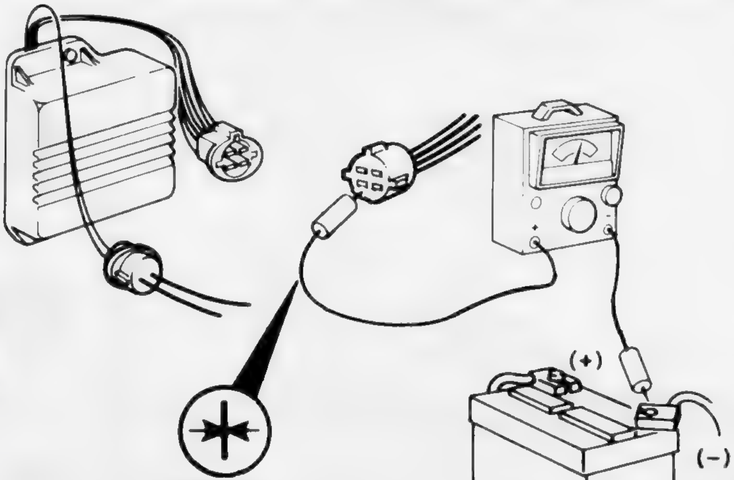


CONNECT OHMMETER TO B2 AND B3

OK — OHMMETER INDICATES 400 - 800 OHMS → REPAIR OR REPLACE HARNESS BETWEEN 3 - WIRE AND 4 - WIRE CONNECTOR → STOP

NOT OK — OHMMETER DOES NOT INDICATE 400 - 800 OHMS → REPLACE SENSOR → STOP

5



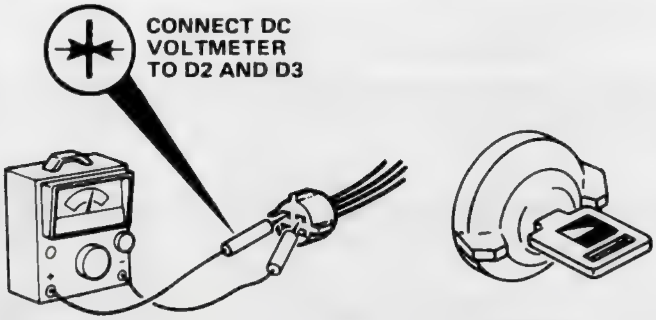
CONNECT OHMMETER BETWEEN D1 AND BATTERY NEGATIVE TERMINAL

OK — OHMMETER INDICATES ZERO (NOT ABOVE 0.002 OHM) → 2

NOT OK — OHMMETER INDICATES ABOVE 0.002 OHM. → LOCATE AND REPAIR SOURCE OF BAD GROUND → STOP

- GROUND CABLE RESISTANCE
- DISTRIBUTOR–TO–BLOCK RESISTANCE
- GROUND SCREW IN DISTRBUTOR TO D1

6



CONNECT DC VOLTMETER TO D2 AND D3

CRANK ENGINE

OK — VOLTMETER FLUCTUATES, INDICATING PROPER SENSOR AND TRIGGER WHEEL OPERATION → STOP

NOT OK — VOLTMETER DOES NOT FLUCTUATE → LOCATE AND REPAIR FAULT → STOP

- DEFECTIVE TRIGGER WHEEL
- DISTRIBUTOR NOT TURNING

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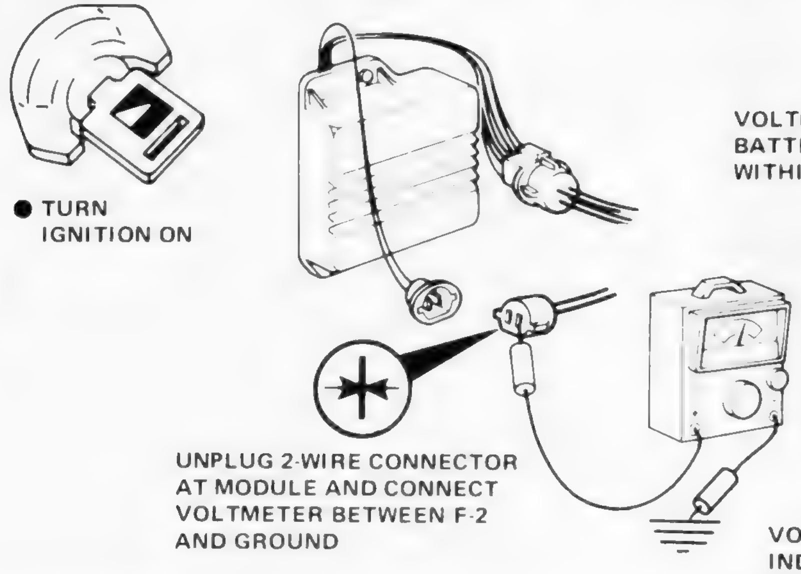
IGNITION FEED TO [redacted] ELECTRONIC CONTROL UNIT

NOTE: DO NOT PERFORM CHART 4 WITHOUT PERFORMING CHART 1

Chart 4

STEP **SEQUENCE** **RESULT**

1



- TURN IGNITION ON

UNPLUG 2-WIRE CONNECTOR AT MODULE AND CONNECT VOLTMETER BETWEEN F-2 AND GROUND

OK → VOLTMETER INDICATES BATTERY VOLTAGE WITHIN 0.2V. → REPLACE CONTROL UNIT → **3**

~~OK~~ → VOLTMETER DOES NOT INDICATE BATTERY VOLTAGE WITHIN 0.2V → **2**

2

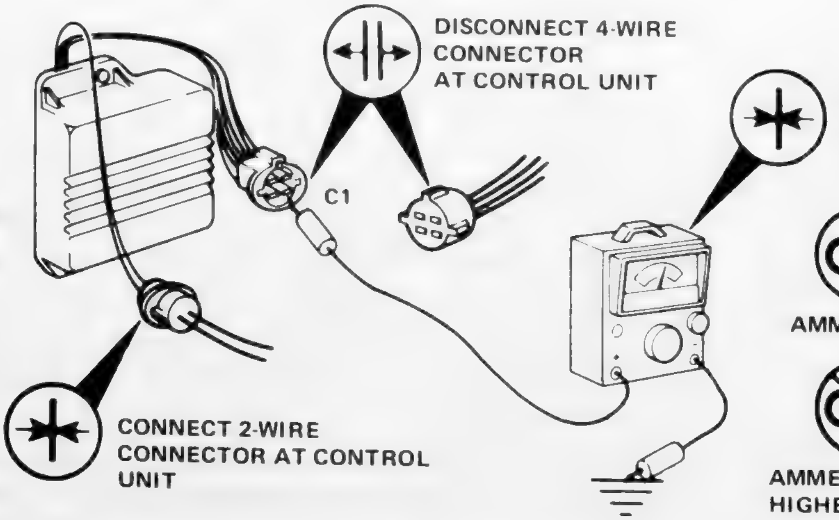
LOCATE AND REPAIR CAUSE OF VOLTAGE REDUCTION

- CORRODED DASH CONNECTOR
- IGNITION SWITCH

→ OK → SPARK AVAILABLE AT COIL WIRE → STOP

~~OK~~ → SPARK NOT AVAILABLE AT COIL WIRE → REPLACE CONTROL UNIT → STOP

3



DISCONNECT 4-WIRE CONNECTOR AT CONTROL UNIT

CONNECT AMMETER BETWEEN C1 AND GROUND

CONNECT 2-WIRE CONNECTOR AT CONTROL UNIT

OK → AMMETER READS 1 AMP ± 0.1 → STOP

~~OK~~ → AMMETER READS HIGHER OR LOWER → REPLACE MODULE → STOP

TESTING

Electrical Tests

Refer to Troubleshooting for test procedures.

Distributor Advance Tests

Centrifugal Advance

(1) Disconnect vacuum line from vacuum advance unit and plug.

(2) Connect timing light and tachometer.

(3) Start engine and observe timing mark while engine is idling.

(4) Slowly increase engine speed to 2000 rpm. Timing should advance smoothly as engine speed increases. Refer to Chapter 1A—General Service and Diagnosis for advance curve information.

Vacuum Advance

NOTE: *Engine must be warmed up to operating temperature.*

(1) Connect vacuum line to vacuum advance unit.

(2) Observe timing mark while engine is idling.

(3) Slowly increase engine speed to 2000 rpm. With vacuum applied, timing should advance sooner than with centrifugal advance alone. At 2000 rpm, vacuum advance should cause total advance to be higher than centrifugal advance alone. Refer to Chapter 1A—General Service and Diagnosis for advance curve information.

Coil Tests

The coil can be tested on any conventional coil tester or with an ohmmeter. A coil tester is preferable as it will detect faults that an ohmmeter will not.

Primary Resistance Test

(1) Remove connector from negative and positive terminals of coil.

(2) Set ohmmeter to low scale and calibrate to zero.

(3) Connect ohmmeter to coil negative and positive terminals. Resistance should read 1.13 to 1.23 ohms at 75°F. At temperatures above 200°F, 1.50 ohms is acceptable.

Secondary Resistance Test

(1) Remove ignition wire from center terminal of coil.

NOTE: *Ignition must be OFF.*

(2) Set ohmmeter to 1000 scale and calibrate to zero.

(3) Connect ohmmeter to brass contact in center terminal and to either primary terminal. Resistance should read 7700 to 9300 ohms at 75°F. A maximum of 12,000 ohms is acceptable if coil temperature is 200°F or more.

Current Flow Test

(1) Remove connector from coil.

(2) Depress plastic barb and withdraw positive wire from connector. Barb is visible from coil side of connector.

(3) Repeat for negative wire.

(4) Connect ammeter between positive terminal and disconnected positive wire.

(5) Connect jumper wire from coil negative terminal to known good ground.

(6) Turn ignition to ON position.

(7) Amperage should read approximately 7 amps, and should not exceed 7.6 amps.

(8) If current flow is more than 7.6 amps, replace coil.

(9) Leave ammeter connected to coil positive terminal. Remove jumper wire from negative terminal. Connect coil green wire to negative terminal. Current flow should be approximately 4 amps.
If current flow is less than 3.5 amps, check for poor connections in 4-wire and 3-wire connectors or poor ground at ground screw inside distributor. If current flow is greater than 5 amps, the control unit is defective.

(10) Start engine. Normal current flow with engine running is 2.0 to 2.4 amps.
If current flow is outside specifications, the control unit is defective.

Coil Output Test

(1) Connect oscilloscope to engine.

(2) Start engine and observe secondary spark voltage.

(3) Remove one spark plug wire from distributor cap. Observe voltage on oscilloscope corresponding to disconnected plug wire. This voltage, referred to as open circuit voltage, should be 20,000 volts minimum.

CAUTION: *Do not remove wires from plugs in cylinders 3 or 5 of a six-cylinder engine or cylinders 3 and 4 of an eight-cylinder engine when performing this test, or sensor may be damaged.*

CAUTION: *Do not operate engine with spark plug disconnected for more than 30 seconds or catalytic converter may be damaged.*

DISTRIBUTOR REPLACEMENT

Removal

(1) Unfasten distributor cap retaining screws. Remove distributor cap with high tension cables and position aside.

(2) Disconnect vacuum hose from distributor vacuum advance unit.

(3) Disconnect distributor primary wiring connector.

(4) Scribe mark on distributor housing in line with tip of rotor. Scribe mark on distributor housing near clamp and scribe matching mark on engine. Note position of rotor and distributor housing in relation to surrounding engine parts as reference points for installing distributor.

(5) Remove distributor holddown screw and clamp.

(6) Withdraw distributor carefully from engine.

Installation

(1) Clean distributor mounting area of engine block.

(2) Install replacement distributor mounting gasket in counterbore of engine.

(3) Position distributor in engine. If engine was not rotated while distributor was removed, perform the following:

(a) Align rotor tip with mark scribed on distributor housing during removal. Turn rotor approximately 1/8-turn counterclockwise past scribed mark.

(b) Slide distributor down into engine. Align scribe mark on distributor with matching scribe mark on engine.

NOTE: *It may be necessary to move rotor and shaft slightly to start gear into mesh with camshaft gear and to engage oil pump drive tang, but rotor should align with scribed mark when distributor is down in place.*

(c) Install distributor holddown clamp, screw and lockwasher, but do not tighten screw.

(4) If engine was rotated while distributor was removed, it will be necessary to establish timing as follows:

(a) Remove No. 1 spark plug. Hold finger over spark plug hole and rotate engine until compression pressure is felt. Slowly continue to rotate engine until timing mark on crankshaft pulley lines up with top dead center (0) mark on timing quadrant. Always rotate engine in direction of normal rotation. Do not turn engine backward to align timing marks.

(b) Turn distributor shaft until rotor tip points in direction of No. 1 terminal in distributor cap. Turn rotor 1/8-turn counterclockwise past position of No. 1 terminal.

(c) Slide distributor down into engine and position distributor vacuum advance housing in approximately the same location (in relation to surrounding engine parts) as when removed. Align scribe mark on distributor with matching scribe mark on engine.

NOTE: *It may be necessary to rotate the oil pump shaft with a long flat-blade screwdriver to engage oil pump drive tang, but rotor should align with the position of No. 1 terminal when distributor is down in place.*

(d) Install distributor holddown clamp, screw and lockwasher, but do not tighten screw.

(5) Install distributor cap (with ignition cables) on distributor housing, making sure rubber sensor lead grommet in distributor housing aligns with depression in distributor cap and that cap fits on rim of distributor housing. Two different diameter screws are used to retain distributor cap.

NOTE: *If distributor cap is incorrectly positioned on distributor housing, cap or rotor may be damaged when engine is cranked.*

(6) Apply AMC Silicone Dielectric Compound or equivalent to connector blades and cavities. Connect distributor primary wiring connector.

(7) Connect timing light to No. 1 spark plug.

CAUTION: *Do not puncture high tension cables or boots to make contact. Use proper adapters.*

NOTE: *The timing case cover has a hole provided for using a magnetic timing probe. Ignition timing may be checked by inserting the probe through the hole until it touches the vibration damper. The probe is calibrated to compensate for probe hole location which is 9.5° ATDC. Eccentricity of the damper properly spaces the magnetic probe and timing is indicated on a meter.*

(8) Operate engine at 500 rpm and observe timing mark with timing light. Rotate distributor housing as needed to align timing mark on vibration damper with mark on timing quadrant. Refer to Chapter 1A—General Service and Diagnosis for timing specifications. When timing is correct, tighten distributor holddown screw and check timing to be sure it did not change.

(9) Disconnect timing light and connect vacuum hose to distributor vacuum advance unit.

DISTRIBUTOR COMPONENT REPLACEMENT

When replacing sensor, trigger wheel or vacuum unit, it is not necessary to remove the distributor from the engine. It is necessary to check ignition timing if sensor or vacuum unit is replaced. Refer to figure 1G-14 for parts identification.

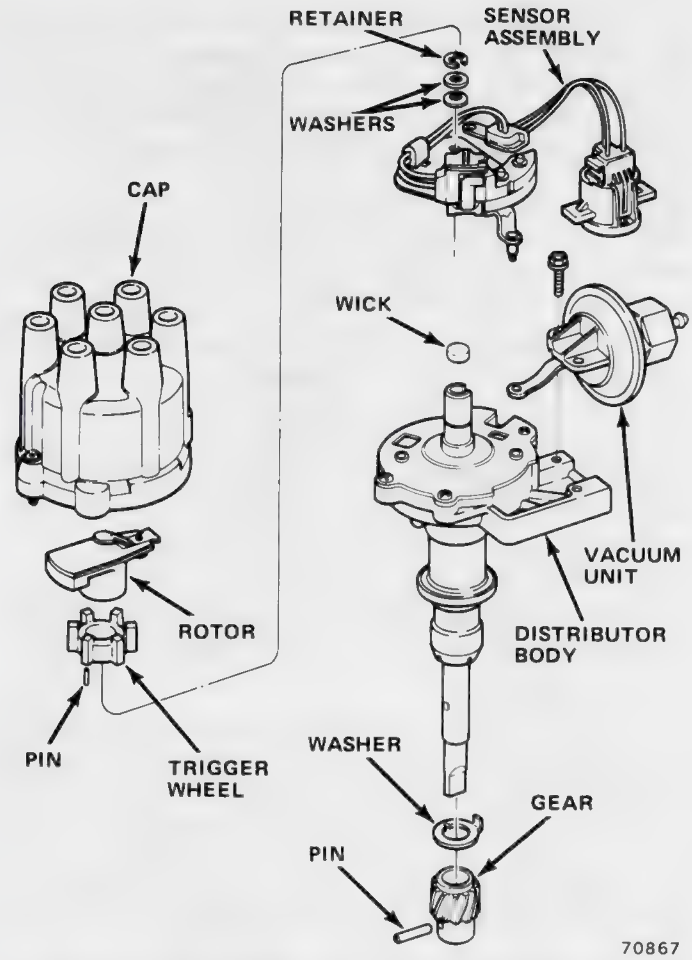


Fig. 1G-14 SSI Distributor Components—Six-Cylinder Shown

Trigger Wheel and/or Sensor

Removal

(1) Place distributor in suitable holding device, if removed from engine.

(2) Remove cap.

(3) Remove rotor.

(4) Remove trigger wheel using small gear puller J-28509, or equivalent. Use flat washer to prevent gear puller from contacting inner shaft. Alternately, two screwdrivers can be used to lever trigger wheel from shaft. Remove pin.

(5) Six-Cylinder—remove sensor retainer and washers from pivot pin on base plate.

(6) Eight-Cylinder—remove sensor snap ring from central shaft. Remove retainer from vacuum unit-to-sensor drive pin and move vacuum unit lever aside.

(7) Remove ground screw from harness tab.

(8) Lift sensor assembly from distributor housing.

(9) If vacuum unit is to be replaced, remove screws and lift vacuum unit out of distributor housing. Do not remove vacuum unit unless replacement is required.

Installation

(1) If vacuum unit was removed, install unit and attaching screws to distributor housing.

NOTE: *If replacement vacuum unit is installed, refer to Vacuum Unit for calibration procedure.*

(2) Position sensor assembly into distributor housing.

(3) Be sure pin on sensor fits into hole in vacuum unit link on six-cylinder. Install vacuum unit lever and retainer to sensor pin on eight-cylinder.

(4) Install washers and retainer onto pivot pin to secure sensor assembly to base plate on six-cylinder. Install snap-ring on eight-cylinder.

(5) Position wiring harness in slot in distributor housing. Install ground screw through tab and tighten.

(6) Install trigger wheel to shaft with long portion of teeth upward using hand pressure. When trigger wheel and slot in shaft are properly aligned, use suitable drift and small hammer to tap pin into locating groove in trigger wheel and shaft. If distributor is out of engine, support shaft while installing trigger wheel pin.

(7) Install rotor. Install distributor cap.

Vacuum Unit

Removal

(1) Remove vacuum hose from vacuum unit.

(2) Six-Cylinder—remove attaching screws and remove vacuum unit from distributor body. It is necessary to tip unit to disengage link from sensor pin protruding through distributor body. It may be necessary to loosen base plate screws for necessary clearance.

(3) Eight-Cylinder—remove distributor cap. Remove retainer from sensor pin. Remove attaching screws and lift vacuumm unit from distributor body.

Installation

(1) If replacement vacuum unit is installed; calibrate as follows:

(a) Insert Allen wrench into vacuum hose tube of original vacuum unit. Count number of **clockwise** turns necessary to bottom adjusting screw.

(b) Turn adjusting screw of replacement vacuum unit clockwise to bottom. Turn counterclockwise same number of turns counted in step (a).

(2) Six-Cylinder—install vacuum unit to distributor body. Be sure that vacuum advance link is engaged on pin of sensor. Install retaining screws. Tighten base plate screws, if loosened.

(3) Eight-Cylinder—install vacuum unit to distributor body. Install retaining screws. Position vacuum unit lever onto sensor pin and install retainer. Install distributor cap.

(4) Check timing and adjust if required.

(5) Install vacuum line to vacuum unit.

Rotor

Inspect the rotor during precision tune-ups as outlined in Chapter 1A—General Service and Diagnosis. A unique feature of the SSI system is the silicone grease applied to the rotor blade during manufacture. Radio interference is greatly reduced by the presence of a small quantity of silicone grease on the rotor blade. After a few thousand miles, this grease becomes charred by the high voltage carried by the rotor (fig. 1G-15). This is normal. Do not scrape the residue from the rotor blade.

When installing a replacement rotor, apply a thin coat (0.03 to 0.12 inch) of AMC Silicone Dielectric Compound, or equivalent, to the tip of the rotor blade.

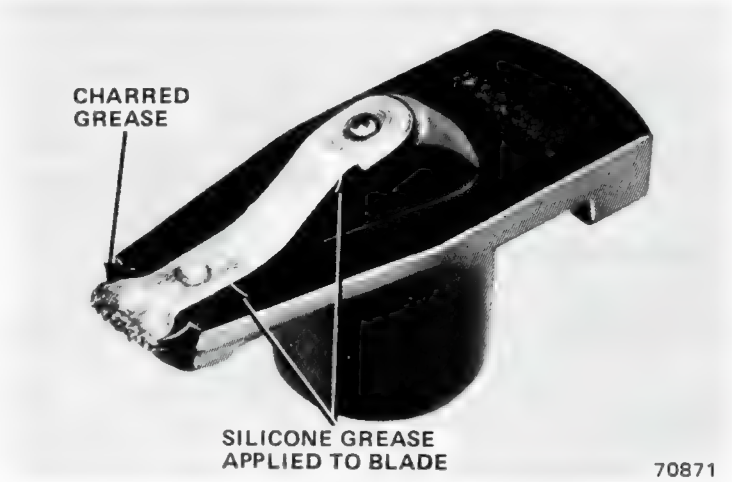


Fig. 1G-15 Rotor Grease Application

SPECIFICATIONS

Distributor and Coil Specifications

Distributor Sensor Resistance	400 to 800 ohms
Coil	
Primary Resistance	1.13 to 1.23 ohms
Secondary Resistance	7700 to 9300 ohms
Open Circuit Output	20 kv minimum
Spark Plug Required Voltage	5-16 kv

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Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Distributor Clamp Screw	18	13-24	13	10-18

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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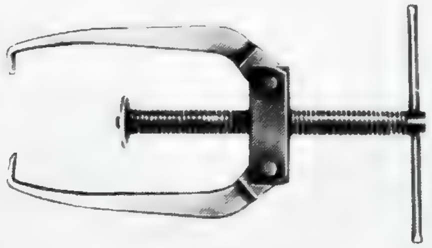
Special Tools



J-28509
TRIGGER WHEEL
PULLER

SPARK CONTROL SYSTEMS

SPARK COOLANT TEMPERATURE OVERRIDE (CTO) SYSTEM

General

Vacuum spark advance on all AMC cars operates on carburetor ported vacuum after warming up. Warm-up driveability is improved by operating the distributor vacuum spark advance by manifold vacuum while the engine is cold. This is accomplished by the CTO system (fig. 1G-16). The CTO switch is threaded into the bottom of the intake manifold on four-cylinder engines, into the left rear of the block on six-cylinder engines, and into the thermostat housing on eight-cylinder engines. A thermal sensor on the CTO switch is in contact with engine coolant (fig. 1G-16). Depending on coolant temperature, the CTO switch permits either manifold vacuum or carburetor ported vacuum to pass through to the distributor vacuum unit. The CTO switch is used alone on some cars and as part of a more complex Transmission Controlled Spark (TCS) System which is discussed later.

Operation

When coolant temperaure is below 160°F, the check ball is held against the inner seat by spring pressure. Manifold vacuum is admitted through port 1 and is applied to port D. A hose connects port D with the distributor spark advance diaphragm. In this operating mode, full vacuum advance is obtained.

When engine coolant reaches 160°F, the check ball is moved outward, blocking manifold vacuum at port 1. Carburetor ported vacuum is admitted through port 2 and is applied to port D. The distributor spark advance diaphragm is now operated by ported vacuum. This may be regarded as the normal operating mode.

Test

Connect a vacuum gauge to the center port (D) of the CTO switch. Below 160°F, manifold vacuum should be indicated. Above 160°F, carburetor ported vacuum should be indicated. Defective switches must be replaced.

NOTE: *Ported vacuum is not available with throttle closed. Ported vacuum is available when throttle is opened to achieve engine speed of 1000 rpm.*

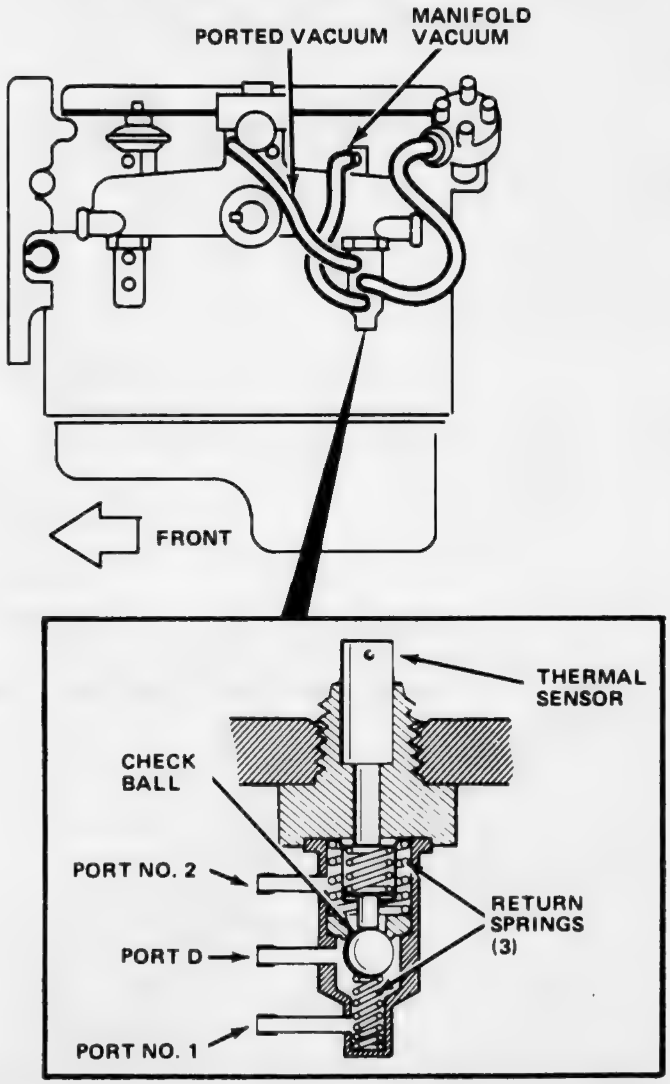


Fig. 1G-16 Spark CTO System—Typical (Four-Cylinder Shown)

CTO Switch Replacement

Removal—Four-Cylinder

(1) Drain coolant from radiator.

(2) Code vacuum lines and disconnect vacuum lines from spark CTO switch.

(3) Place drain pan under intake manifold.

(4) Remove switch from intake manifold.

WARNING: *Be careful of scalding hot water leaking from manifold when removing switch.*

Installation—Four-Cylinder

(1) Install switch.
(2) Connect vacuum lines to switch.
(3) Install coolant.
(4) Purge cooling system of air.

Removal—Six-Cylinder

(1) Drain coolant from radiator.

(2) Code vacuum lines and disconnect vacuum lines from spark CTO switch.

(3) Place drain pan under engine below CTO switch.

(4) Remove switch from block.

WARNING: *Be careful of scalding hot water leaking from block when removing the switch.*

Installation—Six-Cylinder

(1) Install switch.
(2) Connect vacuum lines to switch.
(3) Install coolant.

NOTE: *Remove temperature gauge sending unit from head to aid in bleeding air while filling the cooling system.*

(4) Purge cooling system of air.

Removal—Eight-Cylinder

(1) Drain coolant from radiator.

(2) Remove air cleaner assembly, coil and bracket.

(3) Code vacuum lines and disconnect from spark CTO switch.

(4) Remove switch from thermostat housing.

Installation—Eight-Cylinder

(1) Install switch.
(2) Install coil and bracket.
(3) Connect vacuum lines to switch.
(4) Install air cleaner assembly.
(5) Install coolant.
(6) Purge cooling system of air.

TRANSMISSION CONTROLLED SPARK (TCS) SYSTEM

The TCS system is used on all California cars except four-cylinder and on certain 49-state cars.

The purpose of the TCS system is to reduce the emission of oxides of nitrogen by lowering the peak combustion temperature during the power stroke. This is accomplished by permitting vacuum spark advance only in high gear (manual transmission) or over 36 mph (automatic transmission). The system incorporates a coolant temperature override switch, a solenoid vacuum valve, a solenoid control switch and related wiring and vacuum lines (fig. 1G-17 and 1G-18).

Coolant Temperature Override Switch

The CTO switch used with Transmission Controlled Spark is the same as the CTO switch previously discussed. In the TCS system, the CTO switch ports are connected as follows:

- Port 1—Manifold vacuum.
- Port D—Distributor vacuum spark advance.
- Port 2—Solenoid vacuum valve.

During warm-up, the CTO permits manifold vacuum to operate the distributor vacuum spark advance. After warm-up, the CTO blocks manifold vacuum and routes carburetor ported vacuum to the solenoid vacuum valve.

Solenoid Vacuum Valve

This valve is attached to a bracket at the rear of the intake manifold on six-cylinder engines and to the right rear side of the intake manifold of eight-cylinder engines. When the valve is energized (electrically grounded), carburetor ported vacuum is blocked. The distributor vacuum line is vented to atmosphere through a port in the valve, resulting in no vacuum advance. When the valve is de-energized (not electrically grounded), ported vacuum is applied to the distributor, resulting in normal vacuum advance.

Solenoid Control Switch

This switch, located at the transmission, opens or closes in relation to car speed or gear range. At speeds above 36 mph (automatic transmission) or high gear (manual transmission), the switch opens and breaks the ground circuit to the solenoid vacuum valve permitting vacuum advance to occur.

At speeds under 36 mph (automatic transmission), or lower gear ranges (manual transmission), the switch is closed and completes the ground circuit to the solenoid vacuum valve blocking vacuum advance.

On three-speed manual transmissions, the switch is operated by the shifter shaft, and is screwed into the transmission case forward of the front shifter shaft boss. On four-speed manual transmissions, the switch is screwed into the extension housing forward of the shift lever.

On automatic transmissions, the switch is operated by governor oil pressure (1 psi governor pressure equals approximately 1 mph). It is located on the right rear of the engine block on six-cylinder engines and on a bracket at the rear of the right-hand valve cover of eight-cylinder engines. The switch is preset and should not require attention. If a malfunction is suspected, the switch can be tested and adjusted in accordance with the following procedure.

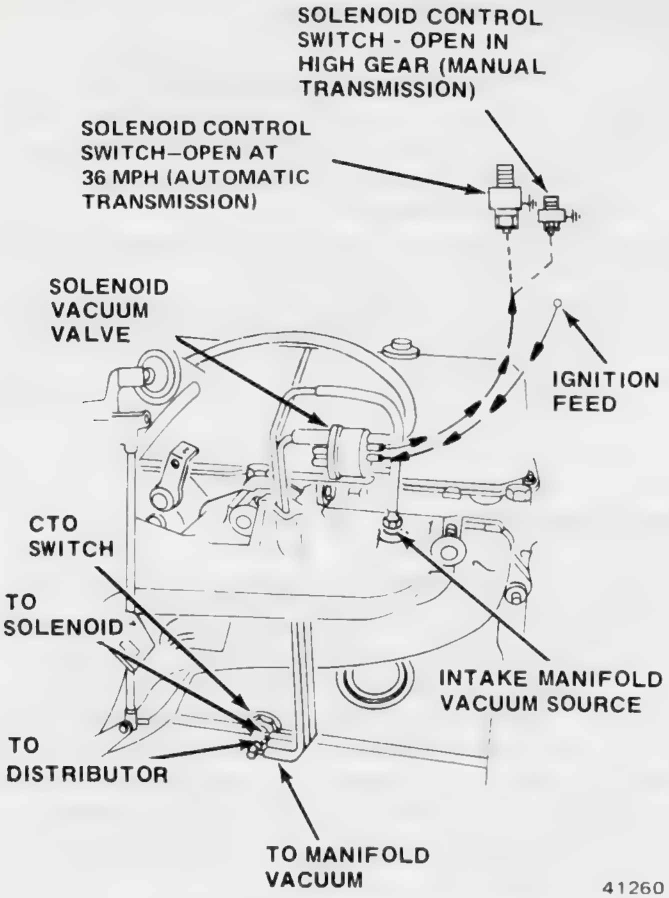


Fig. 1G-17 TCS System—Six-Cylinder

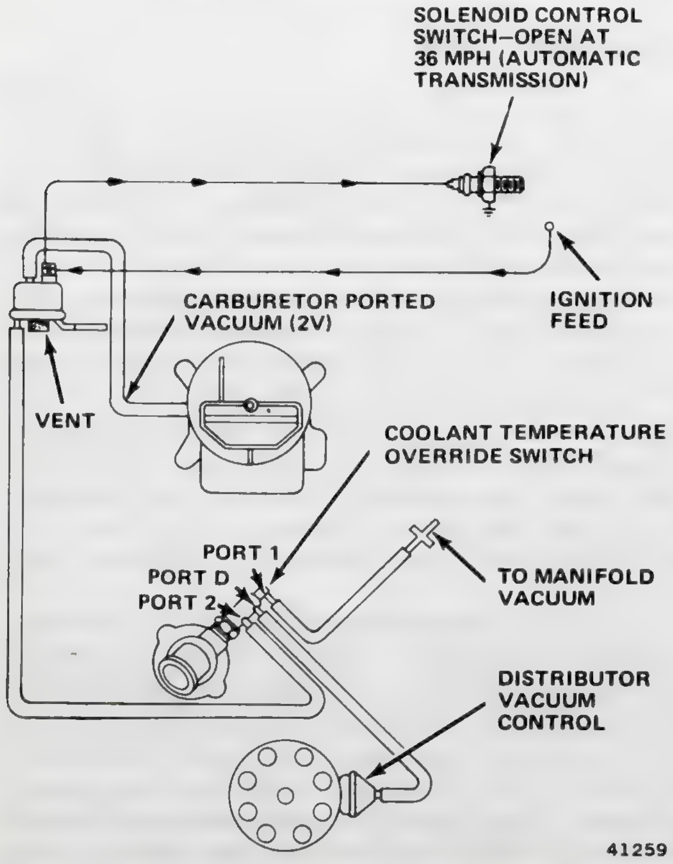


Fig. 1G-18 TCS System—Eight-Cylinder

TCS Test

A vacuum gauge, probe-type test lamp and a jumper wire are used to check the operation of the TCS system. The tests determine if the solenoid has a current supply, if the solenoid control switch opens and closes the solenoid ground circuit properly and if the vacuum valve is functioning. Refer to fig. 1G-19.

Test 1—Current Supply Test

(1) Turn ignition switch ON.

(2) Disconnect wire connector from solenoid vacuum valve.

(3) Connect wire lead of test lamp to ground.

(4) Touch probe end of test lamp to each terminal of connector. Test lamp should light at terminal of orange ignition feed wire. If not, ignition feed to TCS system is defective.

Test 2—Ground Circuit Test—Manual Transmission

(1) Move gearshift lever to NEUTRAL.

(2) Connect test lamp wire to battery positive post. Touch probe to orange solenoid switch wire terminal in solenoid connector. Test lamp should light.

(3) Shift transmission to each gear except HIGH. Test lamp should remain lit.

(4) Shift transmission to HIGH gear. Test lamp should go out.

If test lamp does not light at all, perform Test 4—Solenoid Control Switch Test.

Test 3—Ground Circuit Test—Automatic Transmission

(1) Support vehicle so drive wheels are off ground.

(2) Connect test lamp wire to battery positive post.

(3) Disconnect wire connector from solenoid vacuum valve and insert probe in orange solenoid switch wire terminal.

(4) Start engine and put transmission in DRIVE. Observe test lamp. Note speed at which test lamp goes out (switch opens). Slowly decelerate and note speed at which test lamp goes on (switch closes). Test lamp should go out above 37 mph and should go on below 33 mph.

(5) Adjust switch if operation is outside operating range. Turn 1/16-inch Allen screw in switch terminal clockwise to increase opening speed and counterclockwise to decrease opening speed (fig. 1G-20).

(6) If test lamp does not light at all, perform Test 4—Solenoid Control Switch test.

Test 4—Solenoid Control Switch Test

Perform this test if test lamp did not light when connected to orange wire in Test 2 or Test 3.

(1) Disconnect wire from solenoid control switch at transmission (manual) or rear of engine (automatic).

(2) Connect jumper wire from disconnected wire to ground.

If test lamp now lights as outlined in Test 2 or Test 3, control switch is defective.

Test 5—Solenoid Vacuum Valve Function Test

NOTE: *Engine must be warm before performing this test.*

(1) Place manual transmission gearshift lever in NEUTRAL and apply parking brake. Place automatic transmission in PARK.

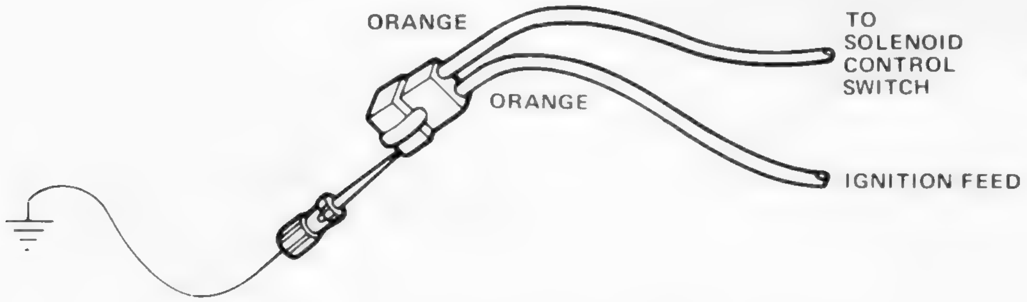
(2) Disconnect distributor vacuum advance line at solenoid valve.

(3) Install vacuum gauge to solenoid vacuum valve where distributor line was disconnected.

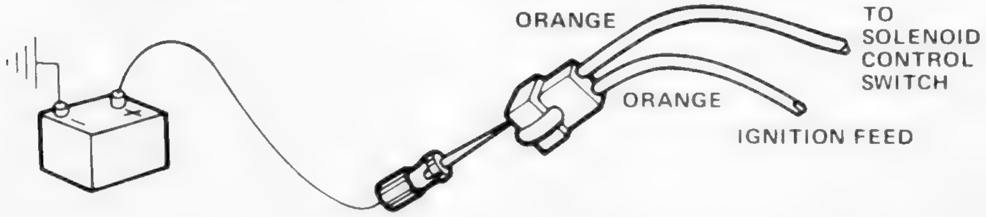
(4) Start engine and run at 1000—1500 rpm. No vacuum should be indicated.

(5) Maintain engine speed and disconnect two-wire connector from solenoid. Vacuum gauge should indicate ported vacuum. Connect and disconnect wire connector several times to verify operation.

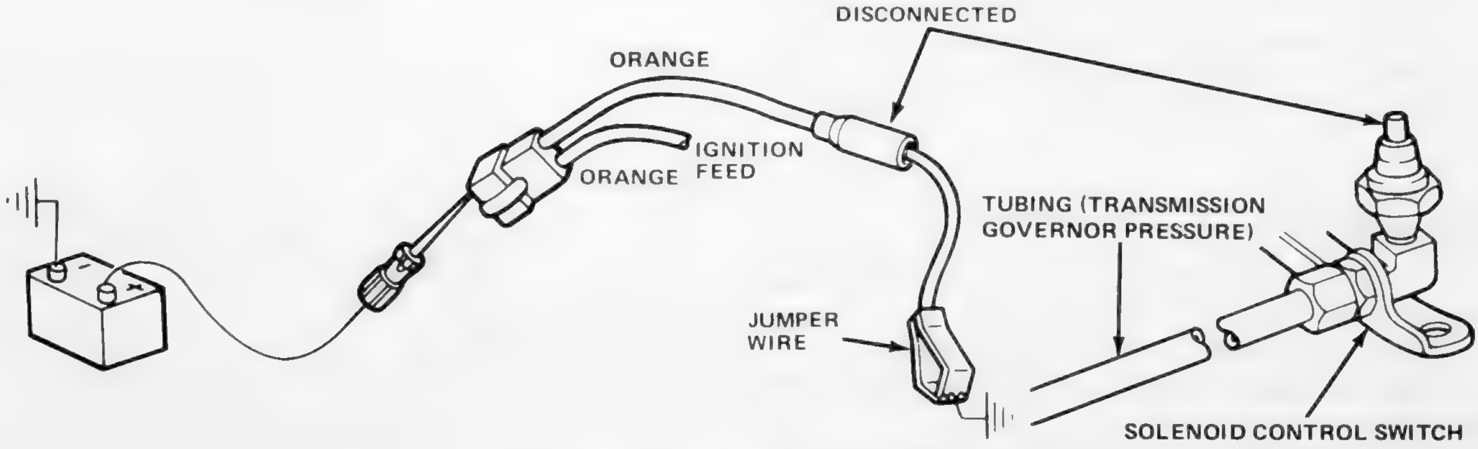
(6) Replace valve if defective. Be sure to connect vacuum lines correctly.



TEST 1 - CURRENT SUPPLY TEST



TEST 2 AND TEST 3 - GROUND CIRCUIT TEST



TEST 4 - SOLENOID CONTROL SWITCH TEST (AUTOMATIC TRANSMISSION SHOWN)

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Fig. 1G-19 TCS System Test

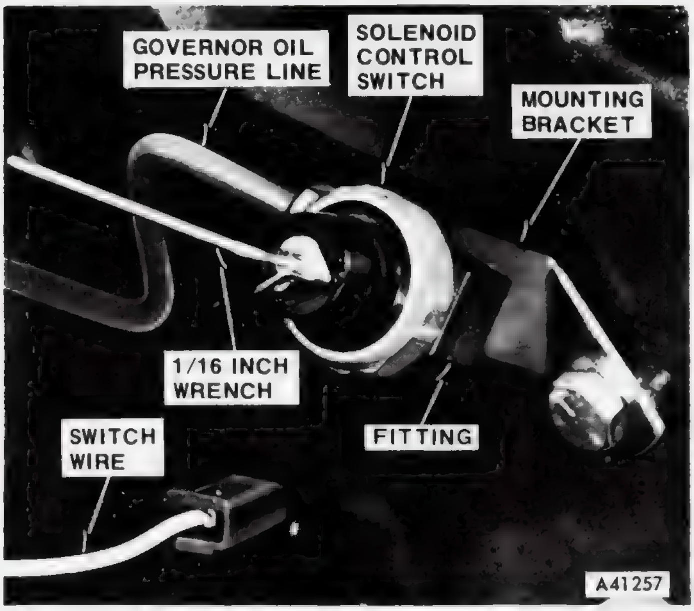

Fig. 1G-20 Solenoid Control Switch Adjustment

VACUUM SPARK CONTROL CHECK VALVE

General

The vacuum spark control check valve is added to the TCS system on some cars. Its purpose is to provide better driveability while the engine is cold and to lower the emission of hydrocarbons (HC).

Operation

When a cold engine is started, manifold vacuum is applied to the distributor vacuum advance unit. But if the engine is accelerated, manifold vacuum drops and distributor vacuum advance is lost. To prevent this from happening, a one-way check valve is installed in the vacuum line on some engines (fig. 1G-21 and 1G-22). The distributor remains in the full advance mode until the CTO switches to ported vacuum. The trapped vacuum slowly bleeds down when the engine is not running.

Check Valve Test

(1) Disconnect distributor advance hose from vacuum advance unit.

(2) Connect vacuum gauge to disconnected hose.

(3) Start engine. Gauge should indicate manifold vacuum.

(4) Stop engine and observe gauge. If vacuum falls off rapidly, check valve is defective.

NOTE: *A very gradual loss of vacuum is normal because of slight leakage in the CTO switch.*

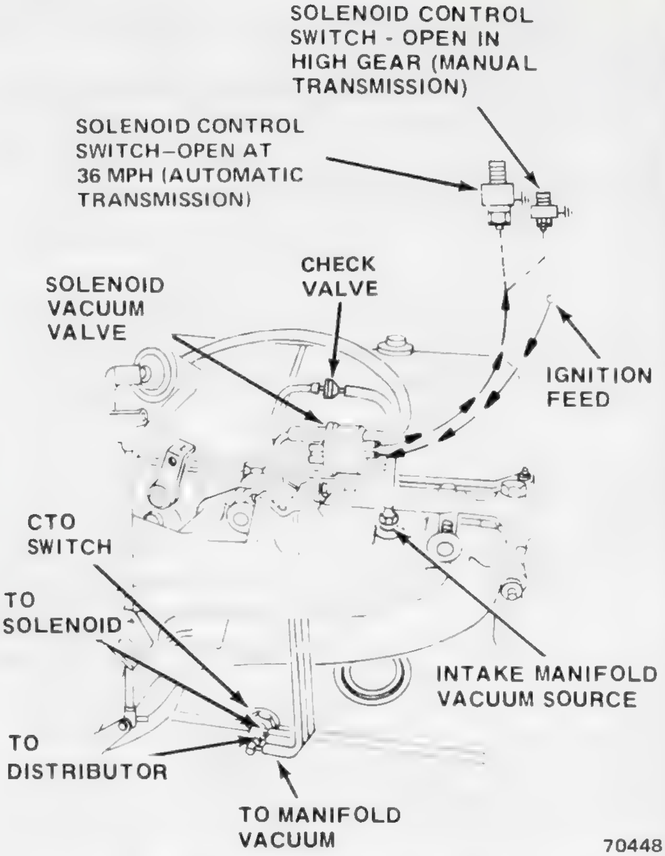

Fig. 1G-21 Vacuum Spark Control Check Valve—Six-Cylinder

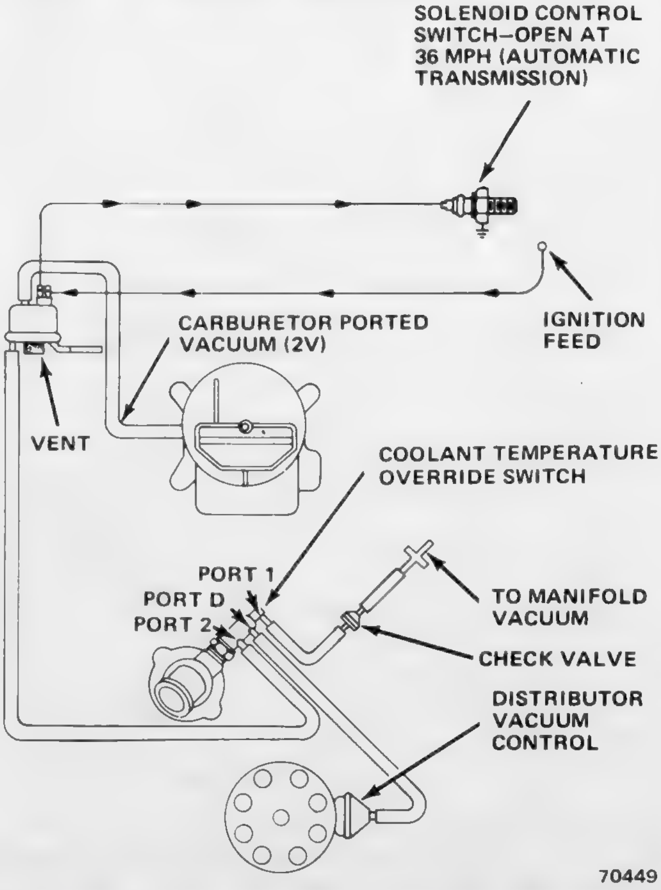

Fig. 1G-22 Vacuum Spark Control Check Valve—Eight-Cylinder

SPECIFICATIONS

Spark Control Specifications

CTO Switch Continuity:

Port 1 to Port D	below 160°F (71°C)
Port 2 to Port D	above 160°F (71°C)

TCS Solenoid Control Switch:

Auto. Transmission	open at 33-37 mph (53-60 kph)
Manual Transmission	open in high gear

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Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
TCS Switch to Case	18-20	17-21	160-180	155-185

All torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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NOTES

CRUISE COMMAND 1H

SECTION INDEX

GENERAL

Features

A new electronic Cruise Command is offered for 1978. A speedometer cable-driven sensor and an electronic "black box" regulator under the instrument panel have replaced the mechanical flyweight regulator used in previous years (fig. 1H-1). The servo assembly contains solenoid-controlled vacuum valves. An additional vacuum dump valve is operated by the brake pedal. The control switch on the turn signal lever includes the familiar ON-OFF-RESUME slide switch and speed setting pushbutton. A small vacuum storage can and one-way valve are also included.

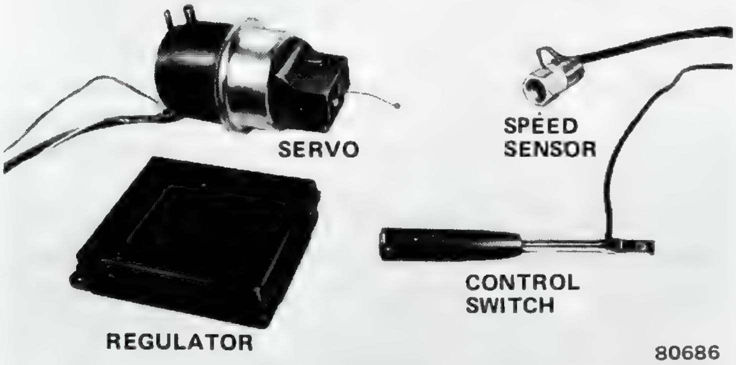

Fig. 1H-1 Electronic Cruise Command Components

How to Use

The Cruise Command is electronically limited to operate only at speeds above 30 mph. At any speed above 30 mph, the unit will maintain the selected speed within 3.5 mph of the selected speed on upgrades not exceeding 7% (most interstate highways). A change greater than 3.5 mph may be experienced on cars with an economy axle ratio or when driving in unusually hilly terrain or at high altitudes.

To activate the system, move the slide switch to the ON position, then accelerate to the desired speed. Push the SET button on the end of the turn signal lever and release. The system activates when the SET button is released.

The driver may regain normal control by pushing the slide switch to the OFF position or by lightly depressing the brake pedal. If the brake method is used, the previously selected speed will remain in memory and may be attained by sliding the switch to RESUME above 30 mph. Memory is erased by turning the unit OFF or by turning the ignition switch OFF.

If a lower speed is desired while cruising at a selected speed, depress the pushbutton and hold until the car decelerates to the new speed. When the button is released, the new speed will be maintained.

If a higher speed is desired, accelerate to the desired speed with the accelerator pedal, depress SET button and release.

WARNING: *Do not use the Cruise Command when driving on slippery or congested roads.*

COMPONENTS

The Cruise Commmand system consists of these components: regulator, speed sensor, servo, control switch, release system, dump valve, vacuum storage can and check valve.

Regulator

The regulator detects vehicle speed through a speed sensor driven by the speedometer cable. The regulator, which is located under the instrument panel, has a built-in circuit to prevent operation below 30 mph.

The regulator is sealed during manufacture and cannot be serviced internally, although some external adjustment is possible.

Speed Sensor

The speed sensor is a tachometer generator installed betwen upper and lower speedometer cables. It converts speedometer cable revolutions into an electrical signal for the regulator.

Servo

The servo, mounted in the engine compartment, receives signals from the regulator and translates these signals into motion, using manifold vacuum. A bead-link chain connects the servo cable to the throttle linkage.

Control Switch

The control switch is an integral part of the turn signal switch. It serves as a communication link between the driver and the regulator assembly.

Release System

The release system de-energizes the Cruise Command in two ways; both are operated by the brake pedal. The valves that control vacuum in the servo are electrically controlled by the regulator. When the brake pedal is depressed, an electrical signal from the brake pedal causes the regulator to signal the servo. The vacuum supply valve is closed and the servo dump valve is opened. To further ensure immediate servo release, a brake pedal-operated mechanical vacuum dump valve (operating independently of the electrical valves) admits atmospheric pressure into the servo whenever the brake pedal is depressed. A hissing sound may be heard momentarily.

OPERATION

Servo

The selected road speed is maintained by the servo, which controls carburetor throttle position as directed by the regulator. Two solenoid-controlled valves are used to control manifold vacuum applied to the servo (fig. 1H-2). In the relaxed state, the charge valve blocks manifold vacuum, while the vent valve admits atmospheric pressure. The spring relaxes the diaphragm and throttle position is unaffected. When the charge valve is activated, manifold vacuum moves the diaphragm and opens the throttle. Throttle opening can be maintained at any position by balancing vacuum feed against vacuum bleed. The electrical siganls that accomplish this are produced by the regulator.

NOTE: *Manifold vacuum is applied to the vacuum storage can through the one-way valve whenever the engine is running. As the Cruise Command uses vacuum in the can, it is replaced as needed. The can acts as a reservoir and provides relatively steady vacuum even when engine manifold vacuum is temporarily low.*

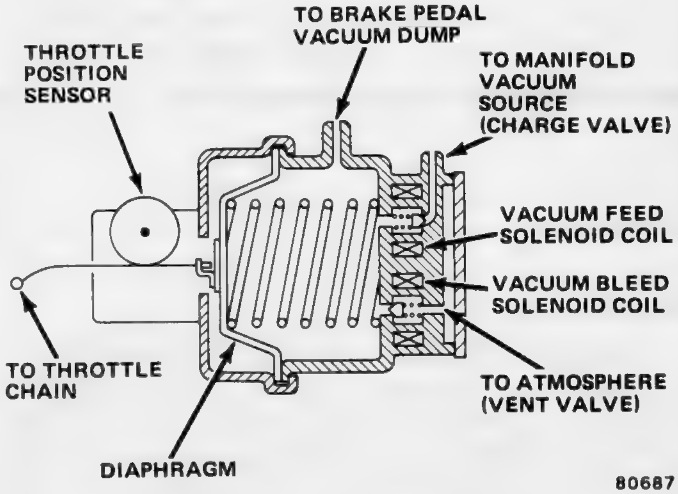

Fig. 1H-2 Servo Assembly

Regulator

The regulator is a sealed black box that contains several electronic circuits.

The speed sensor, driven by the speedometer cable, serves as the road speed signal source. Current generated in the sensor is carried by wire to the amplifier section of the regulator, which amplifies and shapes the speed signal. The amplified signal is further modified by the frequency-to-DC converter, which transforms the speed signal into a DC voltage that is proportional to the vehicle's road speed.

The DC voltage is supplied to three circuits for further action. The low speed switch compares the DC voltage with a built-in standard that represents 30 mph. If the DC voltage is above that standard, the engage/resume circuit of the system is activated. Road speed DC voltage is also supplied to the high and low comparators and to memory.

At the commmand from the SET button, the memory stores the DC voltage for future reference. Two signals are produced by memory, one representing the set speed plus 1/4 mph and the other representing set speed minus 1/4 mph. The plus signal is connected to the high comparator and the minus signal is connected to the low comparator.

If the DC voltage from the DC converter (representing road speed) lies between the plus and minus values, the regulator sends no signal to the charge valve, which remains closed. A signal is sent to the dump valve and it too remains closed. In this condition, the throttle position remains fixed.

Whenever a grade is encountered, road speed decreases, and DC voltage from the DC converter also decreases a proportional amount. When this voltage drops below the low comparator limit (set speed minus 1/4 mph), the charge valve is powered, the diaphragm moves to pull the throttle cable and chain and the throttle is opened. As the throttle opens, a throttle-position sensor inside the servo is activated. Without it, the throttle would continue to be opened further than necessary to maintain set speed. The throttle-position sensor modifies the output of the converter by increasing DC voltage output. When this voltage lies between the high and low reference points, the charge valve closes, leaving the throttle in its new position. In this manner, changes in throttle position are proportional to the amount that road speed differs from set speed. For over-speed conditions (such as descending a hill), the operation is similar, except the high comparator and vent valve are involved. The high comparator detects a DC voltage rise from the DC converter and turns off the vent valve, dumping vacuum. The throttle begins to close. The closing is modulated by the throttle-position sensor and the DC converter output is again brought between the two speed references.

The high and low comparators are permitted to operate only when the engage/resume circuit is activated. This is accomplished by operating the SET button or by moving the slide switch to RESUME. When the SET button is pushed and released, the memory is updated to store the present vehicle speed. Engage/resume is deactivated by operating the brake pedal or by the vehicle speed falling below the low speed reference (30 mph).

TROUBLESHOOTING

For troubleshooting of the Cruise Command system, refer to Service Diagnosis and Testing.

Refer to Volume Three for details on speedometer cable and gear relacement.

Service Diagnosis

Condition	Possible Cause	Correction
SYSTEM DOES NOT ENGAGE IN"ON" POSITION	(1) Restricted vacuum or no vacuum.	(1) Locate blockage or leak and repair.
	(2) Control switch defective.	(2) Replace switch.
	(3) Regulator defective.	(3) Replace regulator.
RESUME FEATURE INOPERATIVE	(1) Bad ground.	(1) Check ground wire at servo.
SYSTEM RE-ENGAGES WHEN BRAKE IS RELEASED	(1) Regulator defective.	(1) Replace regulator.
	(2) Dump valve not opening.	(2) Adjust or replace valve.
	(3) Kink in dump valve hose.	(3) Reroute to remove kink.
CARBURETOR DOES NOT RETURN TO IDLE	(1) Improper linkage adjustment.	(1) Adjust properly.
	(2) Improper chain adjustment.	(2) Adjust chain.

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Condition	Possible Cause	Correction
ROAD SPEED CHANGES MORE THAN 2 MPH WHEN SETTING SPEED	(1) Centering adjustment set wrong.	(1) Adjust centering screw.
ENGINE ACCELERATES WHEN STARTED	(1) No slack in bead chain. (2) Vacuum connections reversed at servo. (3) Servo defective.	(1) Adjust chain. (2) Check connection and correct. (3) Replace servo.
SYSTEM DISENGAGES ON LEVEL ROAD WITHOUT APPLYING BRAKE	(1) Loose wiring connection. (2) Loose vacuum connection. (3) Servo linkage broken. (4) Defective stop lamp switch.	(1) Tighten connections. (2) Check vacuum connections. (3) Repair linkage. (4) Replace switch.
ERRATIC OPERATION	(1) Speed sensor wires reversed. (2) Servo defective. (3) Regulator defective.	(1) Check connection of sensor wires. (2) Replace servo. (3) Replace regulator.
VEHICLE CONTINUES TO ACCELERATE WHEN PUSH BUTTON IS RELEASED	(1) Servo defective. (2) Regulator defective.	(1) Replace servo. (2) Replace regulator.
SYSTEM ENGAGES, LOSES SET SPEED SLOWLY	(1) Vacuum leak at dump valve on brake pedal.	(1) Replace dump valve.

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TESTING

Perform the following tests as part of the diagnosis to determine the cause of the malfunction and the correction required.

Control Switch Continuity Test

Use 12-volt test lamp to check control switch operation. Connect tester to wires indicated in the Control Switch Test (fig. 1H-3).

Circuitry Tests

Perform the following checks as part of the diagnosis to determine the cause and correction of Cruise Command trouble. Refer to figure 1H-4 for wiring details.

(1) Disconnect wire harness connector at regualtor. Use suitable thin tool to depress tab inside hole on regulator marked "Terminal Release".

(2) Verify that each wire is installed in correct location. Refer to figure 1H-4.

(3) Connect test lamp lead to ground. Probe terminals in wire connector as outlined in Harness Test at Regulator (fig. 1H-5). Perform repairs as directed.

ADJUSTMENTS

Centering Adjustment

Adjustment is made by turning the centering adjustment screw on the regulator (fig. 1H-6).

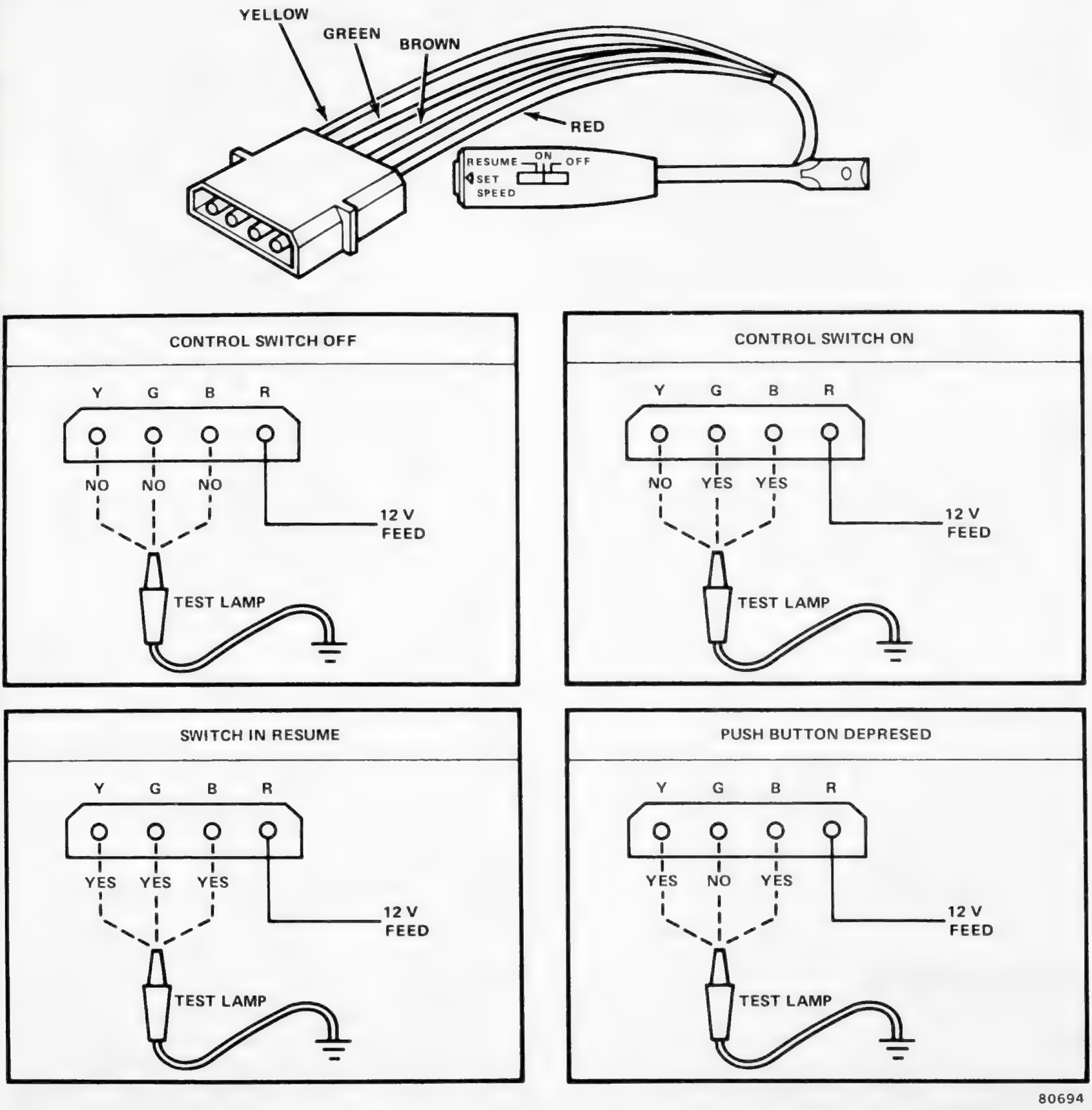


Fig. 1H-3 Control Switch Test

If speed control engages at two or more mph higher than selected speed turn centering adjusting screw counterclockwise a small amount. If engagement speed is two or more mph below selected speed, turn centering adjusting screw clockwise a small amount (fig. 1H-6).

NOTE: *Check for proper centering adjustment on a level road after making each adjustment.*

Vacuum Dump Valve

(1) Depress brake pedal and hold in depressed position.

(2) Move vacuum dump valve toward bracket on pedal as far as possible.

(3) Release brake pedal.

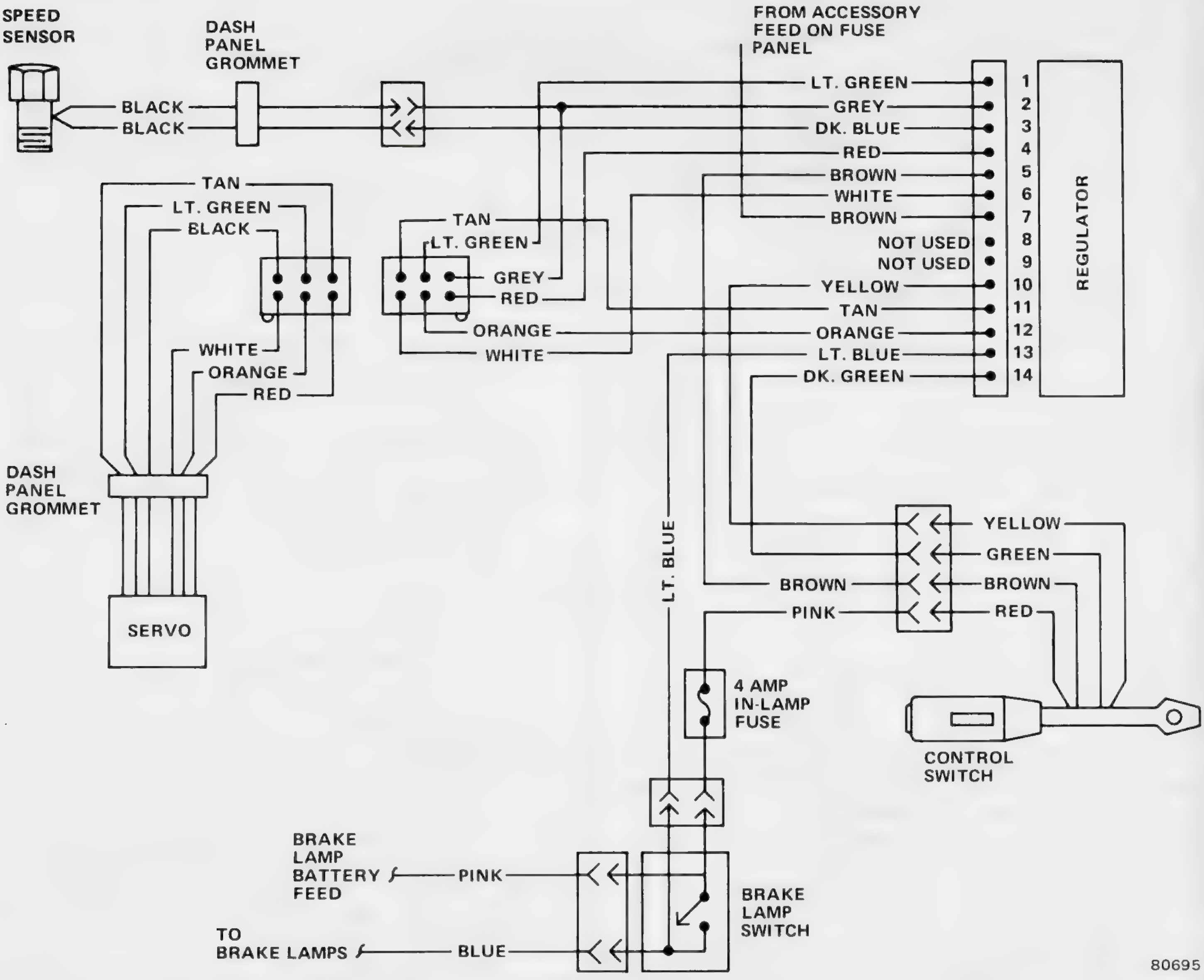


Fig. 1H-4 Cruise Command Schematic

REGULATOR REPLACEMENT

Pacer

The regulator is suspended from the instrument panel harness by straps. It is located left of the brake sled. Remove straps and unplug connector. Insert suitable thin tool to depress tab inside hole on regulator marked “Terminal Release”. To install, plug connector into regulator and suspend from harness with straps.

Gremlin, AMX and Concord

The regulator is mounted on a bracket behind the headlamp switch. Remove screws and unplug connector. Insert suitable thin tool to depress tab inside hole on regulator marked “Terminal Release”. To install, plug connector into regulator and install screws.

Matador

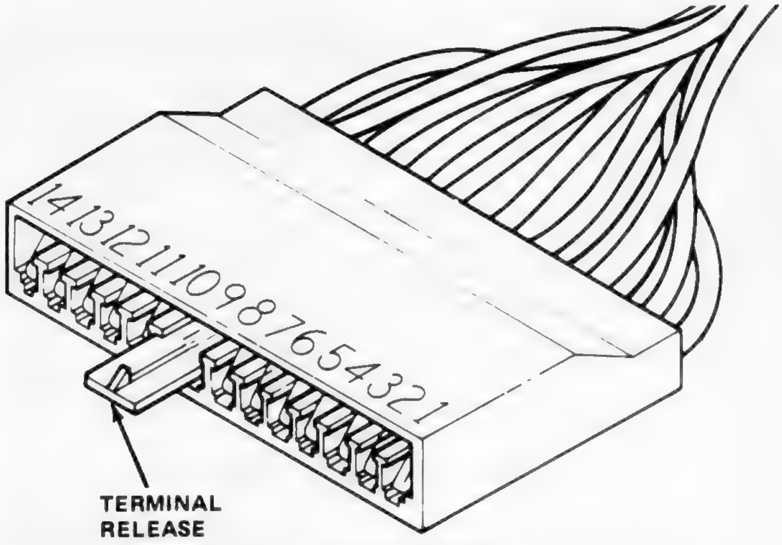
The regulator is suspended from the instrument panel harness by straps. It is located below the radio next to the ash tray. Remove straps and unplug connector. Insert suitable thin tool to depress tab inside hole on regulator marked “Terminal Release”. To install, plug connector into regulator and suspend from harness with straps.

SERVO REPLACEMENT

Removal

(1) Remove retaining nuts and cable housing from servo.

(2) Spread clip connecting cable to servo and remove.



1.	LT. GREEN
2.	GREY
3.	DK. BLUE
4.	RED
5.	BROWN
6.	WHITE
7.	BROWN
8.	NOT USED
9.	NOT USED
10.	YELLOW
11.	TAN
12.	ORANGE
13.	LT. BLUE
14.	DK. GREEN

Condition	Test Lamp Results	Repair
Switch Off–Key Off	No light, all terminals.	None
	Lights at 14, 10 or 5.	Perform steering column control switch test.
	Lights at 13.	Reverse pink and blue wire connection at brake lamp switch.
	Lights at 7.	Wire connected to wrong fuse. Reconnect to accessory fuse.
Switch Off–Key On	Lights at 7.	None
	No Light at 7.	Check accessory fuse. Check for wire end retention in terminal or for defective wire crimp to terminal.
Switch On–Key On	Lights at 5, 7, 14.	None
	No light at 5, 14.	Perform column switch test.
	No light at 7.	Same as switch off–key on.
Switch On–Key Off	Lights at 5, 14.	None
	No light at 5, 14.	Perform column switch test.
Switch in resume–Key Off	Lights at 5, 10, 14.	None
	Light at 10 does not go out when resume is released.	If wire positions are correct, replace column switch.
Set Button Depressed–Key Off	Lights at 5, 10.	None
	Light goes out at 10 when set button is released.	None
	No light at 5, 10, or 10 does not go out when set button is released.	Verify wire positions. If wires are positioned correctly, perform column switch test.
	Light comes on at 14 if set button is released.	None
Brake Pedal Depressed	Lights at 13.	None
	No light at 13.	Check for loose connector at brake switch, blown fuse, defective brake switch.

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Fig. 1H-5 Harness Test at Regulator

Fig. 1H-6 Centering Adjustment

(3) Disconnect vacuum lines from servo.

(4) Remove retaining nut and servo from bracket. Note position of ground cable.

(5) Disconnect harness under instrument panel. Carefully thread harness through dash panel and remove servo.

Installation

(1) Install servo and nut to bracket. Make sure ground cable is placed on stud.

(2) Thread harness through dash panel and connect.

(3) Install cable to servo and squeeze clip to retain cable.

(4) Install cable to servo.

NOTE: *Mounting studs are not equally spaced from hole in servo. Be sure housing is installed correctly.*

(5) Connect vacuum lines.

SERVO CHAIN REPLACEMENT

(1) Open tabs on servo cable.

(2) Disconnect chain from bellcrank pin (six-cylinder) or throttle lever (eight-cylinder). Remove chain.

(3) Install chain to servo cable, allowing seven beads outside tabs. Squeeze tabs together.

(4) Install chain to bellcrank pin or throttle lever.

SERVO CABLE REPLACEMENT

Removal—Six-Cylinder

(1) Remove clip from pin on bellcrank.

(2) Remove transmission throttle control link from pin and remove chain.

(3) Remove accelerator rod from ball studs.

(4) Squeeze tabs that retain cable housing into bracket and remove cable from bracket.

(5) Remove retaining nuts and cable housing from servo.

(6) Spread clip connecting cable to servo and remove.

(7) Spread tabs on chain end of cable and remove chain.

Installation—Six-Cylinder

(1) Install chain to cable and squeeze tabs. Allow seven beads outside cable tab.

NOTE: *Beads must be free to rotate.*

(2) Install cable to servo and squeeze clip to retain cable.

(3) Install cable housing to servo.

NOTE: *Mounting studs are not equally spaced from hole in servo. Be sure housing is installed correctly.*

(4) Install cable housing to bracket. Be sure tabs are locked in bracket.

(5) Place chain onto bellcrank pin. Place throttle link in pin and install lock clip. Seven beads must be visible between bellcrank clip and cable clip.

(6) Install accelerator rod on ball studs.

Removal—Eight-Cylinder

(1) Remove chain from throttle lever.

(2) Squeeze tabs on servo cable housing and remove from bracket.

(3) Remove retaining nuts and cable housing from servo.

(4) Spread clip connecting cable to servo and remove.

(5) Spread tabs on chain end of cable and remove chain.

Installation—Eight-Cylinder

(1) Install chain to cable and squeeze tabs. Allow seven beads outside cable tab.

NOTE: *Beads must be free to rotate.*

(2) Install cable to servo and squeeze clip to retain cable.

(3) Install cable housing to servo.

NOTE: *Mounting studs are not equally spaced from hole in housing. Be sure housing is installed correctly.*

(4) Install cable housing to bracket. Be sure tabs are locked in bracket.

(5) Connect chain to throttle lever. Seven beads must be visible between throttle lever clip and cable clip.

CONTROL SWITCH REPLACEMENT

The Cruise Command control switch is part of the turn signal lever. The switch is not repairable. The switch and harness are serviced only as a unit.

Removal

(1) Remove the following:

- Horn button insert
- Steering wheel
- Anti-theft cover
- Locking plate and horn contact

(2) Remove turn signal lever (allow handle to hang loose outside steering column).

(3) Remove four-way flasher knob.

(4) Remove holddown screws and turn signal switch.

(5) Remove trim piece from under steering column, if equipped.

(6) Disconnect four-wire connector.

(7) *Tilt Column*—Remove harness from plastic connector. Tape two wires back along harness (to allow smaller diamter) and tape string to harness.

(8) *Standard Column*—Tie or tape string to plastic connector.

(9) Remove lever and harness assembly from column.

Installation

(1) Check replacement Cruise Command control switch by connecting to wire harness before installing in steering column. Refer to Control Switch Continuity Test.

NOTE: *When installing the harness, be sure to feed the harness through the turn signal lever opening as the handle will not fit through the opening.*

(2) Tape two leads back along harness and tape harness to string that was attached to original harness before removal.

(3) Pull replacement harness down through steering column. On tilt column, harness must pass through hole on left side of steering shaft.

(4) Install turn signal switch and four-way flasher knob.

(5) Install Cruise Command lever.

(6) Install horn contact, locking plate, and lockring anti-theft cover.

(7) Install steering wheel and horn button insert.

(8) Install trim on steering column.

NOTES

FUEL SYSTEMS 1J

SECTION INDEX

GENERAL INFORMATION

AIR CLEANER

The replaceable element (paper-type) air cleaner is used as standard equipment (fig. 1J-1, 1J-2 and 1J-3).

The air cleaner is necessary to protect the fuel system as well as the working parts of the engine from the abrasive and clogging effects of dust, dirt and sediment normally present in the combustion air supply.

The lower portion of the air cleaner is designed to reduce the noise emitted by air rushing through the carburetor to the intake system. The air cleaner also acts as a flame arrester in the event of a backfire through the carburetor.

The air cleaner element is scheduled for replacement at 30,000-mile intervals. More frequent replacement is advisable when the car is operated in dusty areas or on unpaved roads.

The air cleaner inlet contains the air valve for the Thermostatically Controlled Air Cleaner (TAC) system. The operation and diagnosis of this system is covered under Thermostatically Controlled Air Cleaner System at the end of this chapter.

FUEL FILTER

All carburetors are protected against the entry of dirt and other foreign matter by a replaceable 15-micron, pleated-paper filter, located in the carburetor fuel inlet line. Replace this filter every 15,000 miles.

All cars have a fuel return system (refer to Fuel Return System) requiring an additional nipple on the fuel filter to route fuel vapor to the fuel tank to prevent vapor lock.

The fuel system is further protected by a woven Saran sleeve-type filter attached to the end of the fuel outlet tube inside the fuel tank. This filter is rated at 65 microns and repels water. Under normal conditions it requires no maintenance or service.

FUEL TANK

The fuel tank on all series is suspended from the rear of the underbody by two steel straps.

Pacer

Removal

(1) Remove filler neck-to-body retaining screws.

(2) Slide filler neck from tank grommet.

(3) Raise vehicle and drain tank.

(4) Remove outlet hose, vapor vent line and fuel return hose.

(5) Remove sending unit wiring.

(6) Remove tank mounting straps and remove tank.

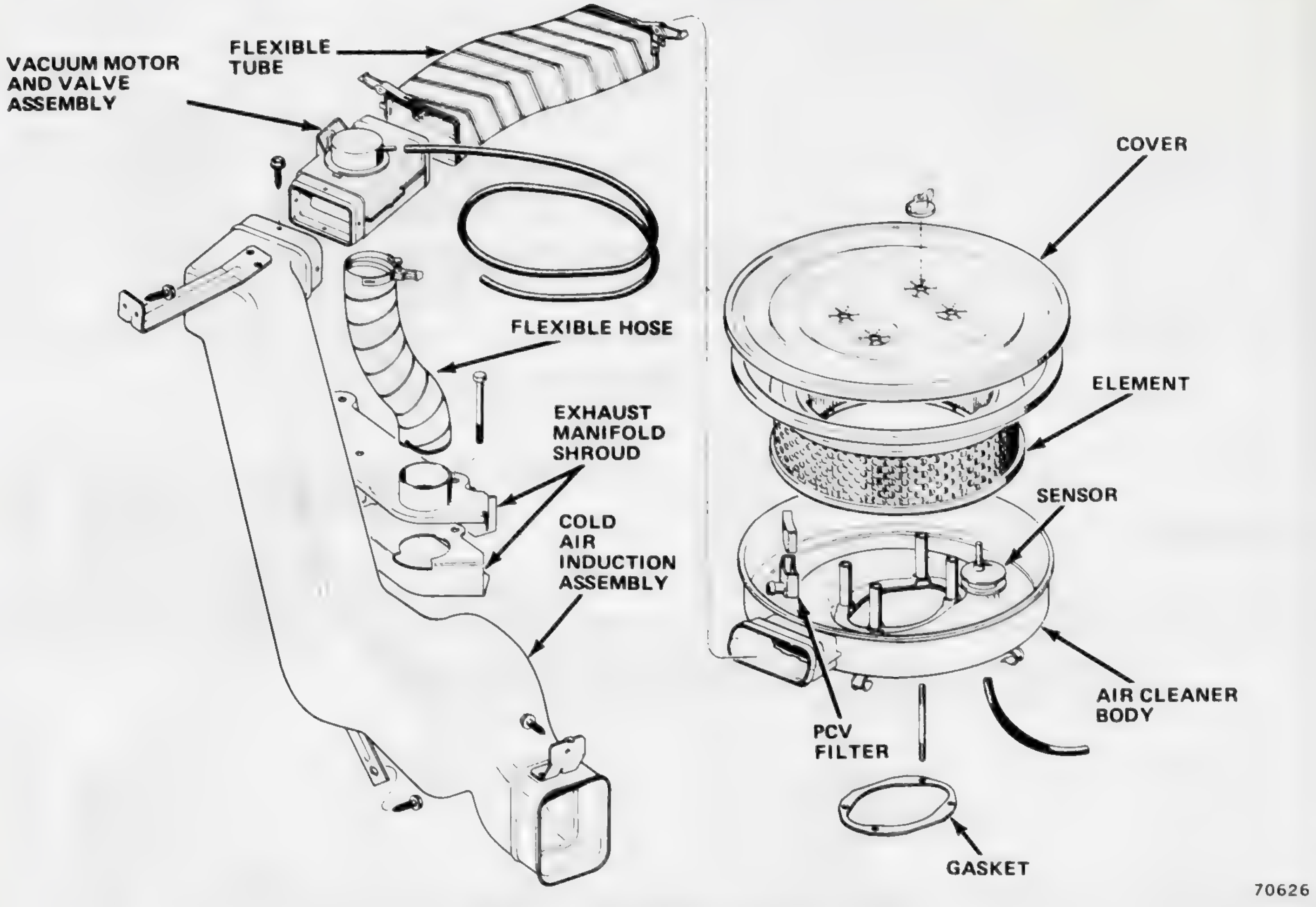

Fig. 1J-1 Four-Cylinder Air Cleaner

Installation

(1) Position tank and install mounting straps.

(2) Install sending unit wiring.

(3) Install fuel outlet hose, vapor vent line and fuel return hose.

(4) Lower vehicle.

(5) Slide filler neck into tank grommet.

NOTE: *Filler neck must be centered in grommet to prevent slow fuel fill-ups.*

(6) Install filler neck-to-body retaining screws.

(7) Install fuel.

Gremlin, Concord and AMX

NOTE: *All Gremlins use the same fuel tank, but fuel capacity is limited in four-cylinder cars by the length of the filler neck inside the tank. Manual transmission cars require thirteen gallons and automatic transmission cars require fifteen gallons for fill-up.*

Removal

(1) Drain tank and raise rear of car.

(2) Remove sending unit wiring.

(3) Remove outlet hose, vapor vent line and fuel return hose.

(4) Remove tank mounting straps and stone shield. Remove tank.

Installation

(1) Apply light coating of grease to filler neck tube. Slide tank onto filler tube.

(2) Position tank. Install stone shield and mounting straps.

(3) Install sending unit wiring.

(4) Install sending unit hose, vapor vent line and fuel return hose.

(5) Lower car.

(6) Install fuel.

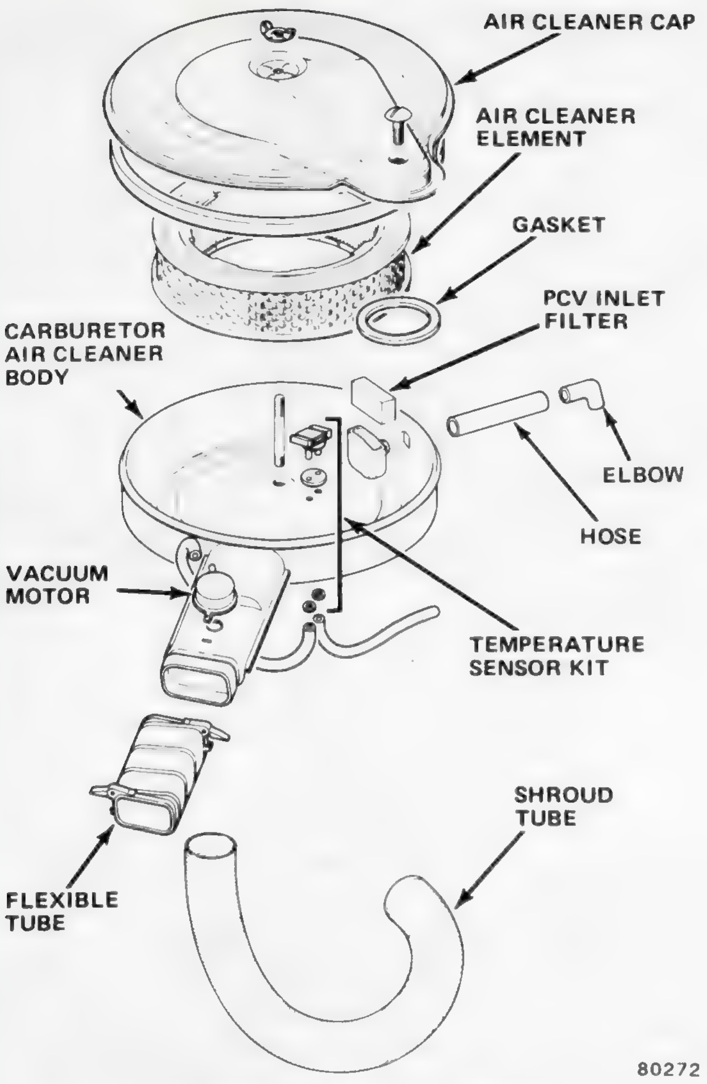

Fig. 1J-2 Six-Cylinder Air Cleaner—2V Application Shown

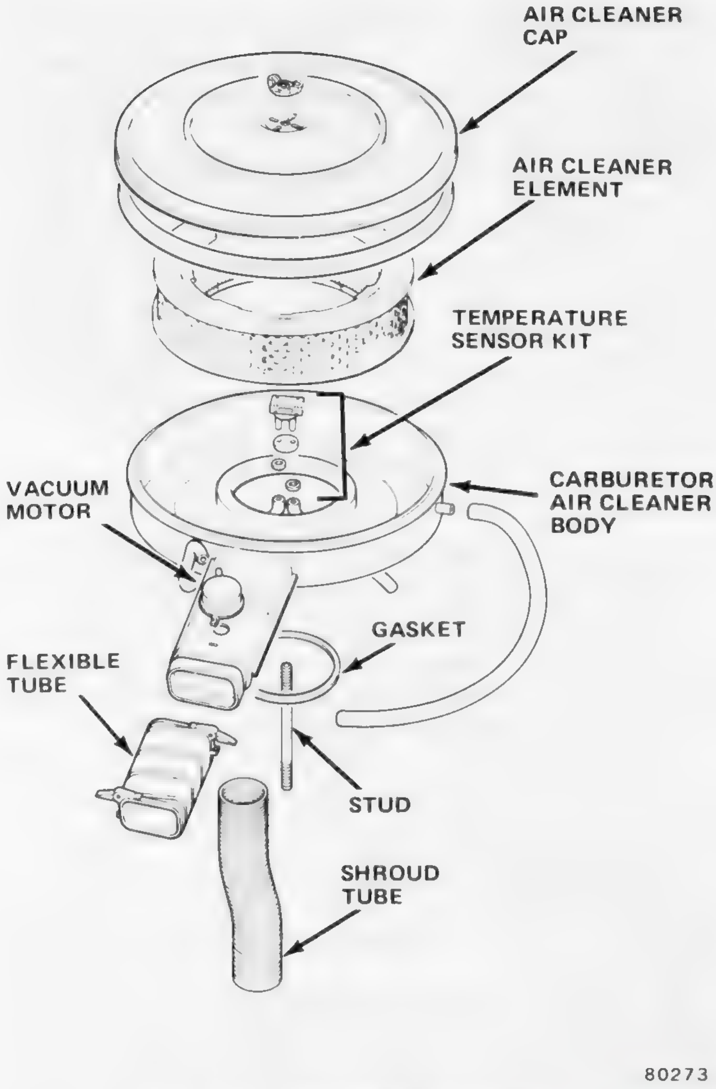

Fig. 1J-3 Eight-Cylinder Air Cleaner

Matador

Removal

(1) Drain tank and raise rear of car.
(2) Remove exhaust shield.
(3) Remove filler neck-to-tank-connector and lower tank vent tube.
(4) Remove outlet hose, vapor vent line(s) and fuel return hose.
(5) Remove sending unit wiring.
(6) Remove tank mounting straps and remove tank.

Installation

(1) Position tank and install sending unit wiring.
(2) Install sending unit hose, vapor vent line(s) and fuel return hose.
(3) Install filler neck-to-tank-connector and lower tank vent tube.
(4) Install tank mounting straps.
(5) Install exhaust shield.
(6) Lower car and install fuel.

Fuel Tank Sending Unit

This assembly utilizes a float pivoted to an electrical contact that rides on a wire resistance element to electrically signal the fuel gauge, indicating the level of fuel in the fuel tank.

Fuel pickup, fuel return system nipples and the sending wire connection are mounted on the sending unit mounting cover, which is secured to the fuel tank with a locking ring.

To replace the fuel tank sending unit on Gremlin, Concords and AMX, drain the fuel tank to 1/2 full or less. It is not necessary to remove the tank. On Pacer and Matador, remove the fuel tank.

Fuel Tank Filler Neck

The filler neck is located at the rear of the right fender on Pacers, at the center of the rear panel on Gremlin, Concord and AMX, and in a recessed area of the left rear fender behind a hinged door on Matador.

All filler necks incorporate a restrictor to prevent entry of nozzles used on leaded-fuel gasoline station pumps. The restrictor reduces the size of the filler neck to a small opening which is covered by a trap door. Only the smaller-size no-lead nozzle will fit through the restrictor. When a no-lead gasoline pump nozzle is inserted through the restrictor opening, it pushes open the restrictor trap door, and the fuel tank can be filled.

The rubber filler hose is positioned in a rubber grommet in the fuel tank and secured to the filler neck on Pacer, Gremlin, Concord and AMX.

The filler neck is connected to the fuel tank inlet by a rubber hose and secured with clamps on the Matador. A drain tube is provided at the filler housing to drain off any fuel splashed while filling the tank. The tube is attached to a fitting at the bottom of the housing and is routed through the floorpan, terminating behind the left rear wheelhousing.

Fuel Tank Filler Neck Cap

The filler cap incorporates a two-way relief valve which is closed under normal operating conditions. The relief valve is calibrated to open only when pressure of 0.5 to 1.0 psi or vacuum of 0.25 to 0.5 psi develop within the tank. When pressure or vacuum is relieved, the valve returns to its normally closed position.

All fuel tank filler caps provide protection from spilled fuel in the event of vehicle rollover. The conventional pressure valve provides adequate protection in rear-filled fuel tanks on Gremlin, Concord and AMX.

Side-filled fuel tanks on Pacer and Matador are equipped with a filler cap having an additional rollover check valve (fig. 1J-4).

The rollover check valve consists of a stainless steel ball in a plastic housing mounted on the fuel tank side of the cap. If the car is tipped sufficiently, the steel ball drops into an orifice, closing the vent and preventing fuel leakage.

A properly operating rollover check valve will maintain 3 psi air pressure applied to the plastic housing when the valve is inverted. It should vent as it is returned to its normal upright position.

NOTE: *It is normal to occasionally encounter an air pressure release when removing the filler cap.*

FUEL VAPOR CONTROL SYSTEM

The fuel vapor control system prevents raw fuel vapors from escaping into the atmosphere. Fuel vapors from the fuel tank and carburetor bowl are collected in a charcoal-filled canister and are metered into the intake manifold for combustion. The various components, shown in figure 1J-5, are described below.

Components

Charcoal Canister

The charcoal canister is filled with granules of activated charcoal. Vapors entering the canister are adsorbed onto the surface of the granules.

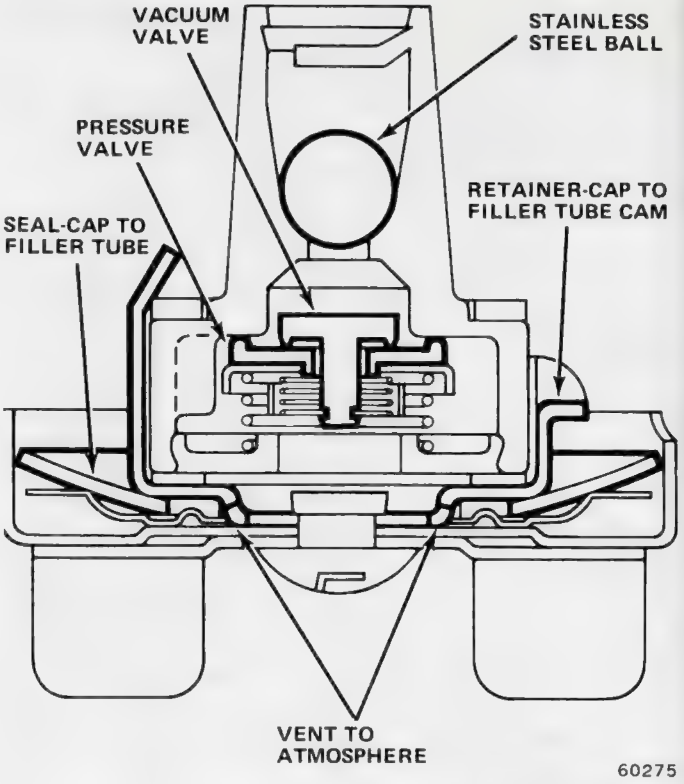

Fig. 1J-4 Filler Cap with Rollover Check Valve—Typical

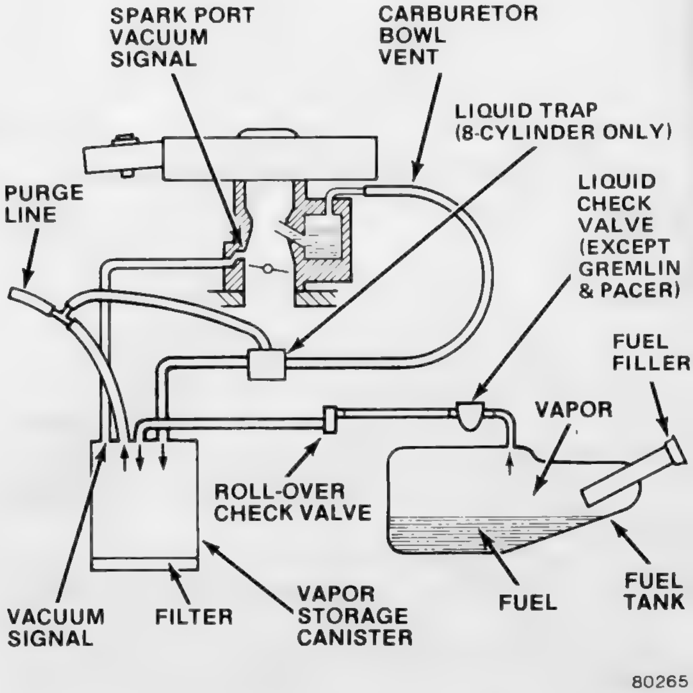

Fig. 1J-5 Fuel Vapor Control System—Typical

The canister has been revised for 1978 by the addition of a staged dual purge feature (fig. 1J-6). Two inlets are provided, one for tank vapor and one for carburetor bowl vapor. The outlet is connected to intake manifold vacuum. The fourth nipple is connected to the carburetor spark port (ported vacuum).

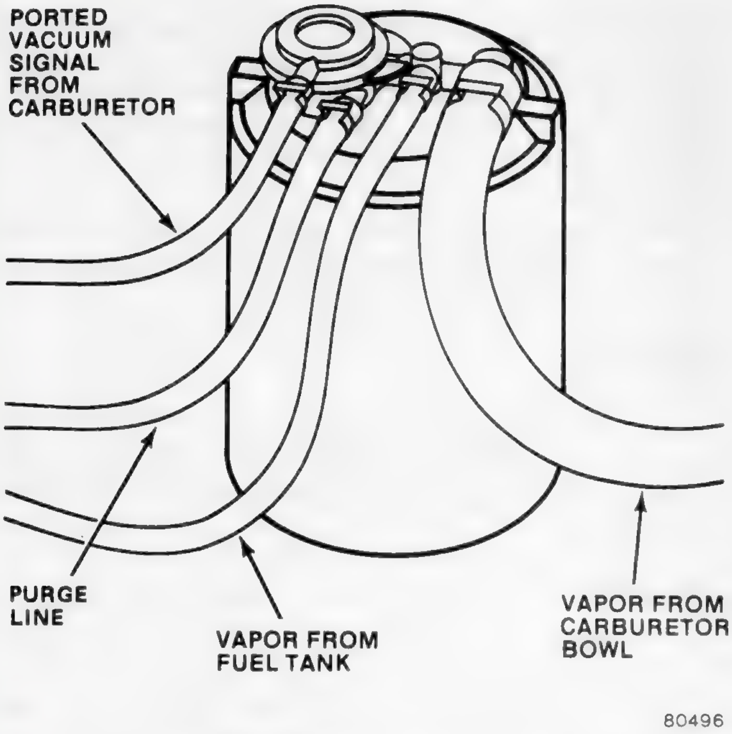

Fig. 1J-6 Charcoal Canister and Hoses

When the engine is running, manifold vacuum draws fresh air through the inlet filter in the canister and purges stored vapors. When ported vacuum reaches 12 inches Hg, the secondary purge circuit is opened, and the canister is purged at a much higher rate.

A replaceable air filter is installed in the bottom of the canister. Replace at intervals specified in the Maintenance Schedule in Chapter B—Maintenance.

Liquid Trap

On eight-cylinder cars only, a liquid trap is located in the carburetor bowl vent-to-canister hose. The liquid trap prevents liquid fuel from reaching the canister. It is purged by its own vacuum purge hose.

Liquid Check Valve

The liquid check valve permits free passage of vapors from the fuel tank, but prevents liquid fuel from reaching the charcoal canister. If liquid enters the check valve, the float rises, forcing the needle into its seat (fig. 1J-7).

Pacer and Gremlin models do not require a liquid check valve. The fuel tanks on these cars includes a large air space at the top which prevents liquid fuel from entering the vapor system.

Concord and AMX models and Matador Wagons use a liquid check valve mounted in the vent line. Matador Coupe and Sedan use a liquid check valve mounted directly in the top of the fuel tank.

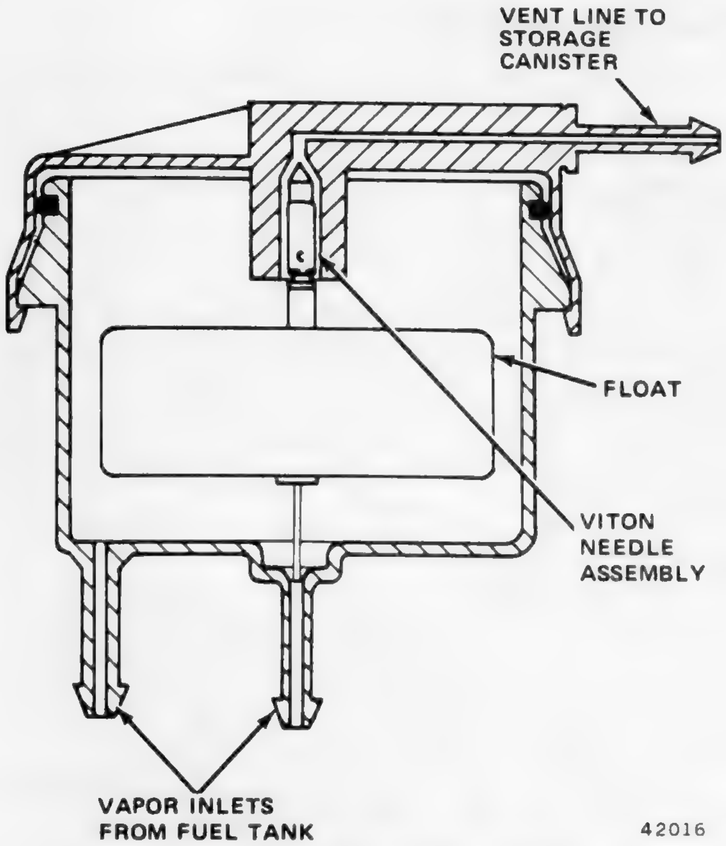

Fig. 1J-7 Liquid Check Valve—Typical

Rollover Check Valve

The rollover check valve prevents fuel flow from the fuel tank through the fuel line in the event of vehicle rollover. The check valve consists of a plunger and a stainless steel ball (fig. 1J-8). When inverted, the stainless steel ball pushes the plunger against its seat. A properly functioning rollover valve will hold 3 psi of air pressure on the inlet side when inverted.

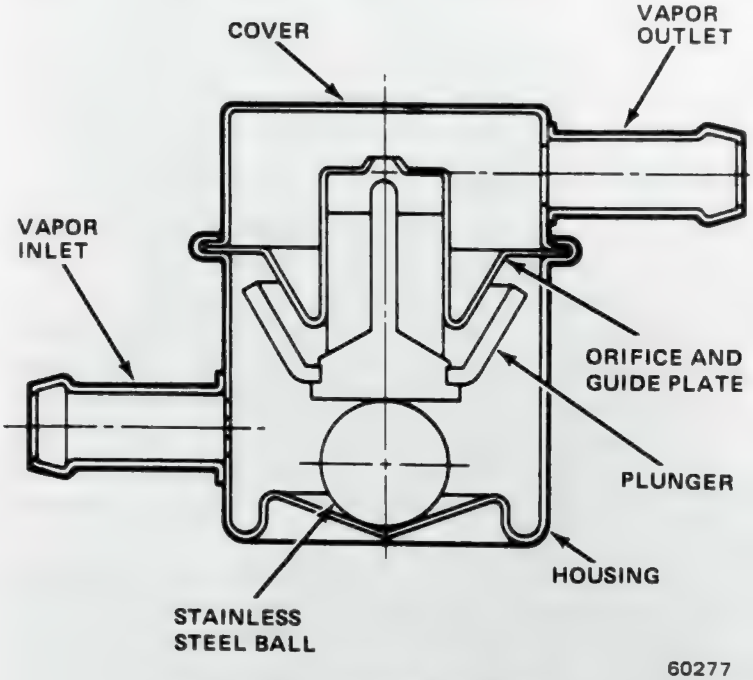

Fig. 1J-8 Rollover Check Valve

Carburetor External Bowl Vent

The carburetor external bowl vent provides an outlet for fuel vapors when the engine is not running (fig. 1J-9). If the vent were not provided, raw fuel vapors would enter the atmosphere. Some would also enter the intake manifold, making hot restarts difficult. When the engine is running, the fuel bowl must be vented to the inside of the air cleaner for proper fuel flow. This is accomplished by automatically closing the bowl vent. Some carburetors use manifold vacuum, and others use a mechanical link to the throttle. Refer to Float Circuit in each carburetor subsection for specific operating principles.

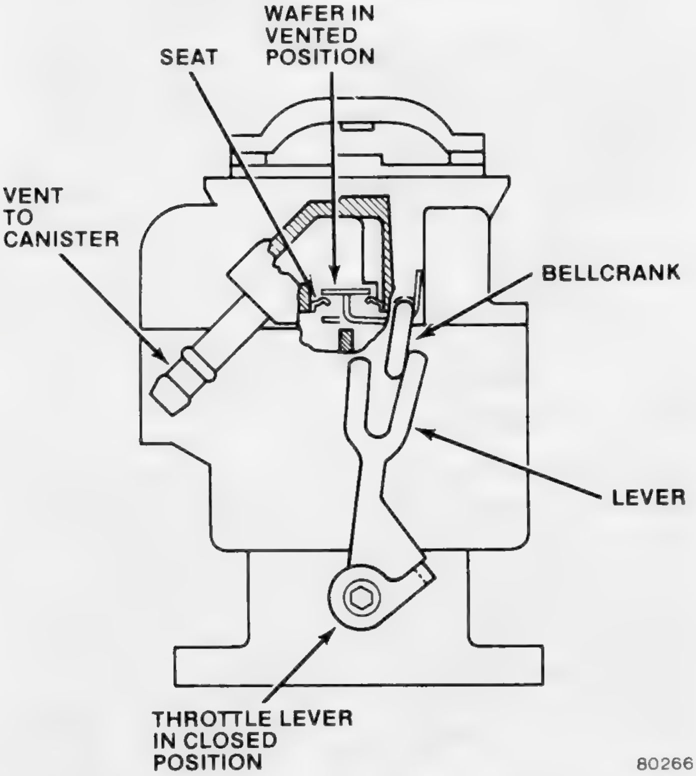

Fig. 1J-9 Bowl Vapor Vent—Typical

FUEL RETURN SYSTEM

All AMC cars have a fuel return system to reduce the possibility of high temperature fuel vapor problems. The system consists of a line connecting an extra nipple on the fuel filter to an extra nipple on the fuel tank sending unit. The fuel filter is installed with the return nipple positioned at the top of the filter. During normal operation, a small amount of fuel returns to the tank. During periods of high underhood temperature, vaporized fuel is returned to the tank rather than entering the carburetor (fig. 1J-10).

Four-cylinder cars and six-cylinder cars equipped with the 2-V carburetor have a check valve in the fuel return system at the fuel filter to eliminate any possibility of fuel feeding back to the carburetor through the fuel return line.

The check valve uses a stainless steel, spring-assisted check ball to close the orifice (fig. 1J-11). It is mounted within the fuel return line and is secured by a clamp. Pressure of 0.1 to 0.6 psi from the fuel filter side opens the check valve and permits normal operation of the fuel return system.

This check valve is marked with an arrow in the direction of flow. If it is reversed, the fuel return system will not operate.

FUEL GAUGE

Refer to Chapter 1L—Power Plant Instrumetation for operation, diagnosis and replacement of the fuel gauge. Service of the sending unit is covered under Fuel Tank in this chapter.

FUEL PUMP

A single-action fuel pump is used for all engine applications.

The fuel pump consists of an actuating lever, a diaphragm and spring, an inlet valve, and an outlet valve (fig. 1J-12). An eccentric on the engine camshaft operates the fuel pump lever which is linked to the pump diaphragm. The lever pulls the diaphrgam to its extended position, drawing fuel through the inlet valve. Spring pressure pushes the diaphragm toward its relaxed position, forcing fuel out through the outlet valve. When the carburetor float needle valve closes, fuel pump output is limited to the amount that bleeds back to the fuel tank through the fuel return line. The fuel accumulated in the fuel pump chamber prevents the diaphragm from relaxing. The actuating lever continues to rock up and down, but is prevented from operating the diaphragm, which is held in its extended position by fuel pressure. Fuel flow from the pump remains halted until excess pressure bleeds through the return line or the carburetor needle opens. This process continues as long as the engine is running.

Fuel pumps cannot be overhauled. Replace a fuel pump that fails the following tests.

NOTE: *Make sure the in-line fuel filter is not clogged before performing tests.*

Pressure Test

(1) Remove air cleaner assembly.

WARNING: *Use care to prevent combustion due to fuel spillage.*

(2) Disconnect fuel inlet line at carburetor.

(3) Disconnect fuel return line at fuel filter and plug nipple on filter.

(4) Connect pressure gauge restrictor and flexible hose (fig. 1J-13) between fuel filter and carburetor.

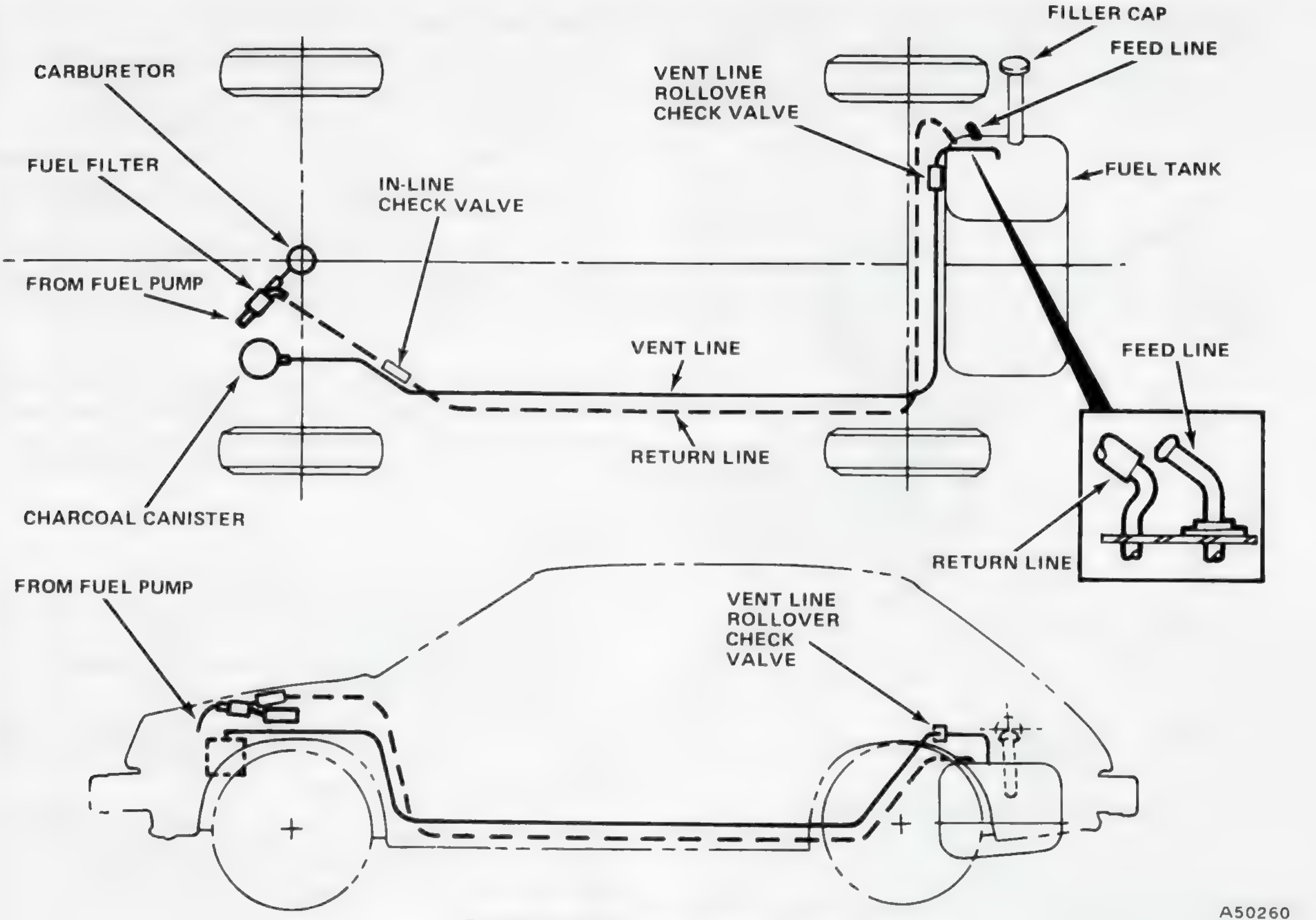

Fig. 1J-10 Fuel Return System—Typical

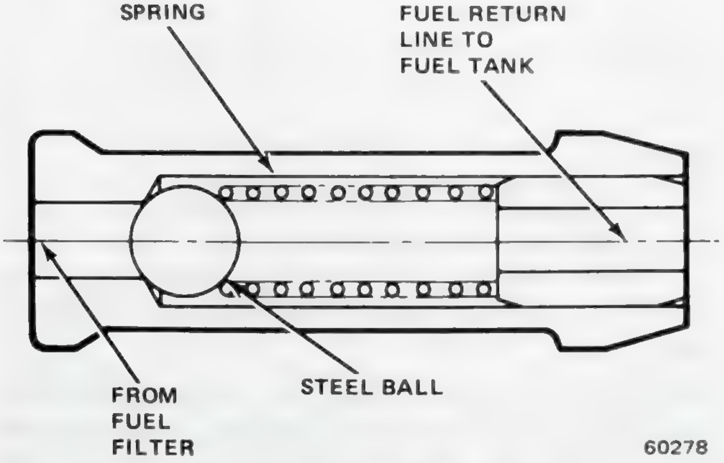

Fig. 1J-11 In-Line Check Valve

(5) Position flexible hose and restrictor so fuel can be discharged into suitable graduated container.

(6) Before taking pressure reading, operate engine at curb idle speed and vent system into container by momentarily opening hose restrictor.

(7) Close hose restrictor, allow pressure to stabilize and note gauge reading. Gauge should indicate 4 to 6 psi for four-cylinder engines, 4 to 5 psi for six-cylinder engines and 5 to 6.5 psi for eight-cylinder engines.

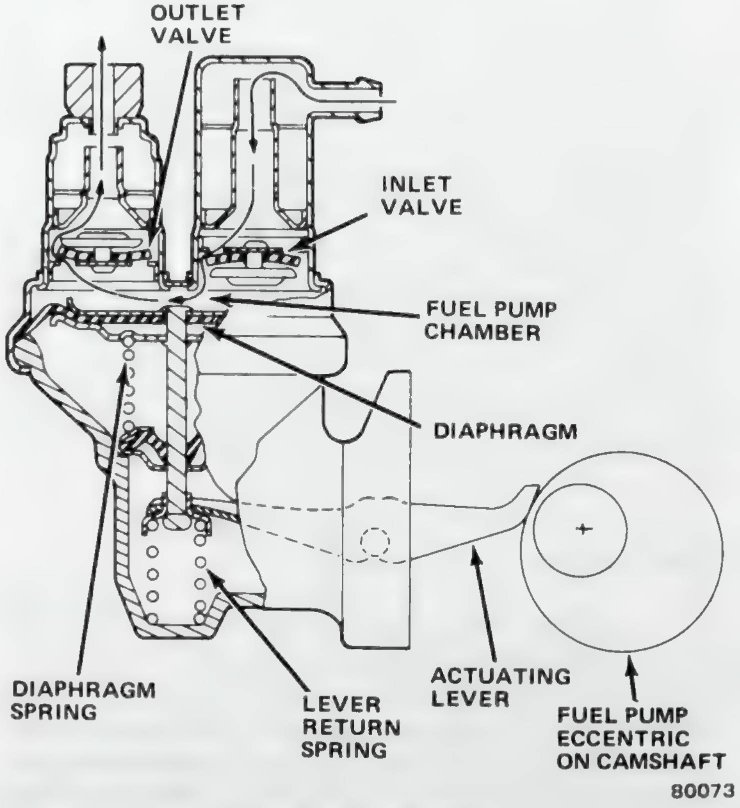

Fig. 1J-12 Fuel Pump

If the pump pressure is not within specification and the fuel lines and filter are in satisfactory condition, the pump is defective and should be replaced. If the pump pressure is within specifications, perform the capacity and vacuum tests.

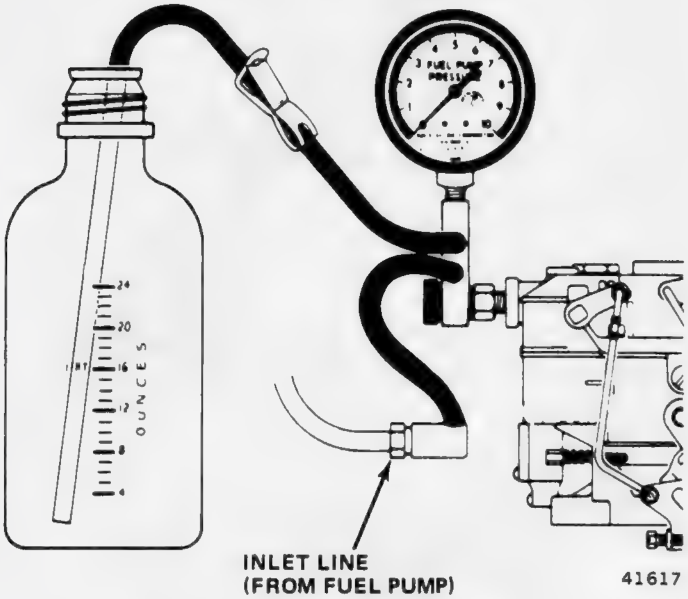

Fig. 1J-13 Fuel Pump Pressure Test

Capacity (Volume) Test

If fuel pump pressure is within specification, test the capacity (volume) as follows:

(1) Operate engine at curb idle speed.

(2) Open hose restrictor and allow fuel to discharge into graduated container for 30 seconds, then close restrictor.

In 30 seconds, a four-cylinder pump should discharge 0.6 (six-tenths) pint of fuel. Six-cylinder and eight-cylinder pumps should discharge at least one pint. If pump volume is less than specified, repeat test using an auxiliary fuel supply and a replacement fuel filter. If the pump volume meets specification while using the auxiliary fuel supply, check for restriction in the fuel supply from the tank and for proper tank venting.

Vacuum Tests

Two vacuum tests may be performed on the fuel pump. In the direct connection test, the vacuum test gauge is connected directly to the fuel pump inlet. This tests the pump's ability to create a vacuum. In the indirect connection test, a vacuum gauge is connected by a T-fitting into the fuel pump inlet line. This test checks for obstruction in the fuel line or the in-tank fuel filter.

Direct Connection Test

(1) Disconnect fuel inlet line at fuel pump. Plug line to prevent fuel spillage.

(2) Connect vacuum gauge to fuel pump inlet.

(3) Operate engine at curb idle rpm and note vacuum gauge reading. Gauge should indicate at least seven inches of mercury (7 inches Hg) for four-cylinder engines and 10 inches Hg for six- and eight-cylinder engines. If the pump vacuum reading is below specification, the pump is defective and should be replaced.

NOTE: *Vacuum gauge will not register a reading until fuel in carburetor float bowl has been used and pump begins to operate at full capacity.*

Indirect Connection Test

(1) Disconnect fuel inlet line at fuel pump.

(2) Install T-fitting between disconnected line and fuel pump. Attach vacuum gauge to T-fitting.

(3) Operate engine at 1500 rpm for 30 seconds. Vacuum should not exceed 3 inches of mercury.

(4) If vacuum exceeds 3 inches of mercury, check fuel line for blockage. A partially clogged in-tank fuel filter may also be the cause.

NOTE: *Vacuum gauge will not register a reading until fuel in carburetor float bowl has been used and pump begins to operate at full capacity.*

Replacement

Four-Cylinder

(1) Disconnect fuel lines from pump.

(2) Remove retaining screws.

(3) Remove pump, spacer and gaskets.

(4) Install spacer, pump and replacement gaskets to head.

NOTE: *Be sure the pushrod is properly positioned against the actuating lever in the pump. If the pushrod is positioned improperly, the pump may be damaged when screws are tightened.*

(5) Install retaining screws.

(6) Connect fuel lines to pump.

Six- and Eight-Cylinder

(1) Disconnect fuel lines from pump.

(2) Remove retaining screws.

(3) Remove pump and gasket.

(4) Install pump and replacement gasket.

NOTE: *Be sure pump actuating lever is positioned on top of camshaft eccentric (fig. 1J-12).*

(5) Install retaining screws.
(6) Connect fuel lines to pump.

FUEL ECONOMY TESTS

When checking fuel economy, insert the testing device between the fuel filter and the carburetor because of the fuel return system. Do not block off the fuel return line as this may affect miles-per-gallon reading.

SPECIFICATIONS

Fuel Pump Specifications

	Volume (30 seconds)	Pressure (PSI)	Vacuum (Hg)	
			Direct	Indirect
Four Cylinder	0.6 pint	4 to 6	7	3
Six Cylinder	1 pint	4 to 5	10	3
Eight Cylinder	1 pint	5 to 6.5	10	3

80262A

CARBURETOR MODEL 5210-2 VENTURI

GENERAL

The Holley-Weber Model 5210 carburetor is a staged 2-barrel design (fig. 1J-14). The primary venturi is smaller than the secondary venturi. The secondary venturi is opened progressively by mechanical linkage.

The carburetor consists of two assemblies: the air horn and the main body (fig. 1J-14). The air horn serves as the fuel bowl cover and contains fuel inlet, float assembly, needle and seat assembly, bowl vent mechanism, power enrichment diaphragm and choke valve assembly. The main body contains primary and secondary venturis, throttle valve assemblies, power enrichment valve, accelerator pump, automatic choke mechanism and solenoid.

Identification

The carburetor is identified by a code number and build date stamped on an identification tag (fig. 1J-15). The build date is indicated by the day of the year followed by the last digit of the year. The tag is attached to the carburetor and must remain with the carburetor to assure proper identification.

CARBURETOR CIRCUITS

Six conventional circuits are used: Float, (Fuel Inlet), Idle (Low Speed), Main Metering (High Speed), Power Enrichment, Pump and Choke.

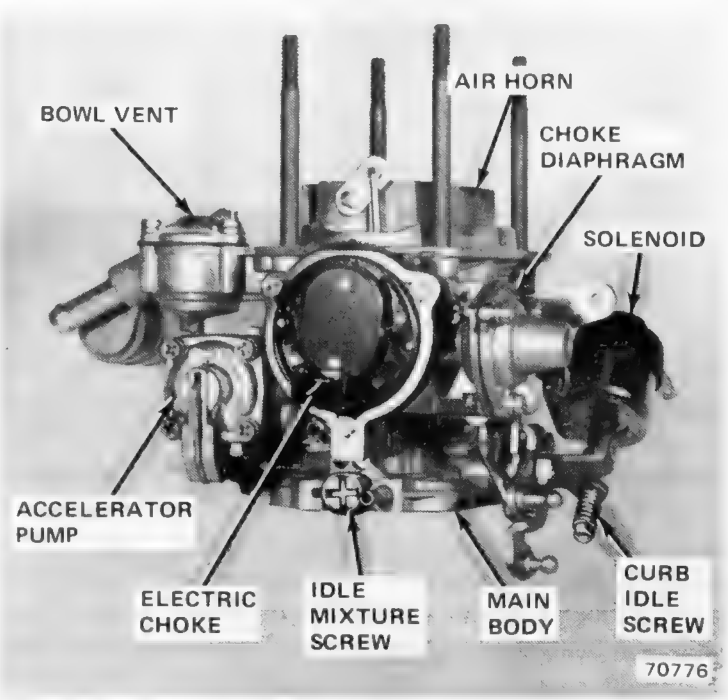

Fig. 1J-14 Model 5210 Carburetor

Float Circuit

The float circuit maintains the specified fuel level in the bowl to provide adequate fuel to supply the metering circuits for all engine operating conditions.

A spring-loaded needle is used to prevent float vibration from affecting fuel level (fig. 1J-16). The synthetic tip of the needle ensures positive fuel shutoff. Special

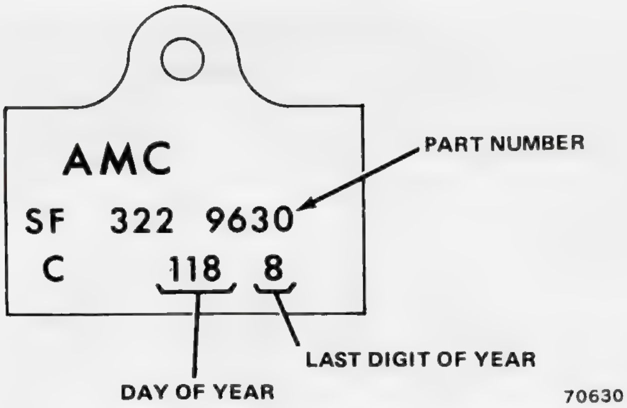

Fig. 1J-15 Identification Tag

precautions must be taken to avoid damage to the tip when adjusting float level. Refer to Service Adjustment Procedures.

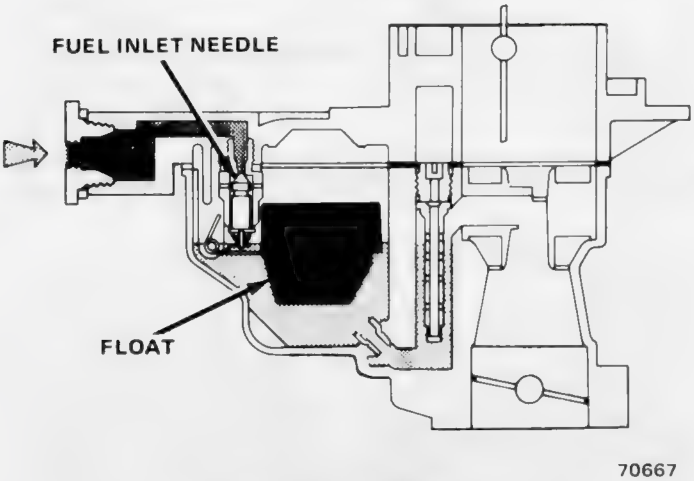

Fig. 1J-16 Float Circuit

Fuel under pressure enters the bowl through the needle and seat assembly. The rate of flow is determined by the distance the needle is moved from the seat. Needle position is determined by the double-pontoon float. When fuel is at the specified level, the float closes the needle and seat, preventing additional fuel from entering. As fuel is used by the engine, the level drops, and the float permits the needle and seat to open. This cycle is repeated as required by fuel requirements of the engine.

The fuel bowl is vented both internally and externally. The internal vents are located in the air horn directly above the fuel bowl. These vents balance air pressure above the fuel with carburetor inlet air pressure. The external vent is accomplished by a vacuum-operated diaphragm (fig. 1J-17). Under normal operating conditions, vacuum holds this vent closed. Upon shut-down, the vent is opened by spring pressure. During heat "soak," fuel vapors are permitted to flow to the charcoal canister instead of to the intake manifold. This maintains good hot start characteristics.

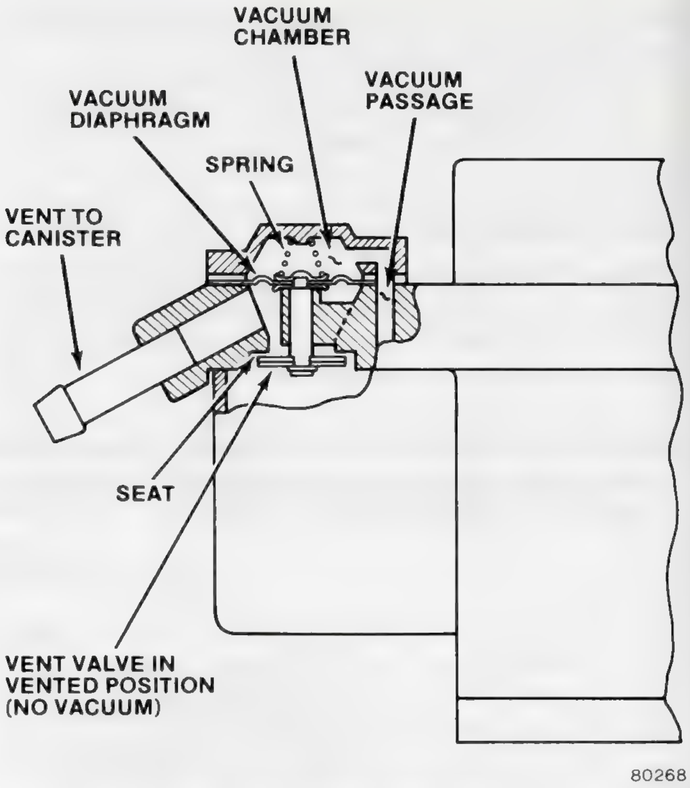

Fig. 1J-17 External Bowl Vent

Idle Circuit

Fuel for idle and off-idle operation flows from the bowl through the primary venturi main metering jet into the main well (fig. 1J-18). Fuel then flows up through the idle well and through the idle restriction. Fuel is mixed with air from the primary idle air bleed. The fuel-air mixture travels downward and past the idle transfer slot. When the throttle is at curb idle, the transfer slot serves as an additional air bleed into the idle fuel mixture. Finally, fuel-air flows past the idle mixture screw and is discharged below the throttle plate.

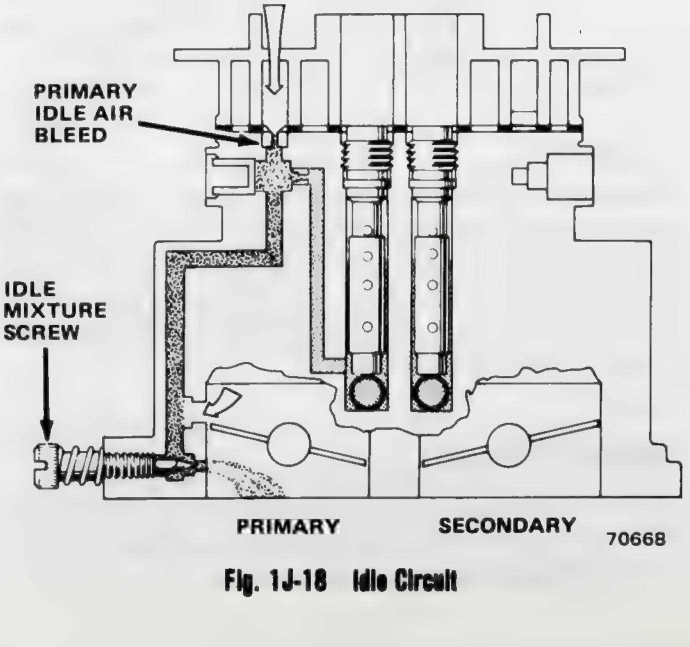

Fig. 1J-18 Idle Circuit

At speed slightly above idle, the throttle plate begins exposing the transfer slot to manifold vacuum and fuel-air mixture is drawn into the airstream. As the throttle opening is increased, airflow through the carburetor is also increased. This creates a lowered pressure in the venturi, and the main metering system begins to function. At that time, discharge from the idle system is decreased.

Main Metering Circuit

At engine speeds above idle transfer phase, air velocity through the booster and venturi create a low pressure in the venturi (fig. 1J-19). Fuel begins to flow in the main metering circuit because of atmospheric pressure in the fuel bowl and low pressure in the venturi. Fuel flows from the fuel bowl through the primary venturi main metering jet into the main well. Fuel moves up the main well and is mixed with air supplied by the high speed air bleed. Air passes through the holes in the sides of the main well tube. Whenever venturi vacuum increases, the air bleed meters an increased amount of air, maintaining the proper fuel-air ratio. The fuel-air mixture passes from the main well into the booster venturi. Here the incoming air and the fuel-air mixture are combined for consumption by the engine.

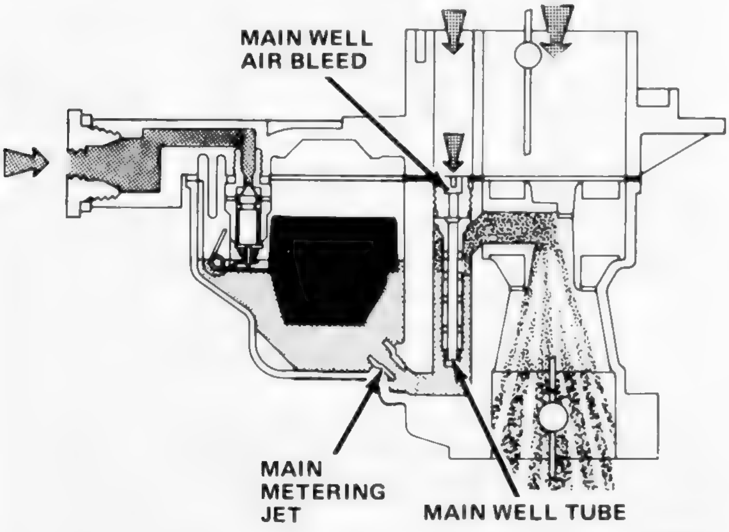

Fig. 1J-19 Main Metering Circuit

The main metering function of the secondary venturi is similar to the function of the primary venturi described above.

Power Enrichment Circuits

Primary Venturi Enrichment

For higher engine output required by heavy load conditions and high speed operation, the ratio of fuel to air must be increased. The vacuum-operated power enrichment circuit supplies fuel under these conditions (fig. 1J-20).

Manifold vacuum is obtained through a passage in the main body and air horn. During idle and light load conditions, manifold vacuum is strong enough to counteract the power diaphragm spring, holding the power valve closed. Higher engine output requires the throttle valve to be opened further, causing a drop in manifold vacuum. With lower vacuum, the diaphragm spring extends the stem and opens the power valve. Fuel flows from the bowl through the power valve into a passage leading to the main well. In the main well, this additional fuel is mixed with the fuel flowing through the main metering jet and enriches the mixture.

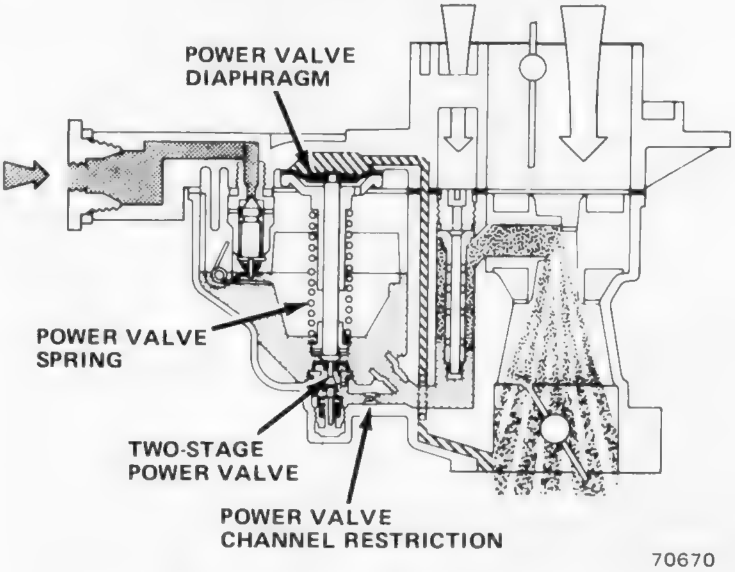

Fig. 1J-20 Primary Venturi Power Enrichment Circuit

The power valve operates in two stages. The first stage begins when engine vacuum drops to the 9- to 7-inch range. The second stage operates in the 4- to 1-inch range.

Secondary Venturi Enrichment

The secondary venturi is provided with an air velocity operated power enrichment system (fig. 1J-21).

As the secondary throttle valve approaches the wide open position, air velocity through the secondary venturi creates a low pressure area at the discharge opening in the air horn. Fuel flows up a vertical channel from the fuel bowl. Air enters through a calibrated bleed and mixes with the fuel. This mixture is discharged into the secondary venturi through a discharge opening.

Pump Circuit

When the throttle valve is opened quickly, airflow through the carburetor responds almost immediately. Fuel is heavier than air, so there is a lag before the fuel flows at a rate sufficient to maintain the proper fuel-air ratio. During this lag, the pump circuit supplies the required fuel (fig. 1J-22).

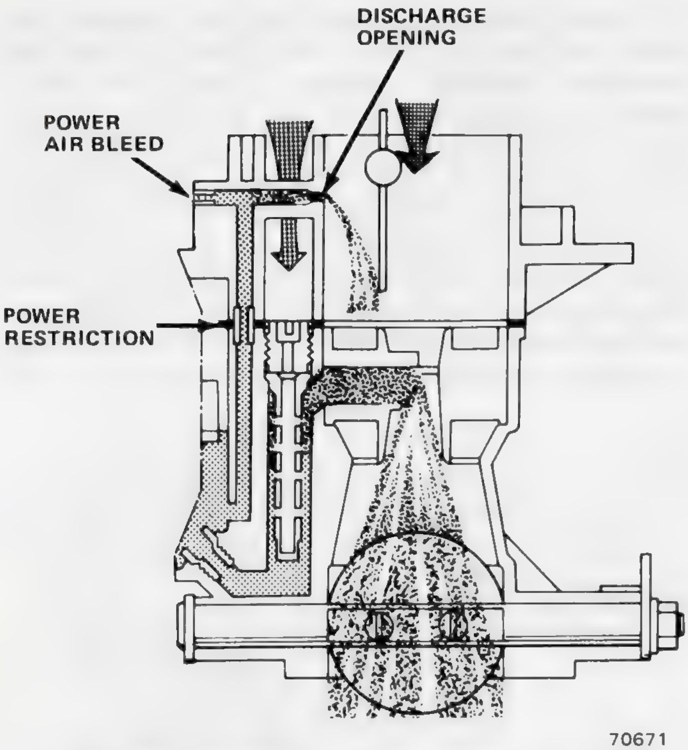

Fig. 1J-21 Secondary Venturi Power Enrichment Circuit

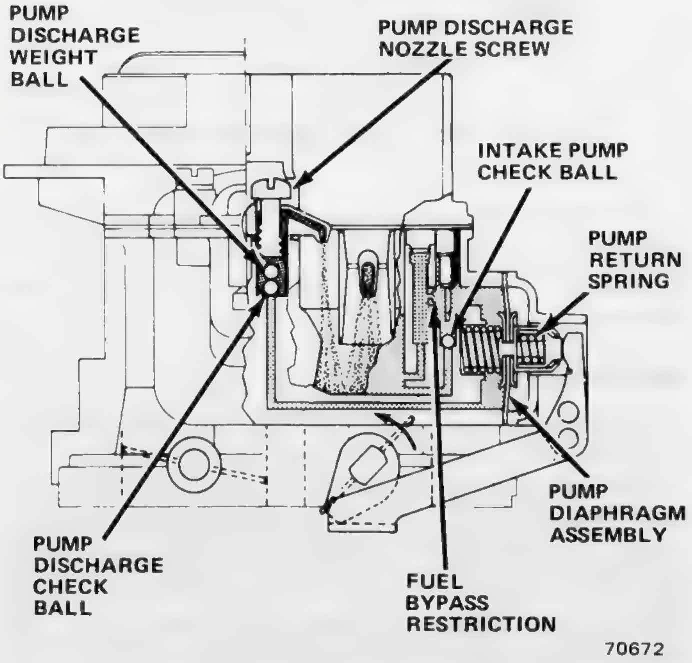

Fig. 1J-22 Pump Circuit

The moment the throttle valve is opened, the pump rod moves inward, forcing fuel into the discharge passages. The moving fuel unseats the discharge check ball and is forced into the primary venturi through the pump discharge nozzle. Excess pump discharge flows back into the fuel bowl through a restriction.

Although the pump discharge has a nozzle in each venturi, only the primary side is drilled. Under some steady speed conditions, venturi vacuum will pull droplets of fuel from the pump discharge nozzle. This is normal.

Choke Circuit

The choke circuit provides a rich mixture for cold-start conditions.

The automatic choke assembly is mounted to the main body. It has a bimetal coil that winds up when cold and unwinds when heated (fig. 1J-23). A manifold vacuum operated diaphragm controls the initial choke valve opening after engine startup.

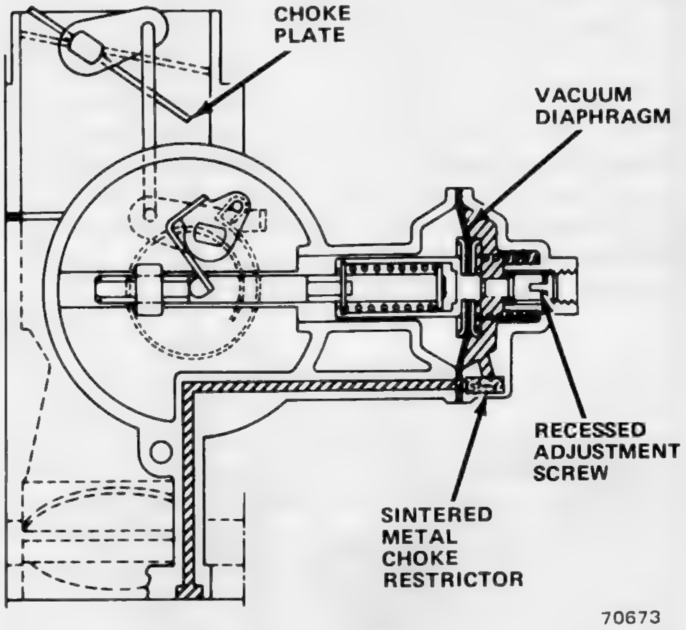

Fig. 1J-23 Choke Circuit

The choke bimetal coil is heated solely by an electric heating coil. No exhaust-heated air is used to heat the choke coil.

An unloader tang on the fast idle cam is provided to permit unloading of a flooded engine. The unloader partially opens the choke valves when the throttle is held wide open.

CARBURETOR REPLACEMENT

Removal

(1) Remove air cleaner cover.

(2) Code all lines attached to carburetor for aid during installation.

(3) Disconnect PCV hose from cylinder head cover. Disconnect TAC flexible hose and vacuum line from air cleaner. Set air cleaner body aside.

(4) Disconnect canister hoses at carburetor.
(5) Disconnect throttle stop solenoid wire.
(6) Disconnect choke wire.
(7) Disconnect throttle cable.
(8) Disconnect EGR hose from carburetor.
(9) Disconnect PCV hose from carburetor.
(10) Disconnect fuel line from carburetor.
(11) Remove carburetor and gasket.

Installation

(1) Install carburetor using replacement gasket.
(2) Connect fuel line.
(3) Connect PCV hose.
(4) Connect throttle cable.
(5) Connect solenoid wire.
(6) Connect choke wire.
(7) Connect canister hoses to carburetor.
(8) Install air cleaner body and connect PCV hose to cylinder head cover.
(9) Connect TAC hose and vacuum line.
(10) Install air cleaner cover.

CARBURETOR OVERHAUL

The following procedure applies to complete overhaul, with the carburetor removed from the engine. A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine. Refer to Service Adjustment Procedures.

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection and replacement of gaskets and worn or damaged parts. It also includes idle adjustment, mixture adjustment and fast idle adjustment after the carburetor is installed. Refer to figure 1J-24 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in kit.*

NOTE: *Flooding, stumble on acceleration, and other performance problems are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the bowl contents for contamination as the carburetor is disassembled.*

Disassembly

(1) Pry choke rod from plastic retainer on choke lever and choke housing lever.

(2) Remove air horn retaining screws, lockwashers and identification tag.

(3) Lift air horn from main body. Be careful to avoid damaging float assembly attached to air horn.

(4) Remove choke rod and dust seal from air horn.

(5) Turn air horn upside down. Remove float pin. Lift float and needle from air horn. Remove needle from float.

(6) Remove retainer, washer and seal from fuel bowl vacuum vent (fig. 1J-25).

(7) Remove power enrichment diaphragm and retaining screws from air horn.

(8) Remove inlet seat and gasket.

(9) Turn air horn right side up. Remove fuel bowl vacuum vent diaphragm housing retaining screws, spring and diaphragm.

(10) Remove solenoid from main body.

(11) Remove retaining ring and screws from choke coil. Remove electric coil and ground ring. Remove sleeve from choke lever, then remove plastic coil housing.

(12) Remove retaining screws and cover from choke diaphragm. Remove spring and diaphragm. Rotate cam on choke shaft to permit diaphragm shaft to slide out of housing (fig. 1J-26).

CAUTION: *Do not attempt to remove metal choke housing. Screws are installed with locking material. Screws or body may be damaged if removal is attempted.*

(13) Remove pump discharge nozzle, retaining screw and gaskets (fig. 1J-27).

(14) Tip main body upside down and catch weight ball and check ball in hand.

(15) Note numbers stamped on main well air bleed jets. Write numbers on sheet of paper for reference during assembly.

(16) Remove primary air bleed. Turn body upside down and catch primary main well tube in hand. Write down number stamped on bottom end of tube.

(17) Repeat for secondary air bleed and main well tube.

(18) Remove primary main metering jet and write-down number. Repeat for secondary main metering jet.

(19) Remove power valve.

(20) Remove accelerator pump cover and retaining screws.

(21) Remove pump diaphragm and spring.

(22) Remove idle limiter cap. Count number of turns to lightly seat needle for reference during assembly. Remove idle mixture screw and spring.

Cleaning and Inspection

Dirt, gum, water or carbon contamination inside the carburetor and on the exterior moving parts are often responsible for unsatisfactory performance. Efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection procedures here do not cover those parts included in the carburetor overhaul

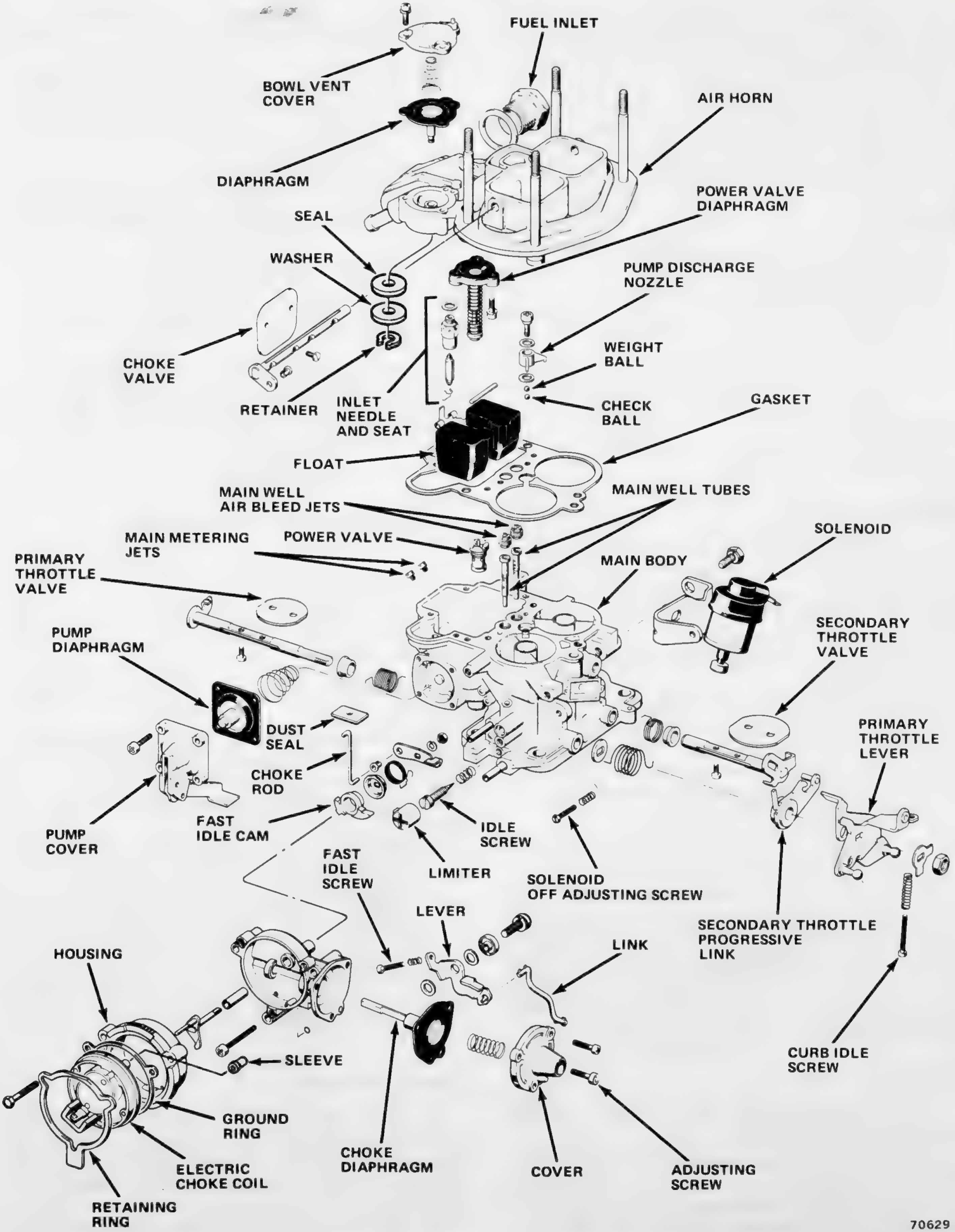

Fig. 1J-24 Parts Identification—Holley-Weber Model 5210

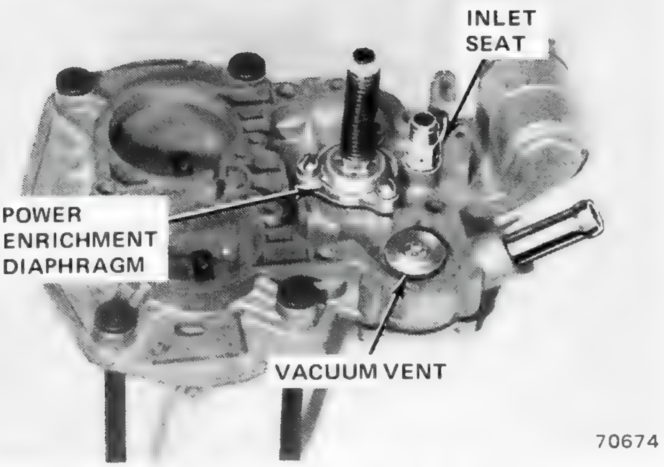

Fig. 1J-25 Bottom View of Air Horn

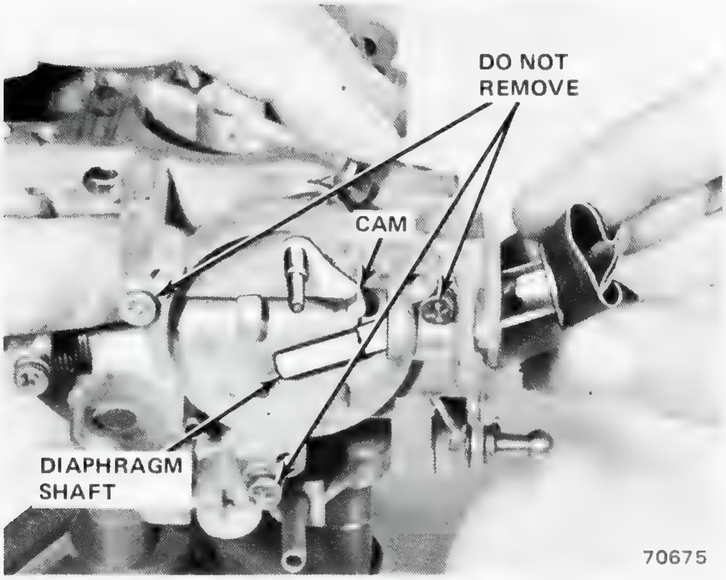

Fig. 1J-26 Choke Housing

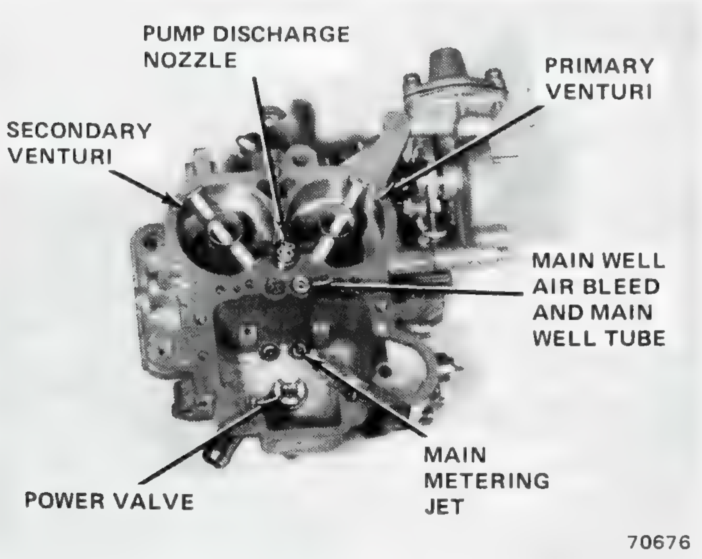

Fig. 1J-27 Main Body with Air Horn Removed

repair kit. Install all gaskets and parts included in the repair kit when the carburetor is assembled. Discard the original gaskets and parts.

Wash all the carburetor parts except the accelerator pump diaphragm, bowl vent diaphragm, power valve diaphragm, choke diaphragm and solenoid in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, use mineral spirits, lacquer thinner or denatured alcohol.

CAUTION: *When cleaning the main body, suspend in cleaner so the choke housing is not submerged. The choke diaphragm vacuum passage between choke housing and main body is sealed with an O-ring. Cleaning solvent may damage this O-ring.*

If commercial cleaner is used, rinse the parts in hot water to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts. Do not use a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for excessive looseness or binding. Inspect the choke plates for nicked edges and for ease of operation. Check the operation of the choke diaphragm to be sure shaft operates smoothly in the guides. Check the throttle shafts for excessive looseness or binding in the bores and check the throttle plates for burrs which prevent proper closing. Inspect the main body, air horn, choke housing and thermostatic coil housing for cracks.

Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace the float pin if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Rotate shafts to be sure the throttle plates do not bind in the bores. The throttle plates must close tightly in the bores.

Assembly

NOTE: *Be sure all holes in the replacement gaskets have been properly punched and that no foreign material has adhered to the gaskets. Inspect vacuum diaphragms for tears or cuts.*

(1) Install accelerator pump spring, diaphragm and cover to main body. Install retaining screws. Be sure pump operating lever is positioned correctly under throttle lever cam before tightening screws.

(2) Install power valve.

(3) Identify primary and secondary main metering jets using information recorded during disassembly. Install main metering jets.

(4) Identify and install primary and secondary main well tubes.

(5) Identify and install primary and secondary main well air bleed jets.

(6) Install check ball and weight ball into accelerator pump discharge tube. Both balls are identical.

(7) Install pump discharge nozzle, using replacement gasket below nozzle and replacement gasket above nozzle. Install retaining screw.

(8) Install choke diaphragm and shaft assembly. It may be necessary to rotate cam on choke shaft to permit diaphragm shaft to slide into position. Flat side of diaphragm shaft faces outward.

(9) Install choke vacuum diaphragm housing and spring. Be sure vacuum port in housing, hole in diaphragm and port in main body are aligned. Install retaining screws and lockwashers.

(10) Install solenoid and retaining screws.

(11) Install bowl vent diaphragm, spring and cover. Be sure vacuum port in air horn, hole in diaphragm and port in housing are aligned. Install retaining screws and lockwashers.

(12) Turn air horn upside down. Install inlet seat and replacement gasket.

(13) Install power enrichment diaphragm and retaining screws.

(14) Install bowl vent valve diaphragm, washer and retainer.

(15) Assemble needle to float assembly. Install float assembly and float pin.

(16) Adjust float height. Refer to Service Adjustment Procedures.

(17) Install choke rod and dust seal into air horn. Snap rod into retainer on choke valve lever.

(18) Position replacement gasket on top of main body. Carefully lower air horn onto main body. Do not bump float. While lowering air horn, position lower end of choke rod into retainer on choke coil lever and snap into place. Assemble identification tag to one air horn screw. Install into hole adjacent to fuel inlet. Install and tighten remaining air horn retaining screws and lockwashers.

(19) Install idle mixture screw and spring. Turn to seat lightly. Then turn out number of turns noted at disassembly. Do not install limiter cap at this time.

(20) Adjust initial choke valve clearance. Refer to Service Adjustment Procedures.

(21) Install choke coil housing. Pin on diaphragm housing must fit into hole in coil housing (fig. 1J-28). Install sleeve on choke lever. Install ground ring into depression on coil housing. Tab protrudes through slot in bottom of coil housing.

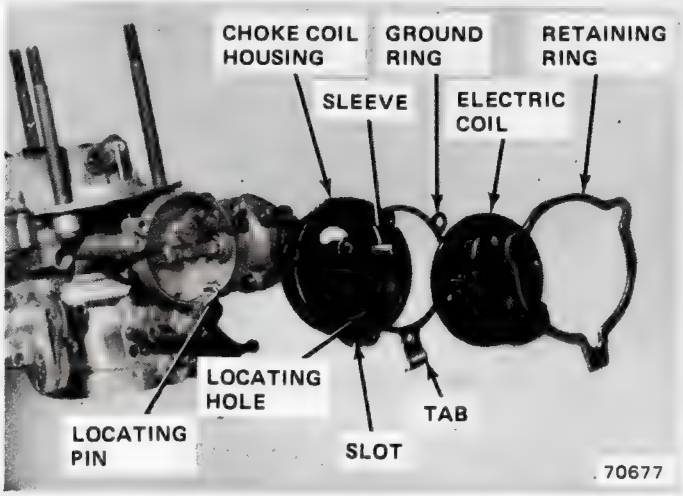

Fig. 1J-28 Assembling Choke Housing

(22) Install electric coil. Be sure loop on end of coil engages sleeve on choke lever. Install retaining ring. Tab on retaining ring must contact tab on ground ring. Loosely install retaining screws. Turn electric coil 1/4-turn rich (clockwise) and tighten one retaining screw.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment

(1) Remove air horn from carburetor main body.

(2) Invert air horn and check clearance between float and air horn surface (fig. 1J-29). Hold air horn at eye level when gauging float level. Float arm should be resting on needle.

CAUTION: *Do not apply pressure to needle while gauging or adjusting the float. The needle tip may be damaged.*

(3) Adjust float by bending float lever as required. Refer to Specifications.

(4) Install carburetor air horn to main body.

Fast Idle Cam Index Adjustment

(1) Set fast idle cam so that screw is held firmly on low step of cam against shoulder of high step (fig. 1J-30).

(2) Insert specified gauge on downstream side of choke plate.

(3) Bend choke lever tang as required to obtain clearance.

Choke Unloader Adjustment

(1) Position throttle lever to wide open.

(2) Insert specified gauge on downstream side of choke plate. Refer to Specifications.

(3) If adjustment is required, bend tang on fast idle lever (fig. 1J-31).

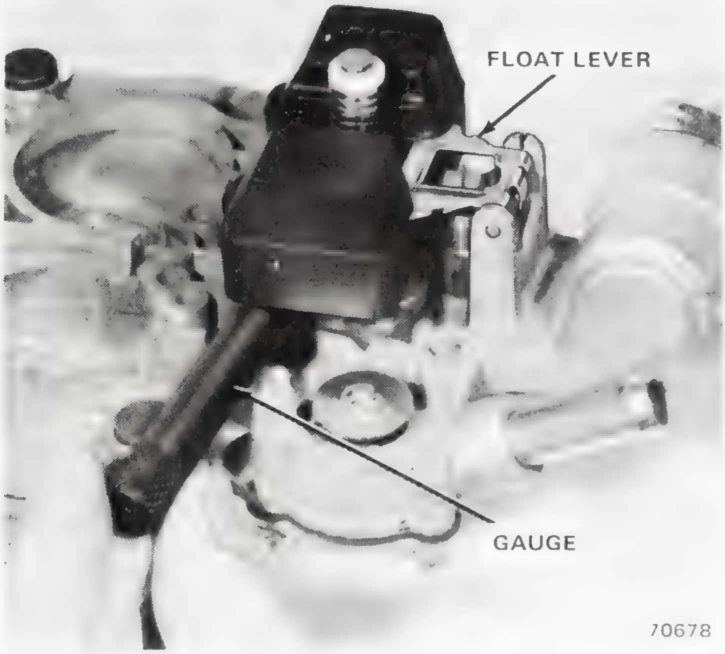

Fig. 1J-29 Float Level Adjustment

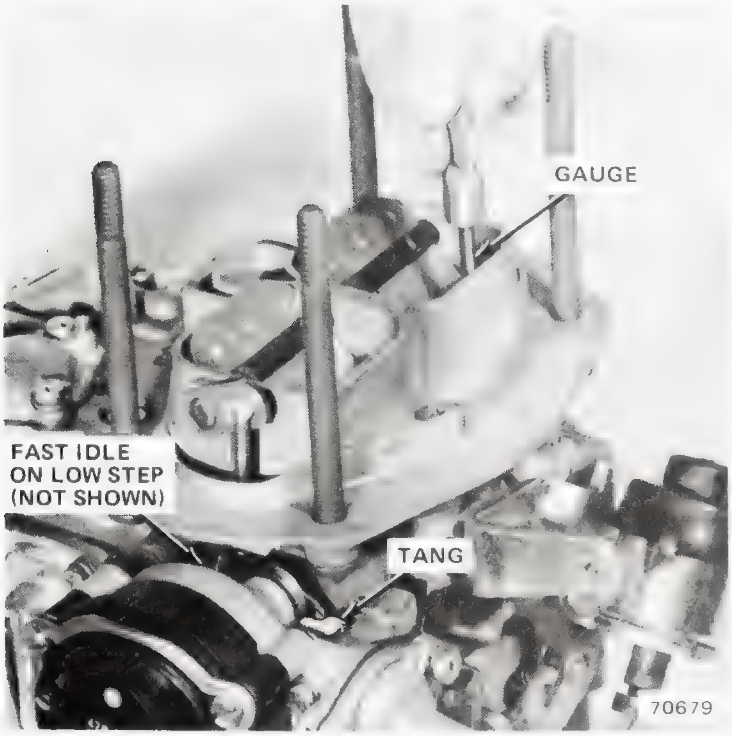

Fig. 1J-30 Fast Idle Cam Index Adjustment

Initial Choke Valve Clearance

Because of carburetor design, the initial choke valve clearance cannot be gauged with engine vacuum applied to the diaphragm. The actuating shaft must be moved manually.

(1) Remove retaining screws and ring from electric choke coil. Remove coil.

(2) Use screwdriver or suitable tool to push diaphragm shaft against stop (fig. 1J-32).

(3) Insert specified gauge on downstream side of primary choke plate.

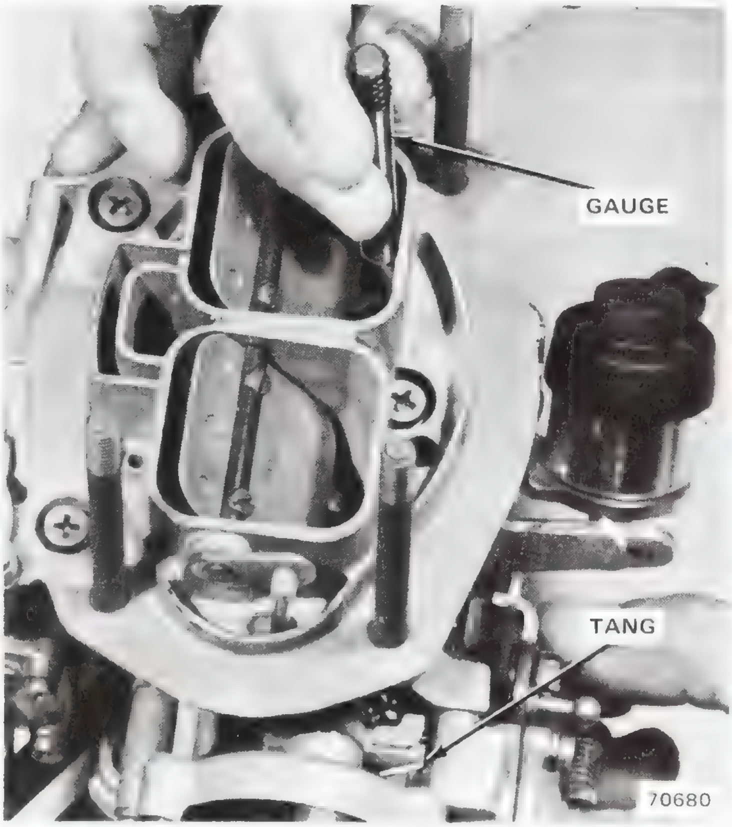

Fig. 1J-31 Choke Unloader Adjustment

(4) Take slack out of linkage.

(5) Turn adjusting screw in or out with 5/32-inch Allen wrench to obtain clearance.

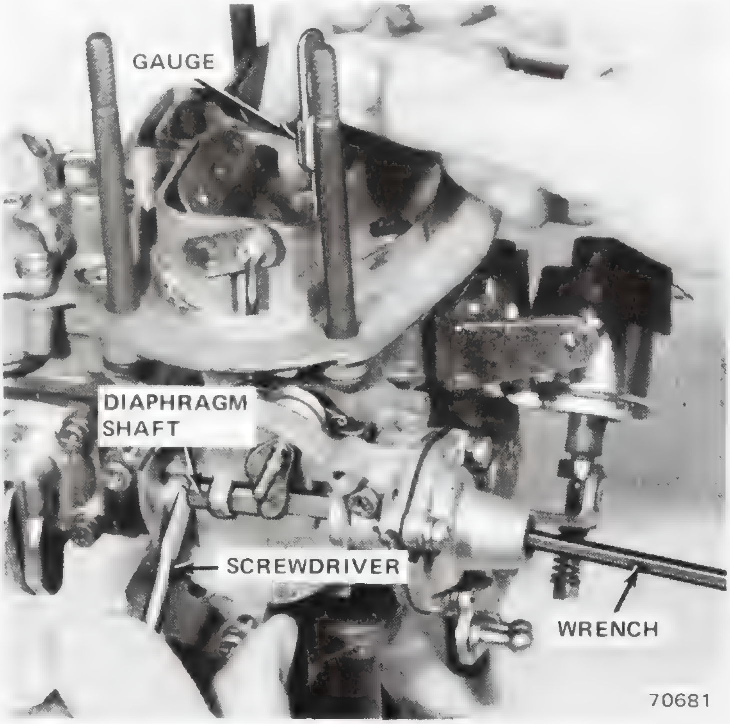

Fig. 1J-32 Initial Choke Valve Clearance Adjustment

Automatic Choke Adjustment

The automatic choke setting is made by loosening the electric coil retaining screws and rotating coil to the desired setting. Refer to Specifications. There are no markings on coil to indicate rich or lean. Rotate coil **clockwise for richer**. Rotate coil **counterclockwise for leaner** (fig. 1J-33). The specified setting will be satisfactory for most driving conditions. In the event that stumble or stall occurs on acceleration during warmup, adjust the choke richer or leaner, using the tolerance provided in Specifications.

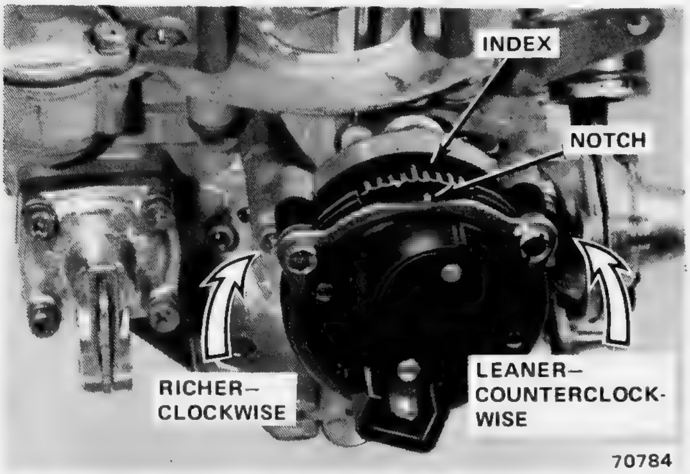

Fig. 1J-33 Automatic Choke Adjustment

Secondary Throttle Stop Screw Adjustment

(1) Turn throttle stop screw out until screw is not in contact with secondary throttle shaft lever.
(2) Turn screw in until it just contacts lever.
(3) Turn screw additional 1/4 turn

Idle Speed and Mixture Adjustment (On Car)

Refer to procedures outlined in Chapter 1A—General Service and Diagnosis.

Fast Idle Speed Adjustment

Set the fast idle speed with the engine at operating temperature and with EGR disconnected. Position the fast idle screw on the lower step of the fast idle cam against the shoulder of the high step. Refer to specifications for the correct setting. Adjust by turning the fast idle adjustment screw.

SPECIFICATIONS

Model 5210 Carburetor Calibrations

	8163	8164	8165
Throttle Bore Diameter			
Primary	1.260	1.260	1.260
Secondary	1.417	1.417	1.417
Venturi Diameter			
Primary	1.033	1.033	1.033
Secondary	1.063	1.063	1.063
Fuel Inlet Seat Diameter	0.0785	0.0785	0.0785
Low Speed Jet (mm)	0.55	0.55	0.55
Idle Air Bleed	0.055	0.055	0.0669
Idle Port Slot	0.025 x 0.175	0.025 x 0.175	0.025x 0.175
Spark Port Diameter	0.062	0.062	0.062
Main Metering Jet			
Primary	239	247	235
Secondary	183	183	171
Main Well Tube			
Primary	14R-974	14R-974	14R-974
Secondary	14R-975	14R-975	14R-975
High Speed Bleed (mm)			
Primary	1.80	1.80	1.80
Secondary	1.20	1.20	1.20
Power Valve Channel Restriction	0.024	0.024	0.024
Power Valve Timing (inches Hg)			
— First Stage	8.0	8.0	8.0
— Second Stage	3.0	5.0	3.0
Secondary Enrichment Channel	0.059	0.059	0.040
Secondary Enrichment Bleed	0.028	0.028	0.028
Discharge Nozzle Diameter (mm)	0.55	0.55	0.50
Discharge Bleed	0.011	0.011	0.011

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Model 5210 Carburetor Specifications

List Number	Application	Float Level		Initial Choke Valve Clearance		Fast Idle Cam Setting		Choke Unloader		Automatic Choke Cover Setting (Notches Rich)	Fast Idle① Speed		Choke Cover ID
		Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range	
8163	121 Manual 49 State	.42	.38 to .46	0.191	0.176 to 0.206	0.193	0.183 to 0.203	.300	.275 to .325	1 NR	1800	1700 to 1900	292
8164	121 Automatic 49 State	.42	.38 to .46	0.202	0.187 to 0.217	0.204	0.194 to 0.214	.300	.275 to .325	1 NR	1800	1700 to 1900	292
8165	121 Manual Altitude	.42	.38 to .46	0.180	0.165 to 0.195	0.177	0.167 to 0.187	.300	.275 to .325	Index	1800	1700 to 1900	292

① Engine hot with EGR disconnected, stop screw on low step of high idle cam against shoulder of high step.

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Special Tools

J-9789-02
UNIVERSAL CARBURETOR
GAUGE SET

CARBURETOR MODEL YF
1 VENTURI

GENERAL

The Carter Model YF carburetor is a one-barrel design incorporating three assemblies: the air horn, the main body and the throttle body (fig. 1J-34).

The air horn assembly serves as the fuel bowl cover and contains the automatic choke assembly, choke valve, fuel bowl vents, fuel inlet fitting, float assembly, needle and seat assembly and solenoid assembly, if equipped.

The main body assembly contains the metering rod and jet, accelerator pump assembly, pump discharge jet, ball and weight, low speed jet, antiperc bleed, economizer and main discharge nozzle.

The throttle body assembly contains the throttle shaft and lever assembly with return spring, curb idle adjusting screw, idle mixture adjusting screw, idle limiter cap, distributor vacuum fitting and EGR vacuum fitting.

For 1978, a mechanically operated bowl vent has been added. This is described in Float Circuit.

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used). The tag is attached to the carburetor and must remain with the carburetor to assure proper identification (fig. 1J-35).

CARBURETOR CIRCUITS

Five conventional circuits are used: Float (Fuel Inlet) Circuit, Idle (Low Speed) Circuit, Main Metering (High Speed) Circuit, Pump Circuit, and Choke Circuit.

Float (Fuel Inlet) Circuit

The float circuit maintains the specified fuel level in the bowl to provide an adequate fuel supply to the metering circuits for all engine operating conditions.

A spring-loaded, two-piece needle is used to prevent float vibration from affecting the fuel level. The needle also incorporates a flared tip which is capable of accomodating small foreign particles, resulting in minimum fuel leakage or flooding under extreme dirt conditions. The flared tip needle also reduces wear, extending the normal life of the needle and seat assembly. Special

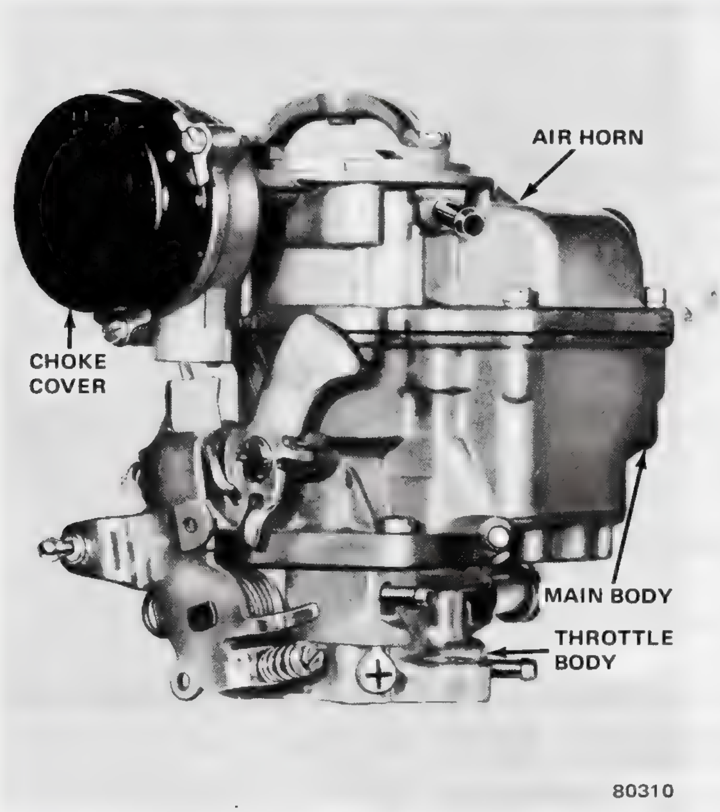


Fig. 1J-34 Model YF Carburetor Assembly

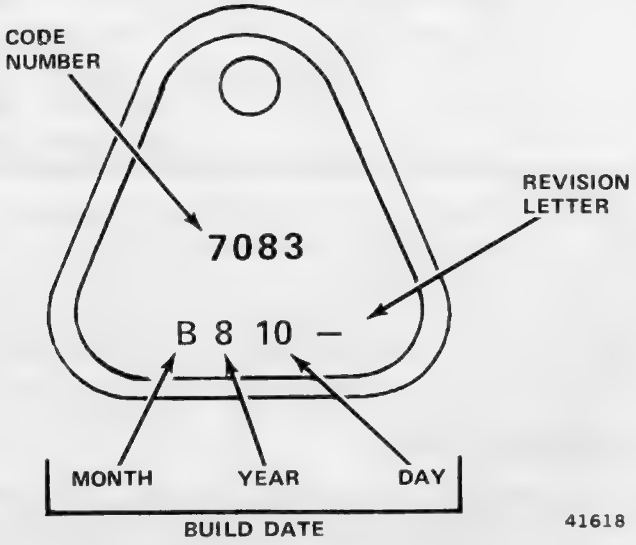


Fig. 1J-35 Identification Tag

precautions must be taken when adjusting the float level. Refer to Float Level Adjustment.

Fuel enters the carburetor through the needle and seat assembly. When the fuel in the bowl fills to the proper level, the float lever pushes the needle toward its seat and restricts the incoming fuel flow to admit only enough fuel to replace that being used (fig. 1J-36).

Bowl Vent

Two bowl vents are provided. The internal vent is used to balance air pressure in the fuel bowl when the engine is running. The external vent provides a method of controlling fuel vapors in the bowl when the engine is not running.

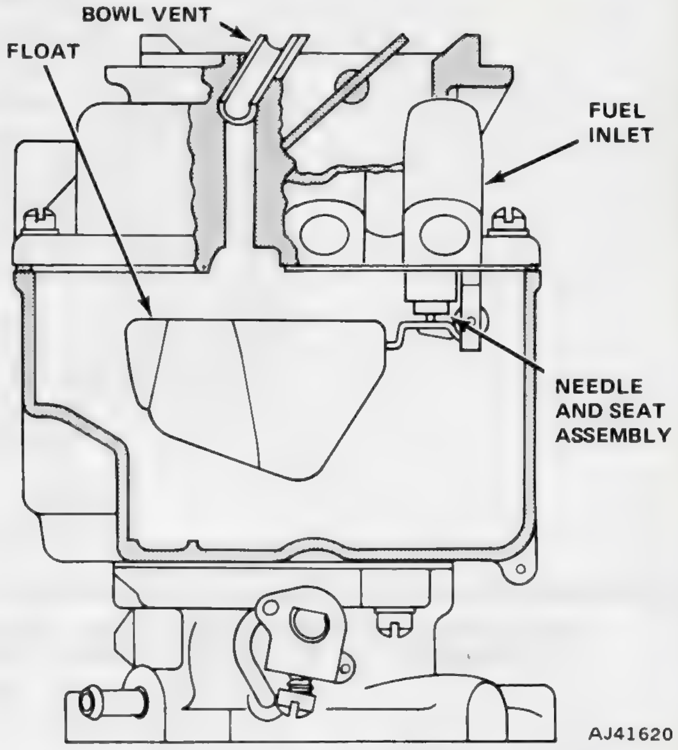


Fig. 1J-36 Float Circuit

The internal bowl vent is provided by a tube and a drilled passage, located inside the air horn. It assures correct air pressure above the fuel for all engine operating conditions. The vent automatically compensates for any air cleaner restriction by balancing pressure between the fuel bowl and the incoming air.

The external fuel bowl vent permits vapors to move from the carburetor to the fuel vapor storage canister (fig. 1J-37). A forked lever attached to the throttle shaft actuates the bowl vent. At idle, or solenoid OFF position, if equipped, the vent opens to permit vapors to pass. At dry throttle position above idle, the vent is mechanically closed. If bowl pressure increases above 0.14-inch H_2O, the valve is forced open temporarily to vent pressure to the canister regardless of throttle position. A hose connected to the air horn vent passage carries the excess pressure and fuel vapor to the fuel vapor storage canister.

Idle (Low Speed) Circuit

Fuel for idle and early part-throttle operation is metered through the idle circuit. The low speed jet is threaded into the low speed well and may be removed for cleaning.

Fuel is metered as it enters the lower end of the low speed jet and flows up through the tube. The fuel is then mixed with air which is metered through the bypass. The fuel-air mixture continues downward through the

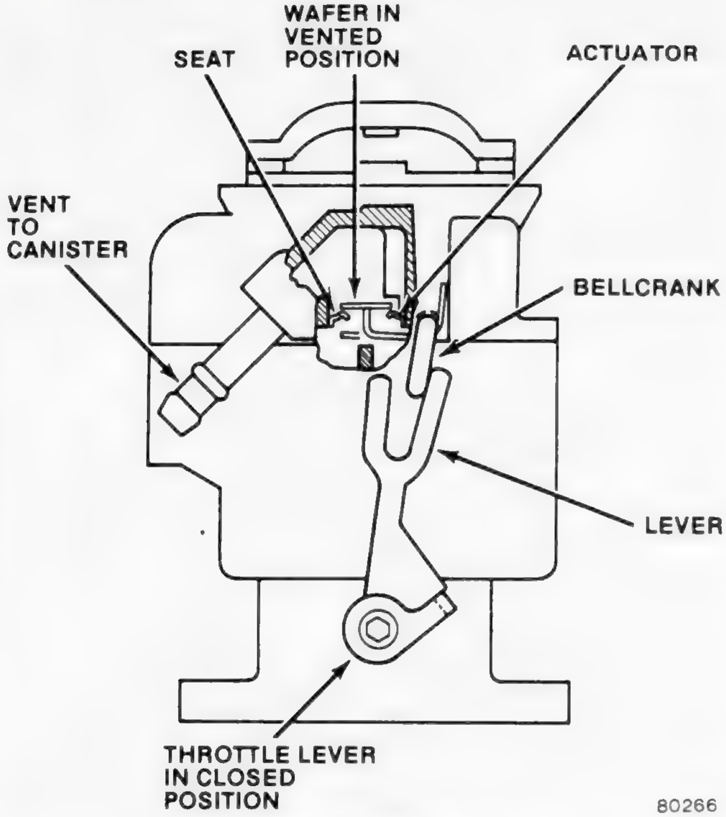


Fig. 1J-37 External Fuel Bowl

economizer and past the idle port where additional metered air is introduced. It is discharged below the throttle valve at the idle port opening and the idle mixture adjustment screw port (fig. 1J-38).

The idle mixture adjustment screw controls the amount of mixture discharged into the manifold. Turning the screw inward (clockwise) decreases the amount of fuel-air mixture supplied for idle. The idle limiter cap limits the adjustment range of the idle mixture adjusting screw, effectively controlling the exhaust emission level at idle speeds to comply with Federal Motor Vehicle Emission Standards.

The idle port is slotted and, as the throttle valve is opened, more of the port is exposed to manifold vacuum to allow an increased discharge of the fuel-air mixture for early part-throttle operation.

Main Metering (High Speed) Circuit

Fuel for most part-throttle and full-throttle operation is supplied through the main metering circuit (fig. 1J-39).

The position of the metering rod in the metering rod jet regulates the amount of fuel admitted to the main discharge nozzle. The lower end of the metering rod is calibrated in steps to accurately meter the fuel required. As the metering rod is raised or lowered in the jet, the opening is varied in size to provide fuel to the engine in the correct proportions required for part-throttle and full-throttle operations. The metering rod is actuated by mechanical linkage and also by changing manifold vacuum.

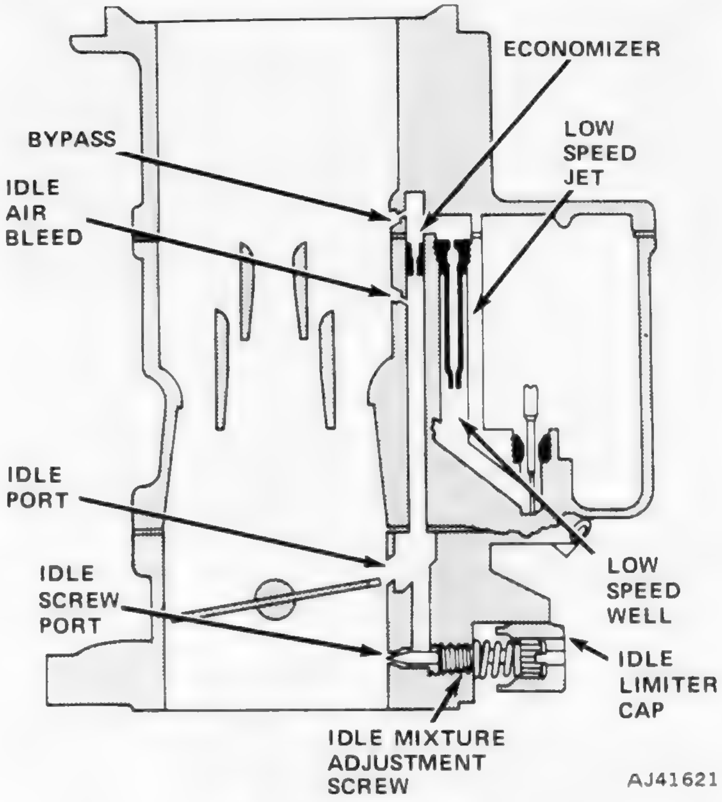


Fig. 1J-38 Idle Circuit

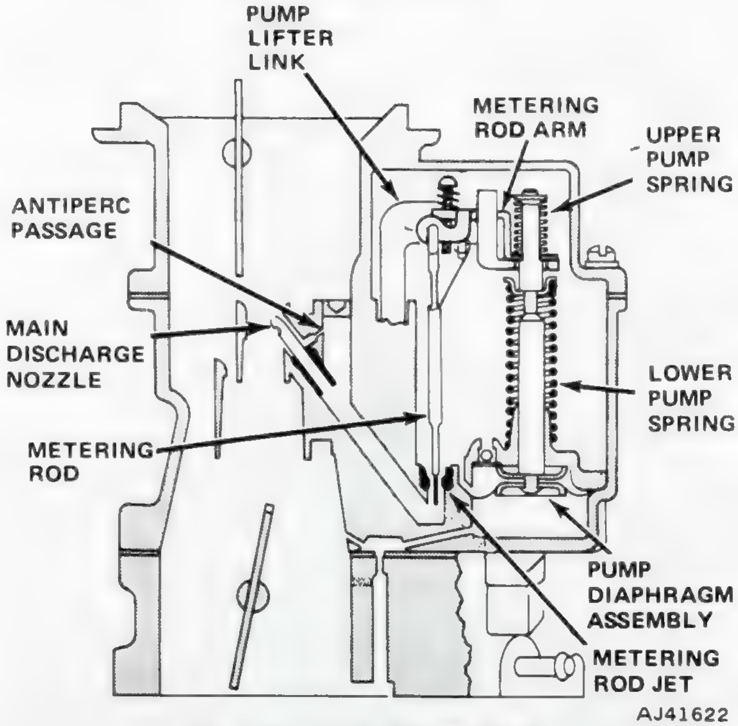


Fig. 1J-39 Main Metering Circuit

The restriction and air bleeds within the vacuum passage leading to the pump diaphragm vacuum chamber provide a lower and more uniform vacuum.

An antiperc passage is used to prevent percolation in the low speed well or main discharge nozzle during hot engine idle or shutdown. It vents vapors and relieves pressure to prevent fuel from being forced out of the nozzle and into the intake manifold.

The main discharge nozzle and the antiperc bushing are permanently installed and cannot be removed.

Mechanical Action

During part-throttle operation, manifold vacuum pulls the pump diaphgram assembly downward, holding the metering rod arm against the pump lifter link which is connected by linkage to the throttle shaft. The metering rod is mechanically controlled as long as manifold vacuum is strong enough to overcome the tension of the lower pump diaphragm spring. The upper spring assists the lower pump spring on acceleration.

Vacuum Action

The metering rod will move upward toward the wide-open or power enrichment position under any engine operating condition in which the tension of the lower pump diaphragm spring is sufficient to overcome the manifold vacuum applied to the pump diaphragm assembly.

Pump Circuit

The pump circuit provides the increased amount of fuel required during acceleration to assure satisfactory engine performance (fig. 1J-40).

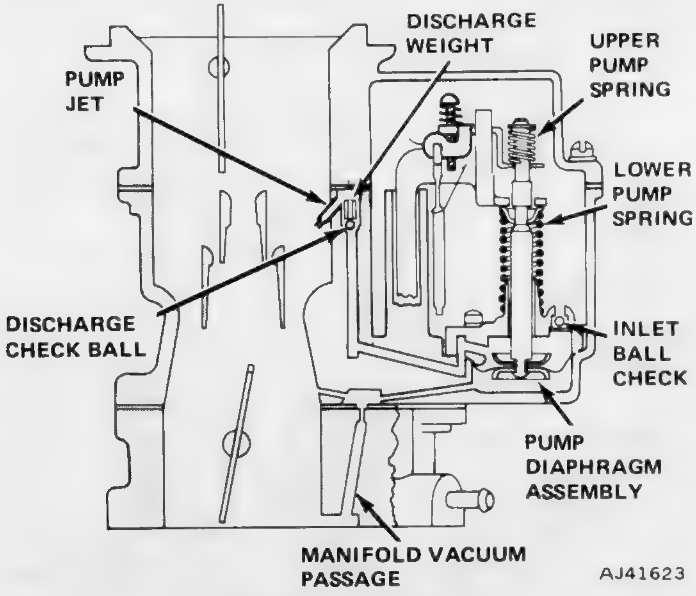


Fig. 1J-40 Pump Circuit

The accelerator pump is actuated in the same manner as the metering rod. When the throttle closes, the pump diaphragm moves downward, both by mechanical linkage and by increased manifold vacuum supplied to the underside of the diaphragm. During the downward movement of the diaphragm, fuel is drawn into the chamber above the diaphragm through the inlet check ball. The discharge check ball is seated during the intake stroke to prevent air from entering the pump chamber. When the throttle is opened, manifold vacuum decreases at the underside of the diaphragm and tension of the lower pump diaphragm spring moves the diaphragm upward. The upward movement of the diaphragm is mechanically assisted by the pump lifter link which is connected by linkage to the throttle shaft. During the upward movement of the diaphragm, fuel under pressure is forced through the pump discharge passage, unseats the discharge check ball, and is discharged through the pump jet. The inlet check ball is seated during the discharge stroke to prevent fuel leakage back into the bowl. If the throttle is opened suddenly, the upper pump spring is compressed, resulting in a smooth pump discharge.

A pump relief bushing, located near the top of the pump discharge passage, allows fuel bowl air pressure to enter the passage. The pump relief serves two purposes. One is to prevent fuel from being drawn out of the pump circuit during high speed constant throttle operation. The other is to bleed off a calibrated portion of the pump discharge back to the fuel bowl, regulating the amount of discharge through the pump jet.

A thermostatic pump bleed has been added to the pump circuit of some YF carburetors of 1978. Refer to Calibrations. This bleed automatically returns excess fuel to the fuel bowl at underhood temperatures above 67°F. This bleed valve is located inside the carburetor fuel bowl adjacent to the pump discharge check ball and weight (fig. 1J-41).

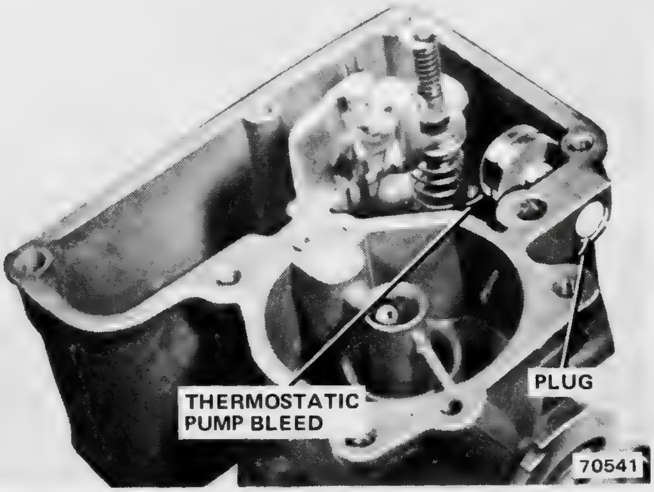


Fig. 1J-41 Thermostatic Pump Bleed

Choke Circuit

The automatic choke provides a richer mixture that is necessary for quick cold engine starting and proper warmup performance (fig. 1J-42). When the engine is cold, thermostatic coil tension holds the choke valve closed. As the engine is cranked, air pressure against the offset choke valve causes the valve to open slightly against the thermostatic coil tension. Intake manifold vacuum, applied to the choke piston, also tends to pull the choke valve open. When the engine starts, the choke valve assumes a partially open position. Thermostatic coil tension is balanced by the pull of vacuum on the piston and force of the air stream against the offset choke valve. This choke valve opening is known as the initial choke valve clearance.

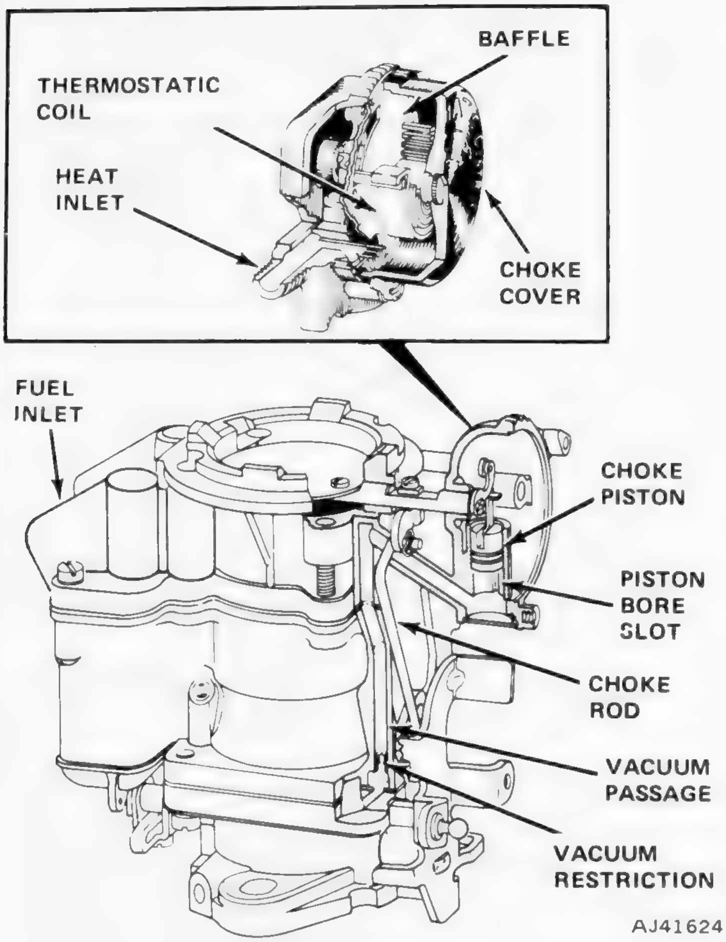


Fig. 1J-42 Choke Circuit

As the choke piston moves down in the cylinder, it exposes slots located in the sides of the cylinder. Intake manifold vacuum draws warm air, heated by the exhaust manifold, through the thermostatic coil housing. This warm air causes the thermostatic spring to gradually lose its tension until the choke valve is in a wide-open position.

When normal engine operating temperature is reached, the thermostatic coil exerts sufficient pressure against the choke piston lever to hold the choke fully open. Since the choke piston is in the full downward position, enough heated air bypasses through the slots of the piston passage to keep the thermostatic coil heated and the choke valve fully open during continued engine operation.

The air flowing through the choke housing must be filtered to minimize contamination of choke piston and associated parts. The air is supplied by a tube originating inside the air cleaner.

If the engine is accelerated during the warmup period, the corresponding drop in manifold vacuum allows the thermostatic coil to momentarily close the choke valve to provide a richer mixture.

A faster idle speed is required to prevent stalling during the warmup period. The fast idle cam, actuated by the choke shaft through connecting linkage, rotates into position against the fast idle screw. The cam is progressively stepped to provide the correct speed in proportion to the choke valve opening. When the choke valve reaches the fully open position, the fast idle cam rotates free of the fast idle screw, allowing the throttle lever to return to curb idle position.

If the engine floods during starting, the choke valve may be opened manually to purge excess fuel from the intake manifold. This is accomplished by depressing the accelerator pedal to the floor and cranking the engine. With the accelerator linkage in this position, a tang on the throttle lever contacts the fast idle cam, causing the choke rod to move upward and open the choke valve a predetermined amount. This choke valve opening is called choke unloader clearance.

CARBURETOR REPLACEMENT

Removal

(1) Remove air cleaner.

(2) Code all lines attached to carburetor for aid during installation.

(3) Remove control shaft from throttle lever and disconnect distributor vacuum line, in-line fuel filter, external bowl vent hose, choke clean air tube, vacuum hoses, pullback spring and choke heat tube at carburetor.

(4) Remove carburetor retaining nuts and remove carburetor.

(5) Remove carburetor mounting gasket from spacer.

Installation

(1) Clean gasket mounting surface of spacer. Install replacement gasket on spacer. Position carburetor on spacer and gasket and secure with retaining nuts. To prevent leakage, distortion or damage to carburetor body flange, alternately tighten nuts in crisscross pattern.

(2) Connect in-line fuel filter, control shaft, choke heat tube pullback spring, vacuum hoses, choke clean air tube and distributor vacuum line.

(3) Install air cleaner.

(4) Adjust idle speed, fast idle speed and idle fuel mixture. Refer to Chapter 1A—General Service and Diagnosis.

CARBURETOR OVERHAUL

A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine. Refer to Service Adjustment Procedures.

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection and replacement of gaskets and worn or damaged parts. It also includes idle adjustment, mixture adjustment and fast idle adjustment after the carburetor is installed. Refer to figure 1J-43 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in kit.*

NOTE: *Flooding, stumble on acceleration, and other performance problems are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the bowl contents for contamination as the carburetor is disassembled.*

Disassembly

(1) Remove choke cover attaching screws, solenoid bracket assembly, air horn assembly and air horn gasket.

(2) Hold air horn assembly bottom side up and remove float pin. Remove float and lever assembly. Turn air horn assembly over and catch needle pin, spring and needle.

(3) Remove needle seat and gasket (fig. 1J-44).

(4) Knock out piston bore plug.

(5) Turn pump main body casting upside down and catch accelerator pump discharge check ball and weight.

(6) At end of throttle shaft, remove screw, actuating arm, wave washer, forked lever and clip (fig. 1J-45).

(7) Loosen throttle shaft arm screw and remove arm and pump connector link (fig. 1J-46).

(8) Remove fast idle cam and shoulder screw.

(9) Remove accelerator pump diaphragm housing screws. Lift out the pump diaphragm assembly, pump lifter link and metering rod together (fig. 1J-47).

(10) Disengage metering rod arm spring from metering rod, and remove metering rod from metering rod arm assembly. Note location of any washers shimming either spring for proper assembly. Compress upper pump spring and remove spring retainer. Remove upper spring, metering rod arm assembly and pump lifter link from pump diaphragm shaft. Compress pump diaphragm spring and remove pump diaphragm spring retainer, spring and pump diaphragm assembly from pump diaphragm housing assembly.

(11) Remove metering rod jet and low speed jet.

(12) Remove retaining screws and separate throttle body flange assembly from main body casting. Remove body flange gasket.

(13) Note position of idle mixture limiter cap. Remove limiter cap. Count number of turns to lightly seat needle. This information will be used in assembly. Remove idle mixture screw.

Cleaning and Inspection

Dirt, gum, water or carbon contamination inside the carburetor and on the exterior moving parts are often responsible for unsatisfactory performance. Efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection procedures here do not cover those parts included in the carburetor overhaul repair kit. Install all gaskets and parts included in the repair kit when the carburetor is assembled. Discard the original gaskets and parts.

Wash all the carburetor parts except the accelerator pump diaphragm in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, use mineral spirits, lacquer thinner or denatured alcohol.

If commercial cleaner is used, rinse the parts in hot water to remove all traces of the cleaning solvent, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon and other foreign matter are removed from all parts.

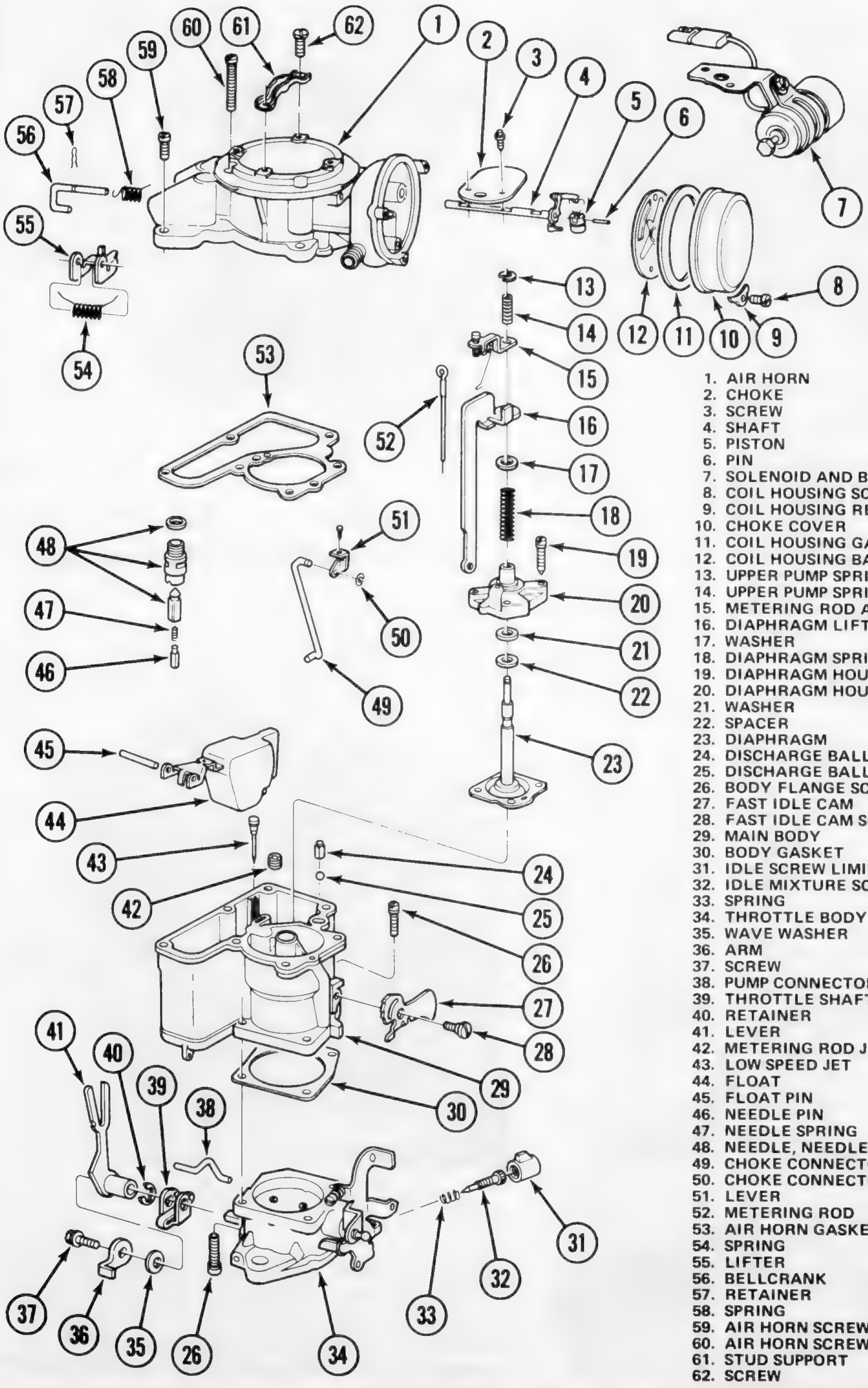
Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts. Do not use a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for excessive looseness or binding. Inspect the choke valve for nicked edges and for ease of operation. Make sure all carbon and foreign material have been removed from the automatic choke housing and the piston. Check the operation of the choke piston in the choke housing to be sure it has free movement (fig. 1J-48). Check the throttle shaft for excessive looseness or binding in the bore and check the throttle valve for burrs which prevent proper closing. Inspect the main body, throttle body, air horn, choke housing and thermostatic spring housing for cracks.

Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace the float pin if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Check position of throttle valve to be sure that notch in plate is aligned with slotted idle port in the throttle body flange (fig. 1J-49).



1. AIR HORN
2. CHOKE
3. SCREW
4. SHAFT
5. PISTON
6. PIN
7. SOLENOID AND BRACKET
8. COIL HOUSING SCREW
9. COIL HOUSING RETAINER
10. CHOKE COVER
11. COIL HOUSING GASKET
12. COIL HOUSING BAFFLE PLATE
13. UPPER PUMP SPRING RETAINER
14. UPPER PUMP SPRING
15. METERING ROD ARM
16. DIAPHRAGM LIFTER LINK
17. WASHER
18. DIAPHRAGM SPRING
19. DIAPHRAGM HOUSING SCREW (4)
20. DIAPHRAGM HOUSING
21. WASHER
22. SPACER
23. DIAPHRAGM
24. DISCHARGE BALL WEIGHT
25. DISCHARGE BALL
26. BODY FLANGE SCREW (3)
27. FAST IDLE CAM
28. FAST IDLE CAM SCREW
29. MAIN BODY
30. BODY GASKET
31. IDLE SCREW LIMITER CAP
32. IDLE MIXTURE SCREW
33. SPRING
34. THROTTLE BODY
35. WAVE WASHER
36. ARM
37. SCREW
38. PUMP CONNECTOR LINK
39. THROTTLE SHAFT ARM
40. RETAINER
41. LEVER
42. METERING ROD JET
43. LOW SPEED JET
44. FLOAT
45. FLOAT PIN
46. NEEDLE PIN
47. NEEDLE SPRING
48. NEEDLE, NEEDLE SEAT, GASKET
49. CHOKE CONNECTOR ROD
50. CHOKE CONNECTOR ROD RETAINER
51. LEVER
52. METERING ROD
53. AIR HORN GASKET
54. SPRING
55. LIFTER
56. BELLCRANK
57. RETAINER
58. SPRING
59. AIR HORN SCREW (SHORT)
60. AIR HORN SCREW (LONG)
61. STUD SUPPORT
62. SCREW

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Fig. 1J-43 Parts Identification—Carter Model YF

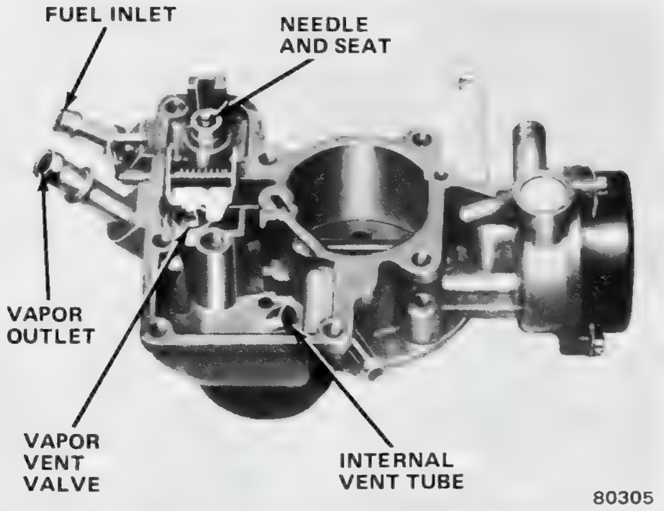

Fig. 1J-44 Interior View of Air Horn

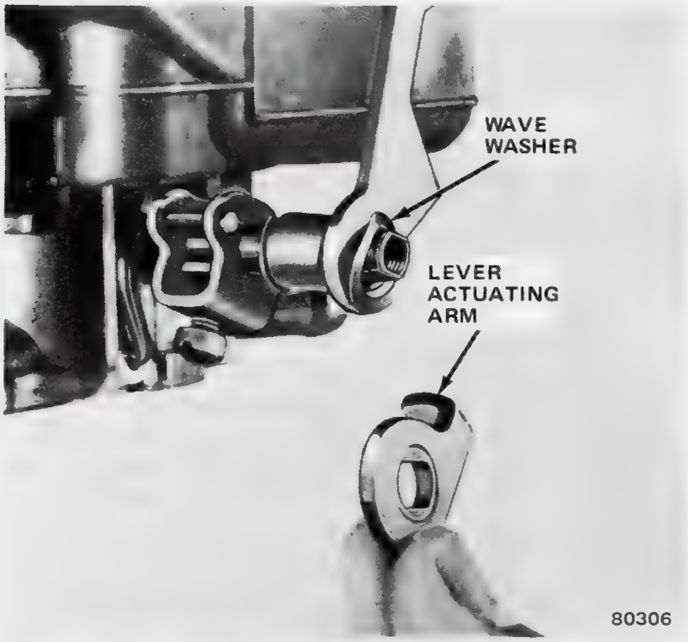

Fig. 1J-45 Bowl Vent Actuating Lever

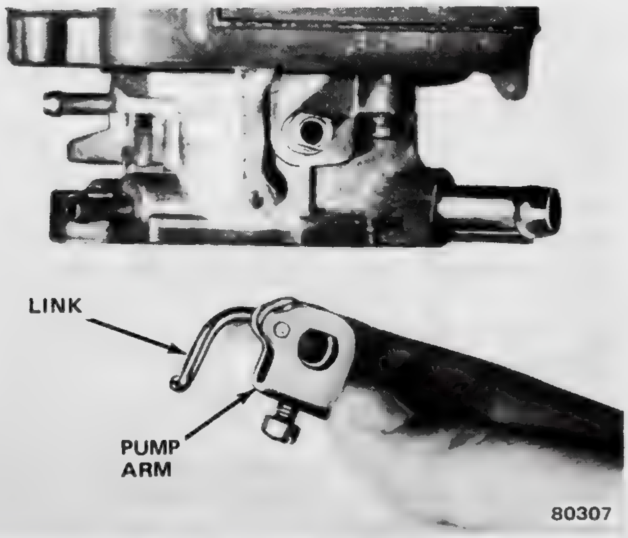

Fig. 1J-46 Pump Arm and Link

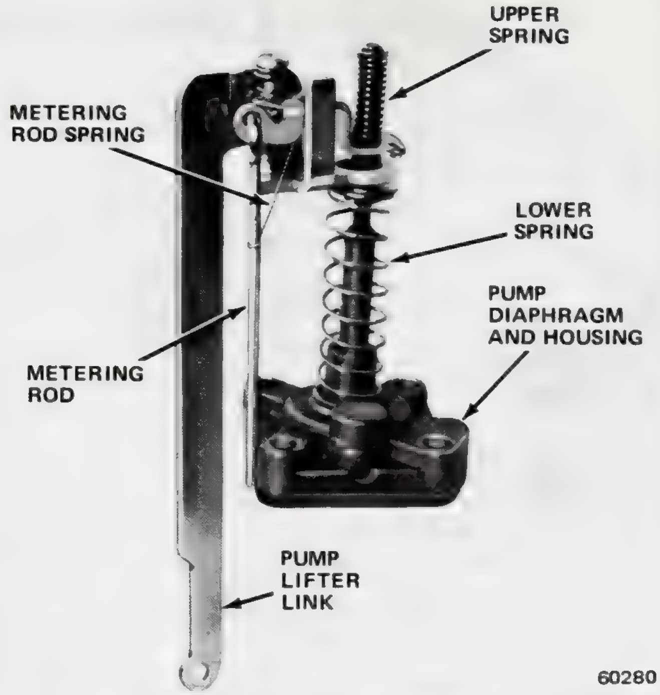

Fig. 1J-47 Accelerator Pump and Metering Rod Assembly

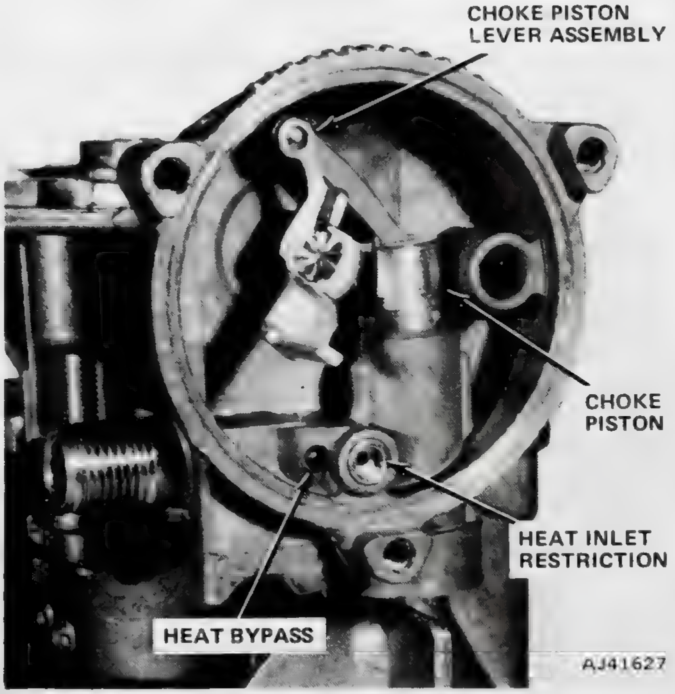

Fig. 1J-48 Choke Piston and Lever Assembly

Rotate shaft to be sure the throttle valve does not bind in the flange bore. Back the idle speed screw out sufficiently that it does not contact the throttle stop to check that the throttle valve closes tightly in the bore.

Inspect all mechanical bowl vent components for proper operation.

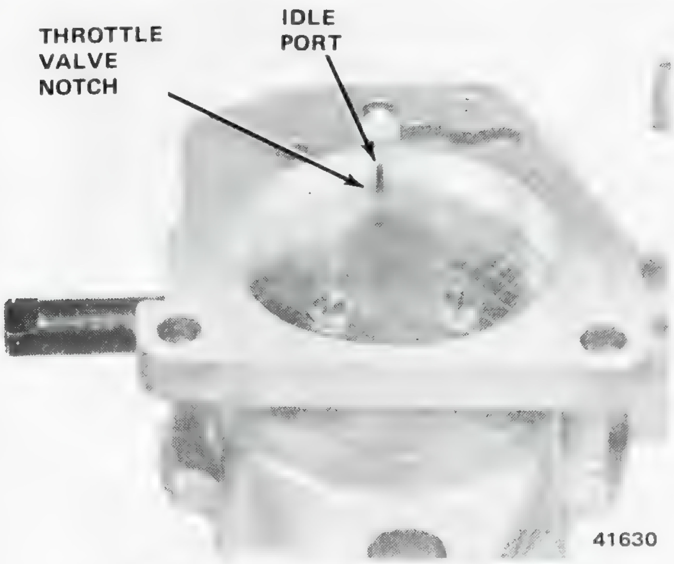

Fig. 1J-49 Throttle Valve Alignment

Assembly

NOTE: *Be sure all holes in the replacement gaskets have been properly punched and that no foreign matter has adhered to the gaskets. Inspect accelerator pump or diaphragm for tears or cuts.*

(1) Position replacement body flange gasket and main body casting on throttle body flange. Install attaching screws and tighten evenly.

(2) Install low speed jet and metering rod jet (fig. 1J-50).

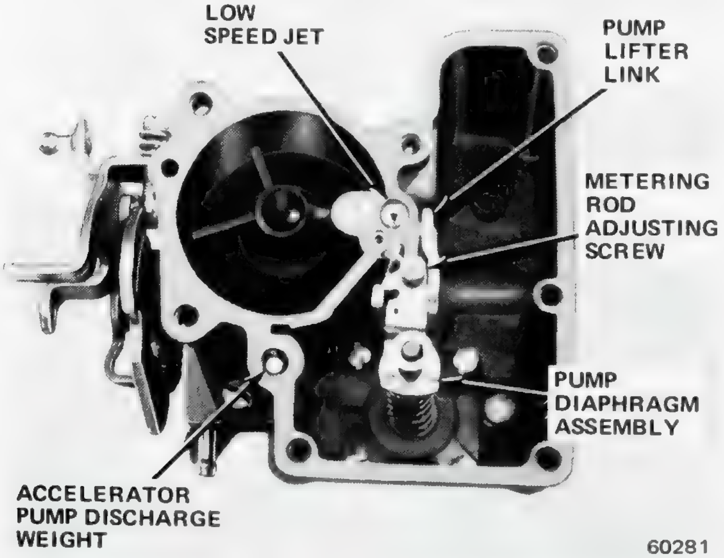

Fig. 1J-50 Interior View of Fuel Bowl

(3) Install pump diaphragm in pump diaphragm housing.

(a) Position pump diaphgram spring on diaphragm shaft and housing assembly.

(b) Install spring shim washers.

(c) Install spring retainer, pump lifter link, metering rod arm and spring assembly and upper pump spring on diaphragm shaft.

(d) Depress spring and install upper pump spring retainer.

(4) Install metering rod on metering rod arm and place looped end of metering arm spring on metering rod (fig. 1J-47).

(5) Align pump diaphragm with diaphragm housing, making sure holes are aligned. Install housing attaching screws through holes in housing and diaphragm.

(6) Align pump housing, pump lifter link and metering rod with main body casting.

(7) Install assembly in main body casting. Be careful to engage pump lifter link with main body and to insert metering rod in metering rod jet.

(8) Start pump housing attaching screws but do not tighten. Push down on diaphragm shaft to compress diaphragm and tighten attaching screws.

(9) Adjust metering rod, following procedure under Metering Rod Adjustment.

(10) Install fast idle cam and shoulder screw. Install throttle shaft arm and pump connector link on throttle shaft and pump lifter link. Tighten lock screw.

(11) Install clip to groove on throttle shaft. Install forked lever and wave washer. Position actuating lever with hole aligned on throttle shaft flats. Install screw.

(12) Install replacement plug in choke piston bore.

(13) Check choke valve for binding. Correct as required.

(14) Install choke link lever and tighten attaching screw.

(15) Install needle seat and gasket in air horn. With air horn inverted, install needle, pin spring, needle pin, float and lever assembly, and float pin. Adjust float level to specifications. Adjust float drop to specifications. Refer to Service Adjustment Procedures.

(16) Place pump check ball and weight in main body casting.

(17) Position replacement air horn gasket, air horn assembly and solenoid bracket on main body. Install and tighten attaching screws.

(18) Adjust initial choke valve clearance. Refer to Service Adjustment Procedures.

(19) Install thermostatic coil housing, gasket and baffle plate, embossed cross facing outward, with gasket between baffle and coil housing.

NOTE: *Be sure thermostatic coil engages choke lever tang.*

(20) Loosely install coil housing retainers and retaining screws. Set coil housing index to specified setting and tighten screws.

(21) Adjust fast idle cam clearance. Refer to Service Adjustment Procedures.

(22) Install choke connector rod and retainer.

(23) Install idle mixture screw. Turn lightly turn to seat, then back off number of turns determined during disassembly. Do not install limiter cap at this time.

(24) Adjust choke unloader to specifications. Refer to Service Adjustment Procedures.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Invert air horn assembly and check clearance from top of float to bottom of air horn with float level gauge (fig. 1J-51). Hold air horn at eye level when gauging float level. Float arm (lever) should be resting on needle pin. Do not bend tab at end of float arm. It prevents float from striking bottom of fuel bowl when empty.

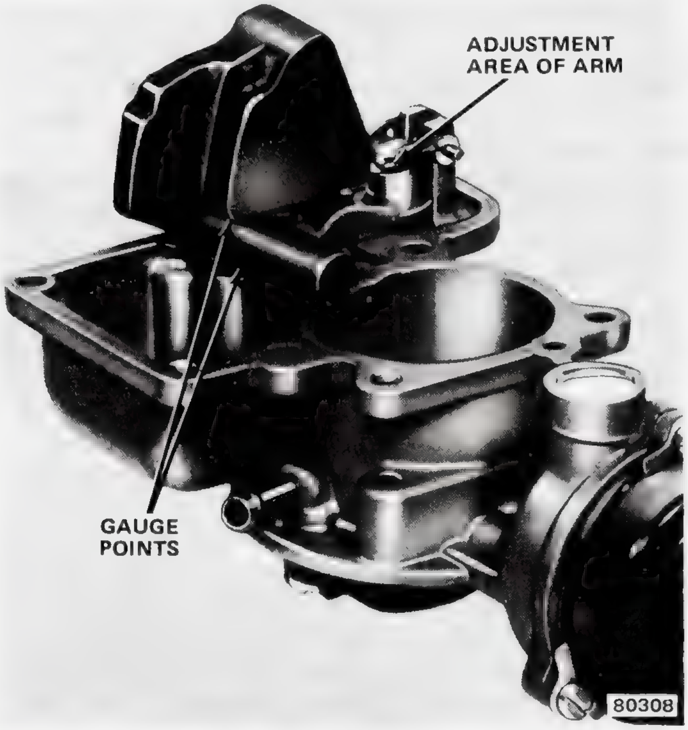

Fig. 1J-51 Float Level Adjustment

CAUTION: *Do not load the needle when adjusting the float.*

(3) Bend float arm as necessary to adjust float level. Refer to Specifications for proper clearance.

(4) Install carburetor air horn and replacement gasket on carburetor.

Float Drop Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Hold air horn upright and let float hang free. Measure maximum clearance from top of float to bottom of air horn with scale. Refer to Specifications for proper clearance. Hold air horn at eye level when gauging dimension (fig. 1J-52).

(3) Bend tab at end of float arm to obtain specified setting.

(4) Install carburetor air horn and replacement gasket on carburetor.

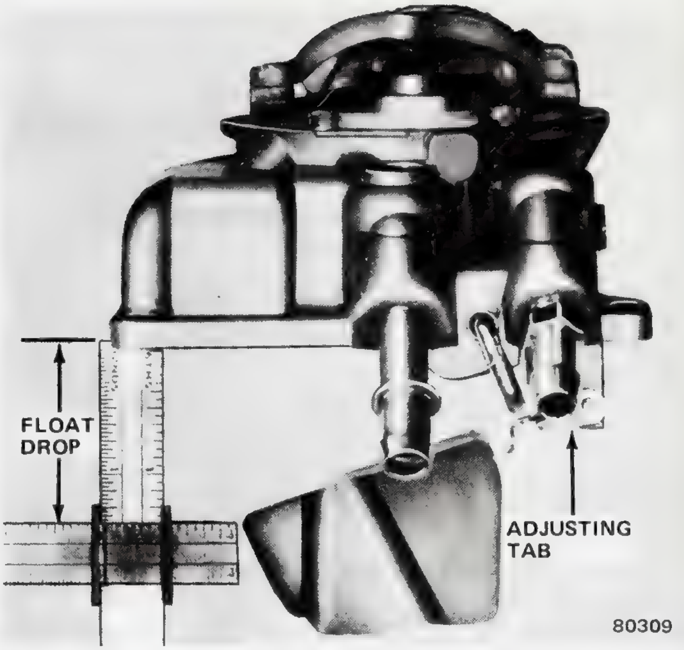

Fig. 1J-52 Float Drop Adjustment

Metering Rod Adjustment

(1) Remove carburetor air horn and gasket from carburetor.

(2) Back out idle speed adjusting screw until throttle valve is closed tight in throttle bore.

(3) Press down on end of pump diaphragm shaft until assembly bottoms.

(4) With assembly bottomed, turn rod adjustment screw counterclockwise until metering rod just bottoms in body casting (fig. 1J-53).

NOTE: *It may be helpful to draw a pencil line on the metering rod to accurately determine when the rod is bottomed.*

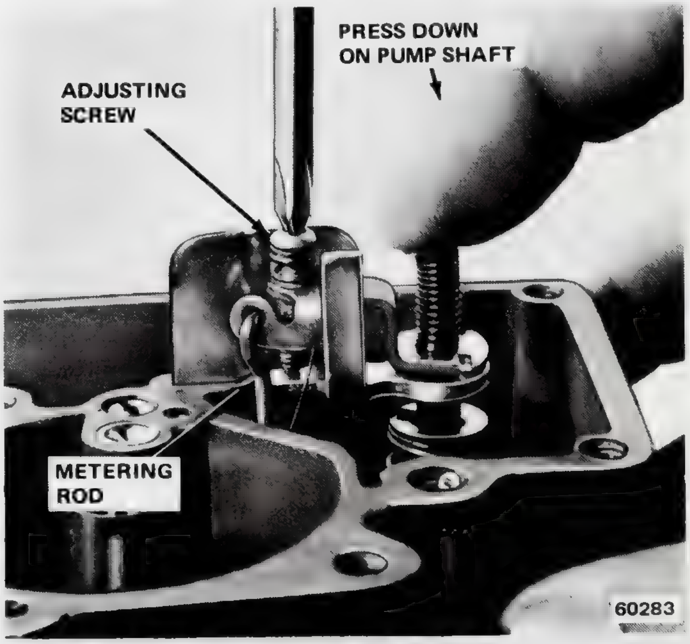

Fig. 1J-53 Metering Rod Adjustment

(5) Turn metering rod adjustment screw clockwise one turn for final adjustment.

(6) Install carburetor air horn and replacement gasket on carburetor.

Initial Choke Valve Clearance Adjustment

(1) Bend 0.025-inch wire gauge at 90° angle approximately 1/8 inch from end.

(2) Remove coil housing, gasket and baffle plate.

(3) Partially open throttle and close choke valve to position choke piston at top of its bore.

(4) Holding choke valve fully closed, release throttle and insert wire gauge into piston slot, against outboard side (right side of choke shaft) of piston bore. Push piston downward with gauge until bent end of gauge enters slot in piston bore. With gauge in place, push on choke shaft bimetal lever in counterclockwise direction to move piston upward, locking gauge in place (fig. 1J-54).

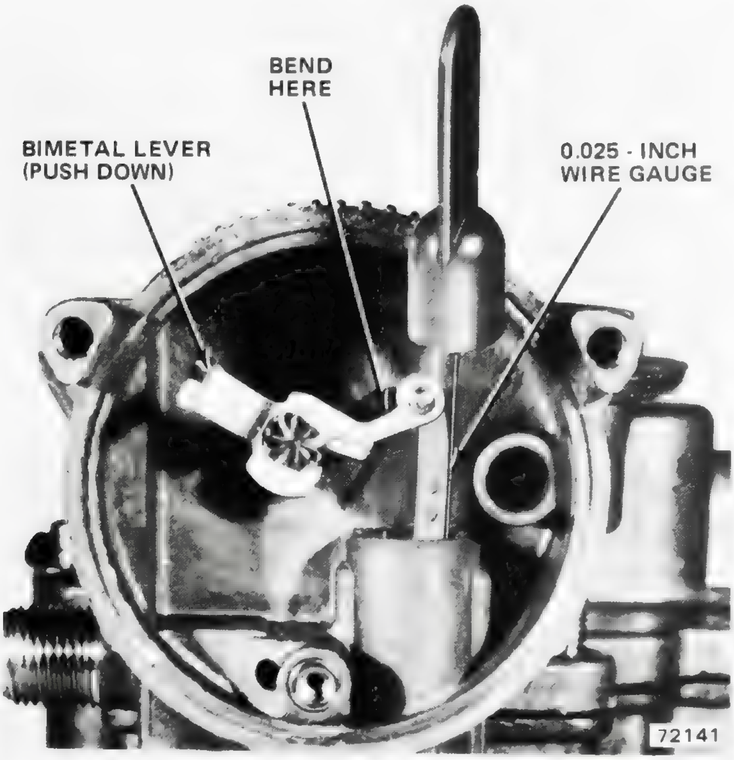

Fig. 1J-54 Initial Choke Valve Clearance Adjustment

(5) Measure clearance between lower edge of choke valve and air horn wall. Refer to Specifications for correct setting.

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall. Position gauge next to bracket.*

(6) Adjust clearance by carefully bending choke piston lever with needlenose pliers. Decrease clearance by bending toward piston and increase clearance by bending away from piston.

(7) Install choke baffle plate with embossed cross facing outward, coil housing gasket and coil housing. Be sure thermostatic coil engages choke lever tang.

(8) Install coil housing retainers and retaining screws, but do not tighten. Turn housing 1/4-turn rich (counterclockwise) and tighten one screw. Proceed to fast idle cam linkage adjustment.

Fast Idle Cam Linkage Adjustment

(1) Position fast idle screw on second step of fast idle cam against shoulder of high step (fig. 1J-55).

(2) Adjust by bending choke connecting rod to obtain specified clearance between lower edge of choke valve and air horn wall. Refer to Specifications for proper clearance.

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall. Position gauge next to bracket.*

(3) Loosen choke housing retaining screw. Set housing index to specification. Tighten all housing retaining screws.

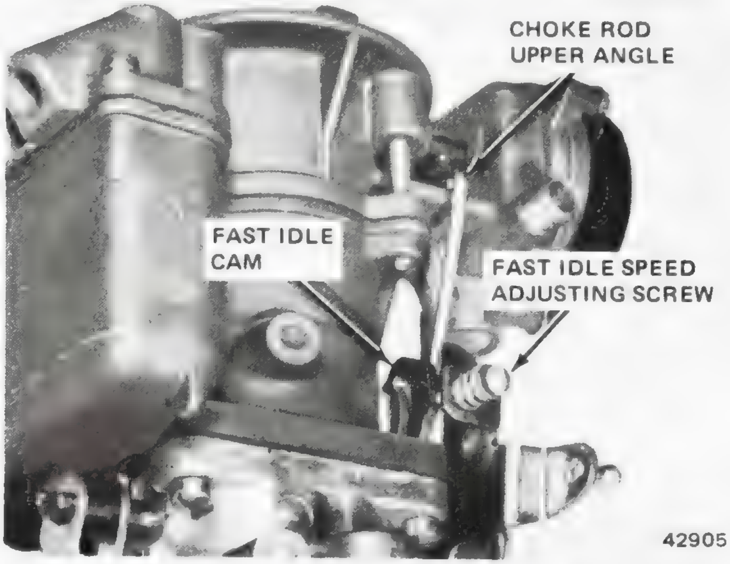

Fig. 1J-55 Fast Idle Cam Linkage Adjustment

Choke Unloader Adjustment

(1) Hold throttle fully open and apply pressure on choke valve toward closed position.

(2) Measure clearance between lower edge of choke valve and air horn wall. Refer to Specifications for correct setting.

NOTE: *It is not necessary to remove air cleaner bracket when measuring clearance between choke valve and air horn wall. Position gauge next to bracket.*

(3) Adjust by bending unloader tang which contacts fast idle cam as shown in figure 1J-56. Bend toward cam to increase clearance and away from cam to decrease clearance.

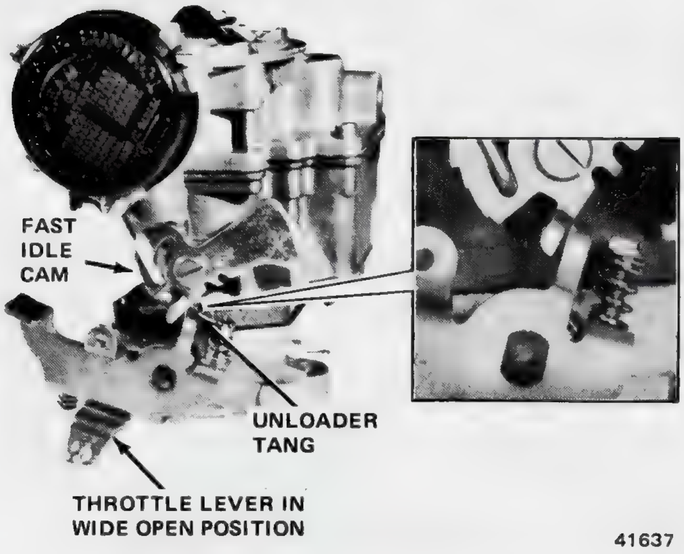

Fig. 1J-56 Choke Unloader Adjustment

CAUTION: *Do not bend the unloader tang downward from a horizontal plane.*

(4) After making adjustment, be sure that unloader tang has at least 0.070-inch clearance from main body flange when throttle is fully open (fig. 1J-57).

(5) Operate throttle and check unloader tang to be sure it does not bind, contact or stick on any part of carburetor casting or linkage. After carburetor installation, check for full throttle opening when throttle is operated from inside vehicle.

NOTE: *If full throttle opening is not obtainable, it may be necessary to remove excess padding under floormat or reposition throttle cable bracket located on the engine.*

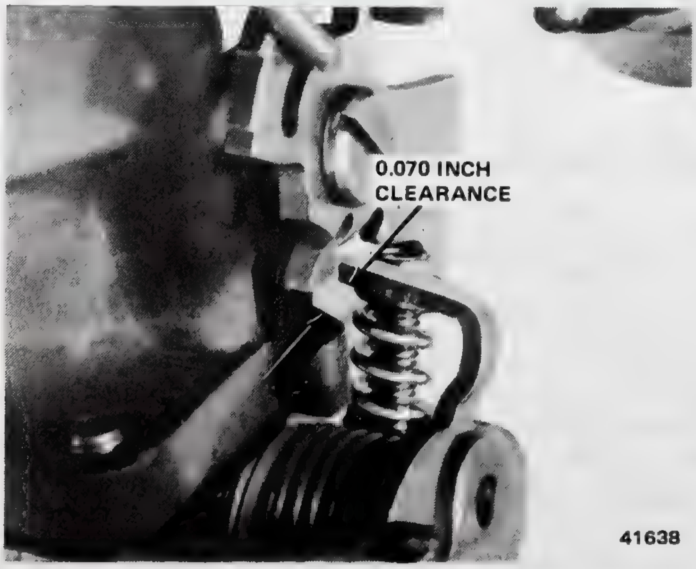

Fig. 1J-57 Unloader-to-Body Clearance

Bowl Vent

This is not a precise adjustment. It is made to ensure that the mechanical bowl vent is open at idle and closed at greater throttle openings. It may be performed on-car or off-car.

(1) Disconnect canister hose from carburetor fuel bowl vent. Install length of clean hose to bowl vent.

(2) Position throttle on high step of fast idle cam.

(3) Apply pressure to hose with mouth. Considerable resistance should be felt.

(4) Manually move fast idle cam until throttle screw drops to third step of cam. Bowl vent should relieve resistance to air pressure as throttle closes.

(5) Repeat steps (2) through (4) to verify.

(6) If pressure is not felt on high step of cam, vent is not closing. Adjust by bending forked end of forked lever.

(7) If pressure does not release on third step of cam, vent is not opening. Adjust by bending forked end of forked lever.

Automatic Choke Adjustment (On- or Off-Car)

The automatic choke setting is made by loosening choke housing retaining screws and rotating housing in the desired direction as indicated by the arrow on the face of the housing. Refer to Specifications for the correct setting. The specified setting will be satisfactory for most driving conditions. In the event that stumble or stall occurs on acceleration during engine warmup, the choke may be set richer or leaner, using the tolerance provided, to meet individual engine requirements.

Idle Speed and Mixture Adjustment (On-Car)

Refer to procedures outlined in Chapter 1A—General Service and Diagnosis.

Fast Idle Speed Adjustment

Set the fast idle speed with the engine at operating temperature and with EGR and TCS solenoid disconnected. Position the fast idle screw in contact with the second step and against the shoulder of the high step of the fast idle cam. Refer to Specifications for the correct setting. Adjust by turning the fast idle adjustment screw.

CHOKE MECHANISM SERVICE

The choke mechanism may be serviced without removing the carburetor from the engine. If the choke binds, sticks or does not operate smoothly, perform the following.

(1) Disconnect bowl vent tube, fuel line and choke fresh air tube.

(2) Disconnect choke rod and remove air horn.

(3) Remove float, float pin and needle.

(4) Remove air cleaner bracket. Remove choke link lever and attaching screw.

(5) Remove choke housing cover.

(6) Rotate choke shaft to pull piston to top of bore.

(7) Knock out piston bore plug.

(8) Clean choke piston, using carburetor cleaner if necessary. Polish piston bore with crocus cloth. Dry all parts.

(9) Install replacement piston bore plug.

(10) Install choke link lever and screw.

(11) Install air cleaner bracket.

(12) Install needle, float and pin.

(13) Install air horn. Connect choke rod.

(14) Install choke housing cover and set to specification.

(15) Install bowl vent tube, fuel line and choke fresh air tube.

SPECIFICATIONS

Model YF Carburetor Calibrations (Inches)

	7201	7228	7229	7235	7267
Throttle Bore Size	1.687	1.687	1.687	1.687	1.687
Main Venturi Size	1.312	1.312	1.312	1.312	1.312
Fuel Inlet Diameter	0.0935	0.0935	0.0935	0.0935	0.0935
Low Speed Jet	0.034	0.034	0.032	0.034	0.032
Bypass Air Bleed	0.0465	0.0465	0.0465	0.0465	0.0465
Economizer	0.055	0.055	0.055	0.055	0.049
Idle Air Bleed	0.0465	0.0465	0.0465	0.0465	0.0465
Metering Rod Jet Number	120-401	120-401	120-401	120-401	120-401
Metering Rod Jet Size	0.101	0.101	0.101	0.101	0.101
Metering Rod Number	75-2253	75-1990	75-2247	75-2258	75-2147

	7201	7228	7229	7235	7267
Step Up Limiter Shim	0.140	None	0.080	0.140	0.080
Nozzle Bleed	0.0635	0.0635	0.0635	0.0635	0.0635
Anti-Perc Bleed	0.028	0.028	0.028	0.028	0.028
Pump Discharge Nozzle (Jet)	0.028	0.028	0.024	0.028	0.028
Vacuum Spark Port	0.052	0.052	0.052	0.052	0.052
Spark Port Location Above Closed Throttle	0.022	0.022	0.022	0.022	0.022
Choke Vacuum Restriction	0.089	0.089	0.089	0.089	0.089
Choke Heat Inlet (Brass Restriction)	0.073	0.063	0.073	0.073	0.073
Thermostatic Pump Bleed	None	None	None	0.024	None

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Model YF Carburetor Specifications

List Number	Application	Float Level		Float Drop	Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Choke Unloader	Fast Idle① Speed		Bowl Vent Starts To Open	Choke Bimetal ID
		Set To	OK Range		Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range		
7201	258 Automatic California	0.476	0.444 to 0.508	1-3/8	0.215	0.195 to 0.235	0.195	0.179 to 0.211	Index	1/2L to 1/2R	0.275 min.	1600	1500 to 1700	3 Step	AA
7228	232, 258 Automatic 49 State	0.476	0.444 to 0.508	1-3/8	0.215	0.195 to 0.235	0.195	0.179 to 0.211	1	1/2 to 1-1/2	0.275 min.	1600	1500 to 1700	3 Step	AA
7229	232 Manual 49 State	0.476	0.444 to 0.508	1-3/8	0.215	0.195 to 0.235	0.195	0.179 to 0.211	1	1/2 to 1-1/2	0.275 min.	1500	1400 to 1600	3 Step	AE
7235	258 Manual California	0.476	0.444 to 0.508	1-3/8	0.215	0.195 to 0.235	0.195	0.179 to 0.211	Index	1/2L to 1/2R	0.275 min.	1500	1400 to 1600	3 Step	AA
7267	232 Manual Automatic Canada	0.476	0.444 to 0.508	1-3/8	0.215	0.195 to 0.235	0.195	0.179 to 0.211	1	1/2 to 1-1/2	0.275 min.	1500	1400 to 1600	3 Step	AE

① Hot with TCS Solenoid and EGR Disconnected

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Special Tools

J-1137
BENDING TOOL

J-9789-02 UNIVERSAL
CARBURETOR GAUGE KIT

CARBURETOR MODEL YF-1 VENTURI WITH ALTITUDE COMPENSATION

GENERAL

The Carter Model YF carburetor with altitude compensation is installed on six-cylinder engines in cars sold for use at elevations of 4000 feet or more (fig. 1J-58). This carburetor features a compensation circuit which mixes a metered amount of additional air with the fuel to prevent a too-rich condition at higher altitudes. A manually operated override permits operation at lower altitudes. In the low-altitude mode, the carburetor performs like a conventional Model YF.

The Model YF carburetor with altitude compensation is serviced the same as the conventional Model YF, except for the compensation device.

Because the altitude compensated Model YF is essentially a variation of the conventional Model YF, this section covers only operational differences and provides procedures necessary to service the compensation device. All other information is covered in the preceding section, Model YF Carburetor—1 Venturi.

CARBURETOR CIRCUITS

Altitude Compensation Circuit

This circuit provides the leaner mixture required for high-altitude operation. The components are: chamber assembly, gasket and screws (fig. 1J-59).

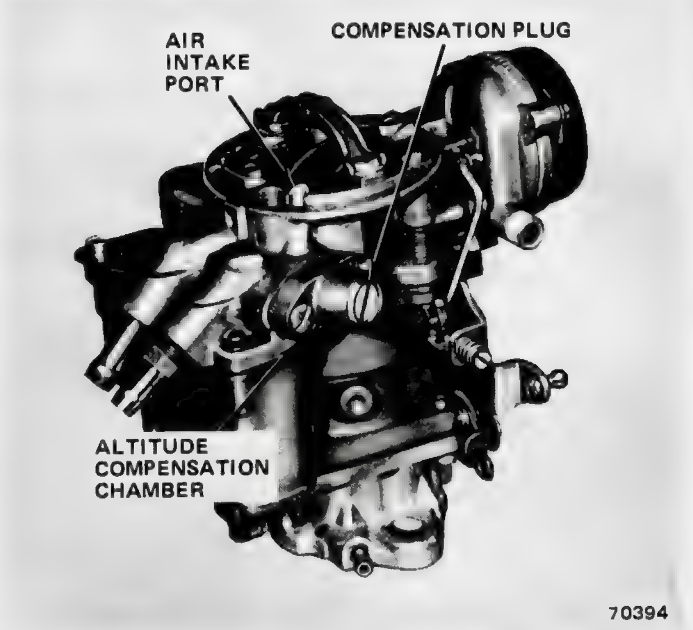
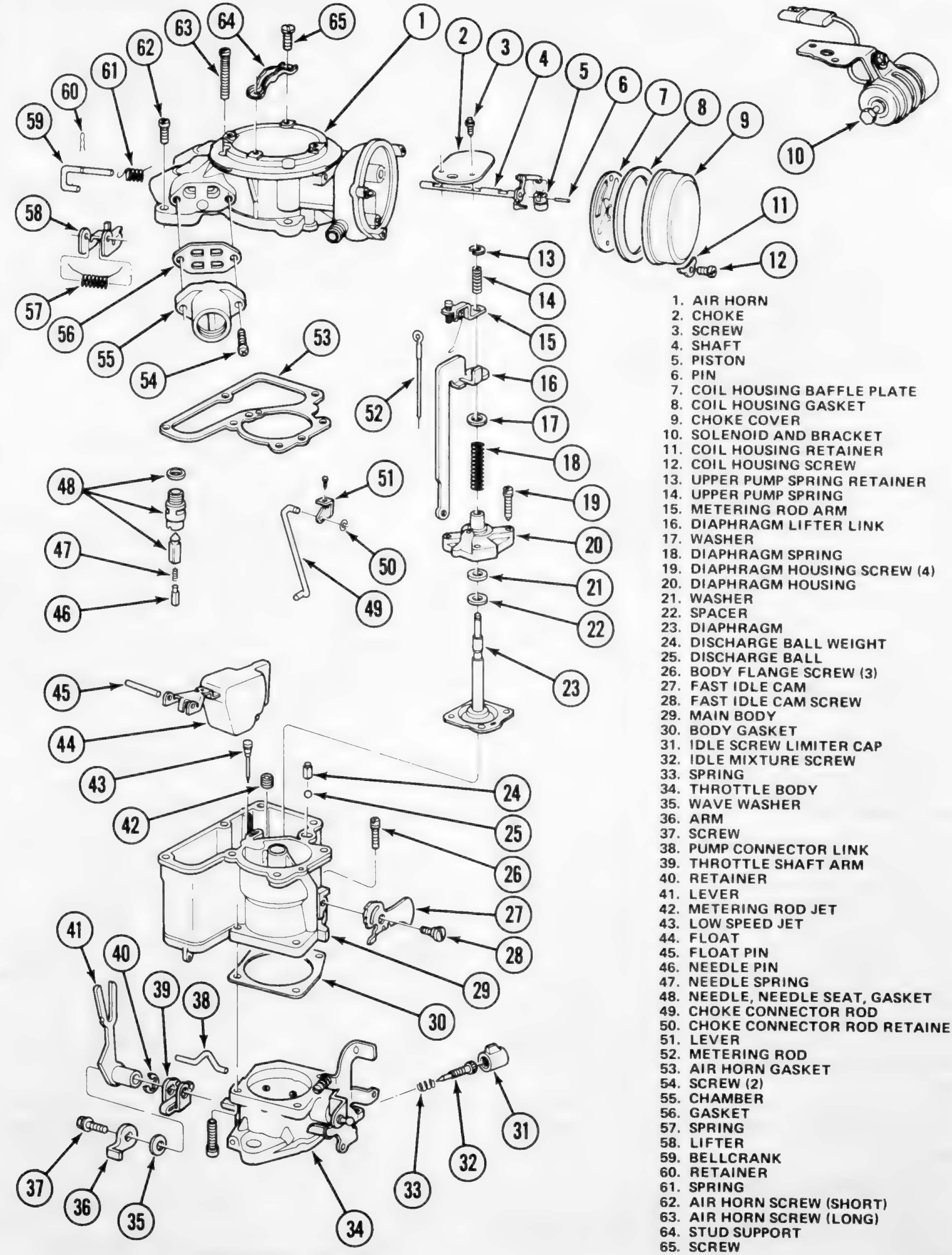


Fig. 1J-58 Model YF Carburetor with Altitude Compensation

The chamber assembly contains a threaded plug which opens the compensation circuit when turned counterclockwise to its outer seat (fig. 1J-60). When the plug is turned clockwise to its inner seat (about 2 1/2 turns), the compensation circuit is blocked.



1. AIR HORN
2. CHOKE
3. SCREW
4. SHAFT
5. PISTON
6. PIN
7. COIL HOUSING BAFFLE PLATE
8. COIL HOUSING GASKET
9. CHOKE COVER
10. SOLENOID AND BRACKET
11. COIL HOUSING RETAINER
12. COIL HOUSING SCREW
13. UPPER PUMP SPRING RETAINER
14. UPPER PUMP SPRING
15. METERING ROD ARM
16. DIAPHRAGM LIFTER LINK
17. WASHER
18. DIAPHRAGM SPRING
19. DIAPHRAGM HOUSING SCREW (4)
20. DIAPHRAGM HOUSING
21. WASHER
22. SPACER
23. DIAPHRAGM
24. DISCHARGE BALL WEIGHT
25. DISCHARGE BALL
26. BODY FLANGE SCREW (3)
27. FAST IDLE CAM
28. FAST IDLE CAM SCREW
29. MAIN BODY
30. BODY GASKET
31. IDLE SCREW LIMITER CAP
32. IDLE MIXTURE SCREW
33. SPRING
34. THROTTLE BODY
35. WAVE WASHER
36. ARM
37. SCREW
38. PUMP CONNECTOR LINK
39. THROTTLE SHAFT ARM
40. RETAINER
41. LEVER
42. METERING ROD JET
43. LOW SPEED JET
44. FLOAT
45. FLOAT PIN
46. NEEDLE PIN
47. NEEDLE SPRING
48. NEEDLE, NEEDLE SEAT, GASKET
49. CHOKE CONNECTOR ROD
50. CHOKE CONNECTOR ROD RETAINER
51. LEVER
52. METERING ROD
53. AIR HORN GASKET
54. SCREW (2)
55. CHAMBER
56. GASKET
57. SPRING
58. LIFTER
59. BELLCRANK
60. RETAINER
61. SPRING
62. AIR HORN SCREW (SHORT)
63. AIR HORN SCREW (LONG)
64. STUD SUPPORT
65. SCREW

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Fig. 1J-59 **Parts Identification—Carter Model YF with Altitude Compensation**

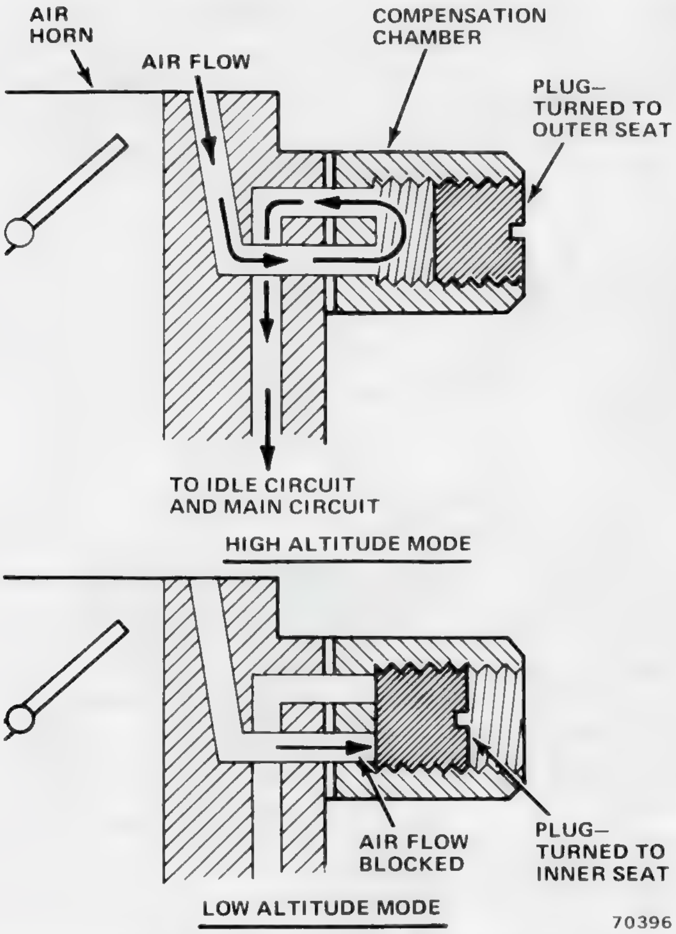

Fig. 1J-60 Compensator Plug Operation

Air that is admitted past the moveable plug flows through the chamber and into the air horn. Here, the airflow is channeled into two circuits, idle and main. Each circuit contains a pressed-in restrictor calibrated for the particular carburetor application.

Idle (Low Speed) Circuit

Air flows from the chamber, through the restrictor and into the compensation passage (fig. 1J-61). Fuel flowing from the float bowl is metered as it passes through the low-speed jet. The fuel is mixed with air which is metered through the bypass. The fuel-air mixture continues downward through the economizer. Below the economizer, the compensation circuit bleeds additional air into the mixture. Air is introduced at the idle port as in the conventional Model YF carburetor. The mixture is discharged below the throttle valve at the idle port opening and the idle mixture adjustment screw port.

The remainder of the idle circuit and transition to early part-throttle operation is identical to the conventional Model YF.

Main Metering (High Speed) Circuit

Fuel for most part-throttle and full-throttle operation is supplied through the main metering circuit (fig. 1J-62).

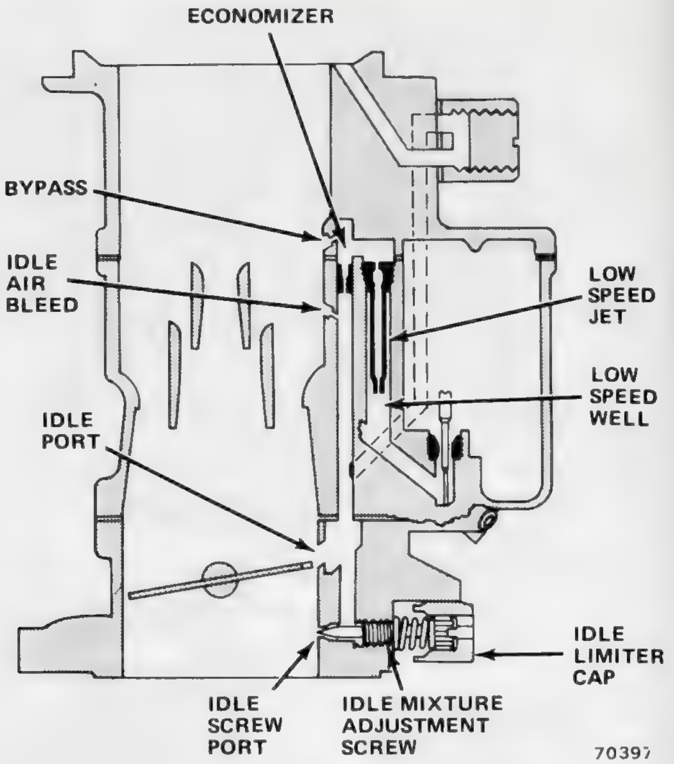

Fig. 1J-61 Compensation Circuit—Idle

As in the conventional Model YF, a metering rod is used to regulate the amount of fuel admitted to the main discharge nozzle. Mechanical and vacuum operation of the metering rod is not changed in any way. The altitude compensation circuit admits a metered amount of air bleed to the fuel as it flows from the metering rod jet up to the main discharge nozzle.

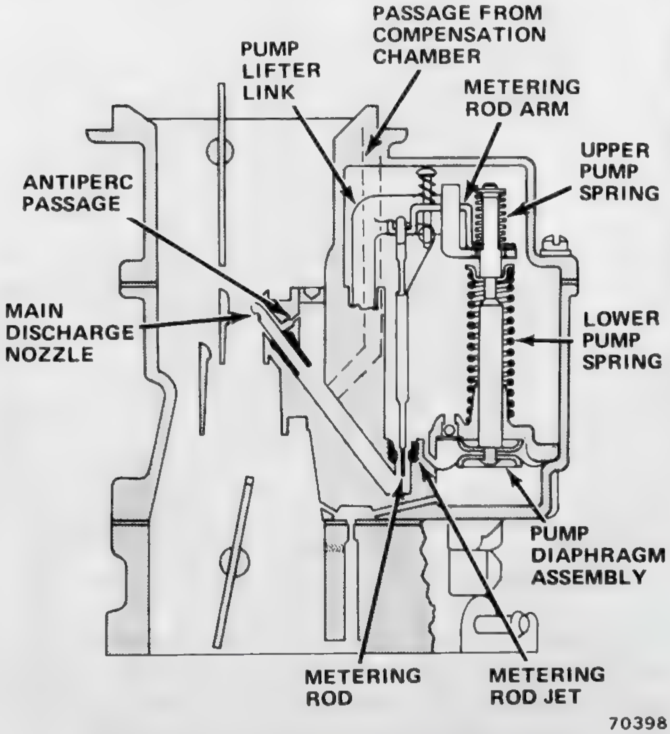

Fig. 1J-62 Compensation Circuit—Main Metering

CARBURETOR OVERHAUL

In addition to the conventional Model YF overhaul procedures, perform the following:

Disassembly

(1) Remove compensation chamber attaching screws.

(2) Remove chamber and gasket.

NOTE: *The restrictors are pressed into the air horn. Do not attempt to remove. The moveable plug is permanently installed in the chamber. Do not attempt to remove.*

Assembly

(1) Position chamber to air horn, using replacement gasket.

(2) Install attaching screws.

(3) Adjust moveable plug. Refer to Compensation Plug Adjustment.

SERVICE ADJUSTMENT PROCEDURES

In addition to the conventional Model YF adjustments, perform the following:

Compensation Plug Adjustment

The compensation plug has two positions, outer seat and inner seat.

NOTE: *Never adjust the plug to any position other than all the way in or all the way out.*

- Turn the plug **counterclockwise** to the outer seat for operation at altutudes above 4000 feet (fig. 1J-63).
- Turn the plug **clockwise** to the inner seat for operation at altitudes below 4000 feet.

Total travel from outer seat to inner seat is approximately 2 1/2 turns.

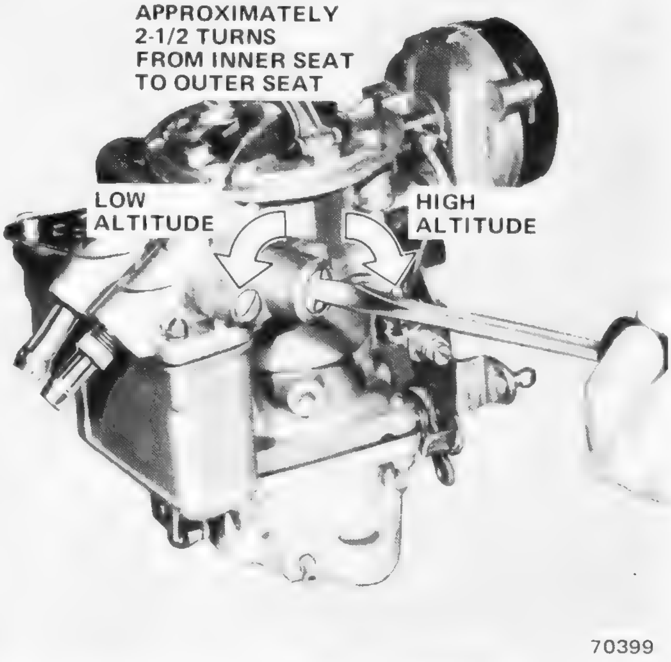

Fig. 1J-63 Compensator Adjustment

SPECIFICATIONS

Model YF with Altitude Compensation Carburetor Calibrations (Inches)

	7232	7233
Throttle Bore Size	1.687	1.687
Main Venturi Size	1.312	1.312
Fuel Inlet Diameter	0.0935	0.0935
Low Speed Jet	0.033	0.034
Bypass Air Bleed	0.0465	0.0465
Economizer	0.063	0.063
Idle Air Bleed	0.0465	0.0465
Metering Rod Jet Number	120-398	120-398
Metering Rod Jet Size	0.098	0.098
Metering Rod Number	75-2175	75-2209

	7232	7233
Step Up Limiter Shim	None	0.080
Nozzle Bleed	0.0635	0.0635
Anti-Perc Bleed	0.028	0.028
Pump Discharge Nozzle (Jet)	0.022	0.022
Vacuum Spark Port	0.052	0.052
Spark Port Location Above Closed Throttle	0.022	0.022
Choke Vacuum Restriction	0.089	0.089
Choke Heat Inlet (Brass Restriction)	0.078	0.078
Altitude Compensation Idle Bleed	0.022	0.026
Altitude Compensation Main Bleed	0.024	0.033

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Model YF with Altitude Compensation Carburetor Specifications

List Number	Application	Float Level		Float Drop	Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Choke Unloader	Fast Idle① Speed		Bowl Vent Starts To Open	Choke Bimetal ID
		Set To	OK Range		Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range		
7232	258 Automatic Altitude	0.476	0.444 to 0.508	1-3/8	0.221	0.201 to 0.241	0.201	0.185 to 0.217	2	1-1/2 to 2-1/2	0.275 min.	1600	1500 to 1700	3 Step	AJ
7233	258 Manual Altitude	0.476	0.444 to 0.508	1-3/8	0.221	0.201 to 0.241	0.201	0.185 to 0.217	1	1/2 to 1-1/2	0.275 min.	1500	1400 to 1600	3 Step	AJ

① Hot with TCS Solenoid and EGR Disconnected

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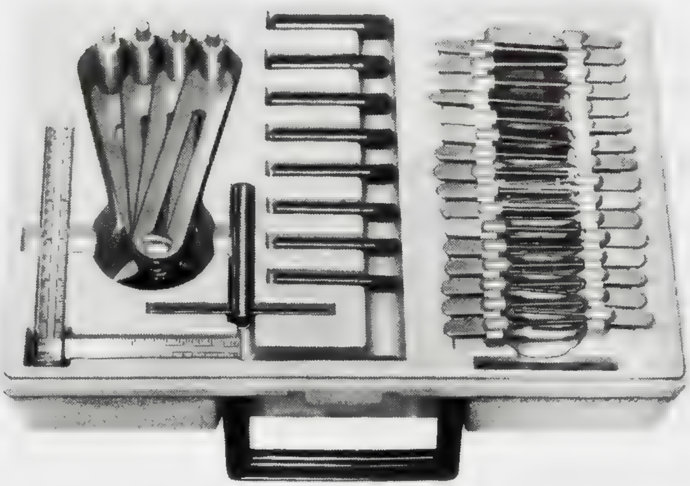
Special Tools

J-1137
BENDING TOOL



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CARBURETOR MODEL BBD-2 VENTURI

GENERAL

The Carter Model BBD two-venturi carburetor incorporates three lightweight aluminum assemblies, the air horn, main body and throttle body (fig. 1J-64).

The air horn contains the choke valve assembly, mechanical linkage for accelerator pump and metering rods and bowl vent mechanism.

The main body contains fuel bowl, accelerator pump, vacuum piston and metering rod assembly, venturi assembly and solenoid, if equipped.

The throttle body contains throttle valves and levers, choke housing, choke vacuum diaphragm and idle mixture screws.

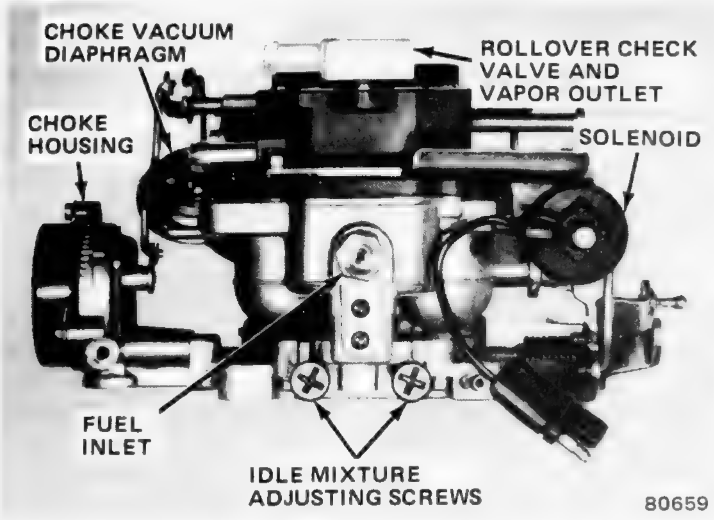


Fig. 1J-64 Model BBD Carburetor Assembly

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used). The tag is attached to the carburetor and must remain with the carburetor to assure proper identification (fig. 1J-65).

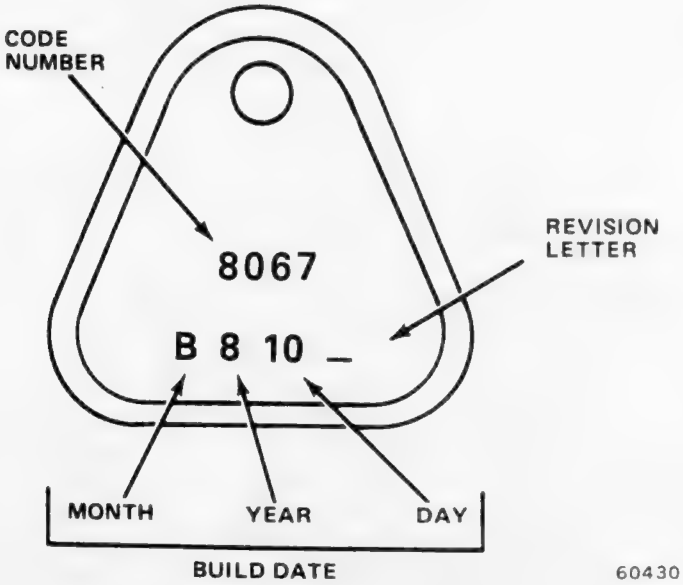


Fig. 1J-65 Identification Tag

CARBURETOR CIRCUITS

Five conventional circuits are used: Float (Fuel Inlet) Circuit, Idle (Low Speed) Circuit, Main (High Speed) Circuit, Pump Circuit and Choke Circuit.

Float (Fuel Inlet) Circuit

The float circuit maintains the specified fuel level in the bowl to provide sufficient fuel to metering circuits for all engine operating conditions (fig. 1J-66).

Fuel flows into the bowl through a needle and seat assembly controlled directly by dual floats hinged to the float fulcrum pin.

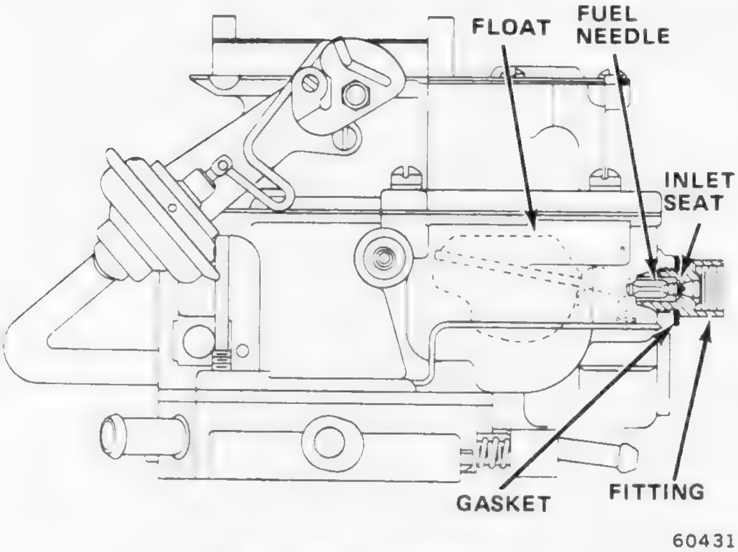


Fig. 1J-66 Float Circuit

When the fuel in the bowl fills to the proper level, the float lever pushes the needle toward its seat and restricts incoming fuel, admitting only enough to replace that being used.

The BBD carburetor vents externally to the charcoal canister through two fittings. The plastic fitting on the bowl cover plate contains a vapor pressure relief valve which opens to vent bowl vapor whenever pressure becomes great enough. A rollover check valve in this fitting closes the vapor line in case of a rollover accident.

The second bowl vent is mechanically actuated by the throttle shaft (fig. 1J-67). Whenever the throttle is at idle, the accelerator link is moved to maximum travel to draw fuel into the accelerator pump. A lobe on the pump lifter link contacts the bowl vent and opens it, allowing fuel vapors to flow freely.

Both bowl vents are connected by a T-fitting to the canister inlet hose.

Idle (Low Speed) Circuit

Fuel for idle and early part-throttle operation is metered through the idle circuit.

Fuel flows through main metering jets into the main wells and continues through the idle fuel pickup tube where fuel mixes with air entering through idle air bleeds located in the venturi cluster screws (fig. 1J-68).

At curb idle, this fuel-air mixture flows down the idle channel and is further mixed with air entering the idle channel through the transfer slot which is above the position of the throttle valve at curb idle. The mixture

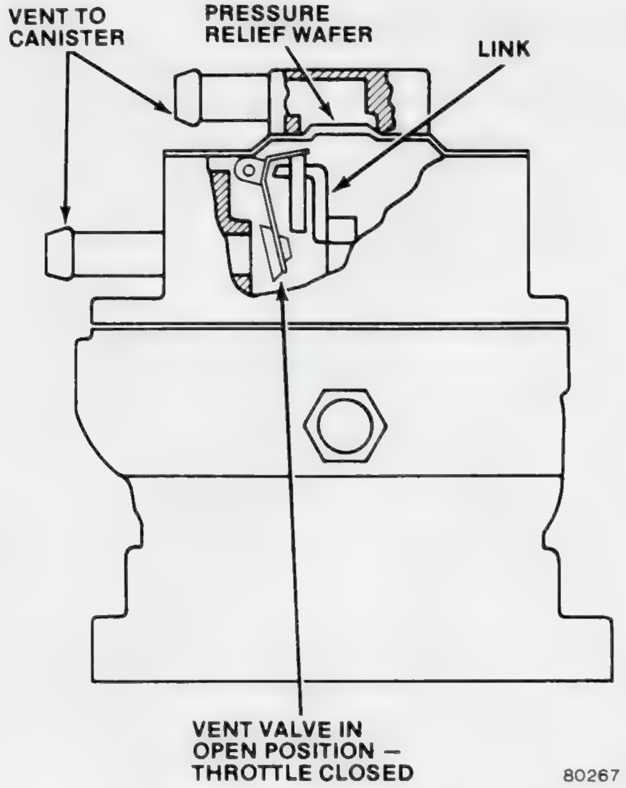


Fig. 1J-67 External Bowl Vent

then passes the idle mixture adjustment screw which controls the volume of mixture discharged below the throttle valve.

During low speed operation, the throttle valve moves to expose the transfer slot as well as the idle port. This increased airflow creates low pressure in the venturi and the main metering system begins to discharge fuel.

Main (High Speed) Metering Circuit

At part throttle and cruising speed, increased airflow through the venturi creates a low pressure area in the venturi. Since air above the fuel level in the bowl is at normal pressure, fuel flows to the lower pressure area created by the venturi and magnified by the booster venturi.

The fuel flow moves through the main jets to the main well. Air enters through the main well air bleeds. The resulting mixture of fuel and air is lighter than raw fuel, responds more quickly to changes in venturi vacuum, and is more readily vaporized when discharged into the venturi (fig. 1J-69).

Power Enrichment Circuit

During heavy road load or high speed operation, the fuel-air ratio must be enriched to provide increased engine power.

Power enrichment is accomplished by means of two calibrated metering rods yoked to a single manifold vacuum actuated piston (fig. 1J-69). The metering rod piston rides on a calibrated spring which attempts to keep the piston at the top of its cylinder. This allows only the smallest diameter of the tapered metering rods to extend into the main metering jets and permits maximum fuel flow through the jets to the main well cavities.

At idle, part throttle or cruise conditions when manifold vacuum is high, the piston is drawn down into the vacuum cylinder against calibrated spring tension and the larger diameters of the metering rods extend into the main metering jets, restricting the fuel flow to the main well cavities. An additional control is provided by

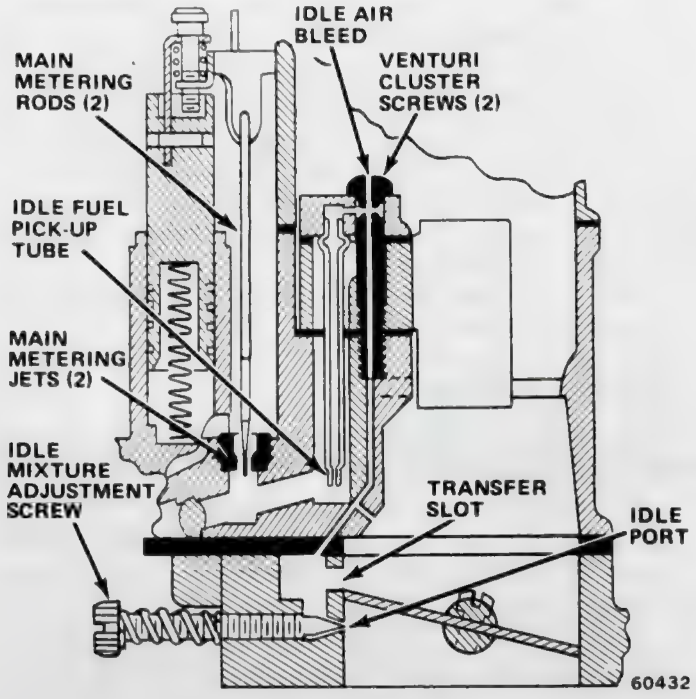


Fig. 1J-68 Idle Circuit

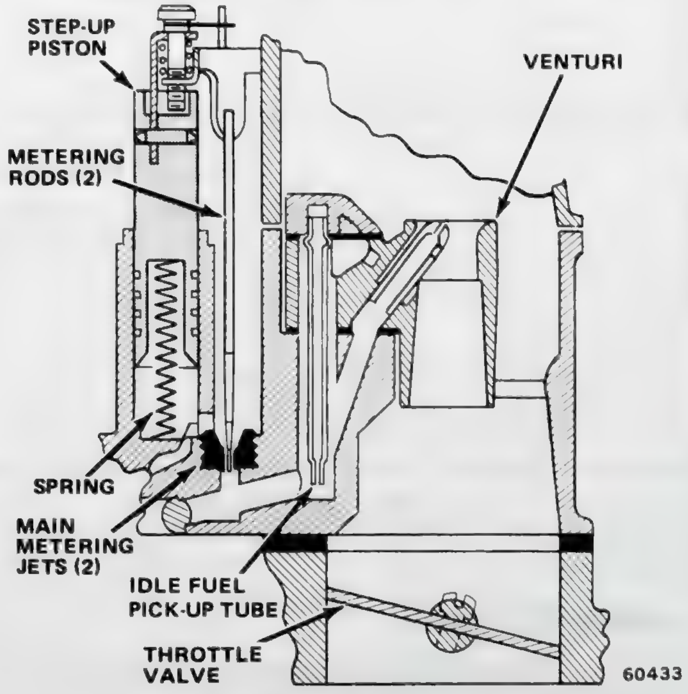


Fig. 1J-69 Main Metering Circuit

the rod lifter on the accelerator pump rod. This provides a direct relationship between metering rod position and throttle valve opening.

Pump Circuit

When the throttle is opened suddenly, airflow response through the carburetor is almost immediate. There is a brief time lag before fuel inertia can be overcome. This lag causes the desired fuel-air ratio to be leaned out.

A piston-type accelerator pump system mechanically supplies the fuel necessary to overcome this deficiency (fig. 1J-70).

Fuel is drawn into the pump cylinder from the fuel bowl through a port and check ball in the bottom of the pump well below the pump piston. When the engine is turned off, fuel vapors in the pump cylinder vent through the area between the pump rod and pump piston.

As the throttle lever is moved, the pump link operates through a system of levers to push the pump piston down, assisted by the pump drive spring. Fuel is forced through a passage, past the pump discharge check ball, and out the pump discharge jets in the venturi cluster.

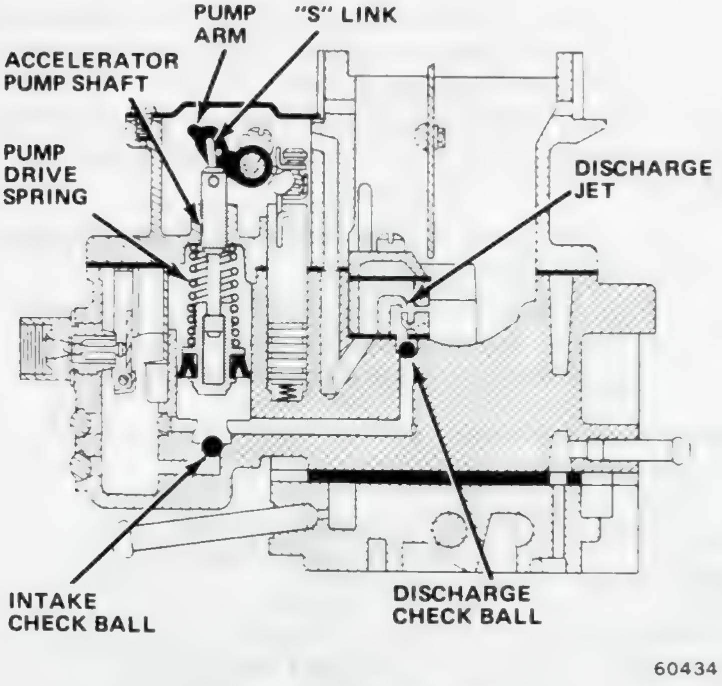


Fig. 1J-70 Pump Circuit

Choke Circuit

The choke valve, located in the air horn assembly, provides a high vacuum both above and below the throttle valves when closed. During cranking, vacuum above the throttle valve causes fuel to flow from the main metering and idle circuits and provides the richer fuel-air ratio needed for cold engine starting (fig. 1J-71).

The choke shaft is connected by linkage to a thermostatic coil within the choke cover, which winds up when cold and unwinds when heated. When the engine is cold, the tension of the thermostatic coil holds the choke valve closed. When the engine starts, manifold vacuum is applied to the diaphragm assembly to open the choke valve slightly. This is called the initial choke valve clearance.

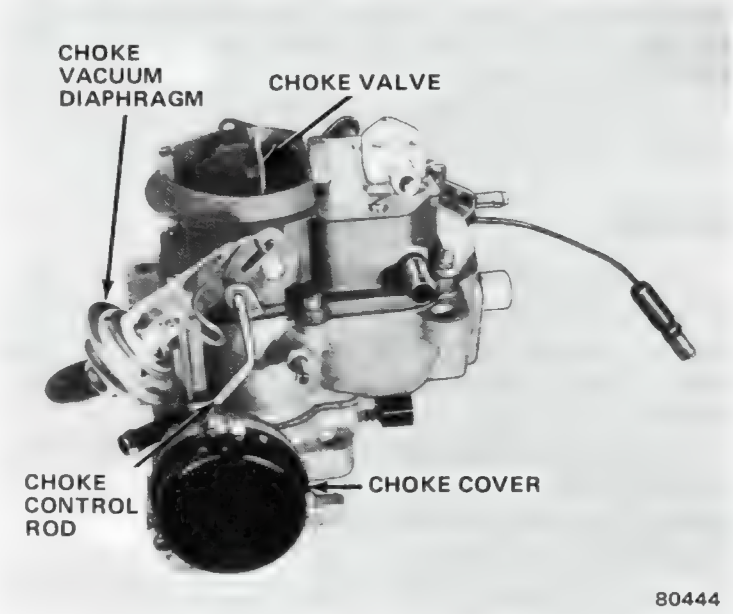


Fig. 1J-71 Choke Components

As the thermostatic coil is warmed by air rising through the heat tube from the exhaust manifold, the coil expands and exerts pressure to further open the choke valve, keeping it fully open at operating temperature.

If the engine is accelerated during the warm-up period, the corresponding drop in the manifold vacuum allows the thermostatic coil to momentarily close the choke valve to provide a richer mixture.

A faster idle speed is provided to prevent stalling during warm-up. The fast idle cam, actuated by the choke shaft through connecting linkage, rotates into position against the fast idle screw. The cam is progressively stepped to provide the correct idle setting in proportion to the choke valve opening. When the choke valve reaches its fully open position, the cam rotates free of the fast idle screw, allowing the throttle lever to return to curb idle position when released.

If the engine floods during starting, the choke valve may be opened to vent excess fuel by depressing the accelerator pedal to the floor and cranking the engine. With the accelerator linkage in this position, a tang on the throttle lever contacts the fast idle cam, causing the choke rod to move upward to open the choke valve a predetermined distance.

CARBURETOR REPLACEMENT

Removal

(1) Remove air cleaner.

(2) Code all lines attached to carburetor for aid during installation.

(3) Remove accelerator cable from accelerator lever and disconnect vacuum hoses, return spring, choke clean air tube, PCV hose, fuel line, choke heat tube and solenoid wire, if equipped.

(4) Remove carburetor retaining nuts. Remove carburetor. Remove carburetor gasket from spacer.

Installation

(1) Clean gasket mounting surface of spacer. Position carburetor on spacer and gasket and install nuts. To prevent leakage, distortion or damage to carburetor body flange, alternately tighten nuts in crisscross pattern.

(2) Connect fuel line, throttle cable, choke heat tube, PCV hose, return spring, choke clean air tube, all vacuum hoses and solenoid wire, if equipped.

(3) Install air cleaner.

(4) Adjust engine idle speed, idle fuel mixture and solenoid. Refer to Chapter 1A—General Service and Diagnosis.

CARBURETOR OVERHAUL

The following procedures apply to complete overhaul with the carburetor removed from the engine.

A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine. Refer to Service Adjustment Procedures.

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection and replacement of all gaskets and worn or damaged parts. It also includes idle adjustment, mixture adjustment and fast idle adjustment after the carburetor is installed. Refer to figure 1J-72 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in the kit.*

NOTE: *Flooding, stumble on acceleration, and other performance problems are in many instances caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the bowl contents for contamination as the carburetor is disassembled.*

Carburetor Disassembly

(1) Place carburetor on repair stand to protect throttle valves from damage and to provide stable work base.

(2) Remove retaining clip from accelerator pump arm link and remove link (fig. 1J-73).

(3) Remove cover and gasket from top of air horn.

(4) Remove screws and locks from accelerator pump arm and vacuum piston rod lifter. Slide pump lever out of air horn. Remove pump arm and rod lifter. Lift vacuum piston and metering rods straight up and out of air horn as assembly. Remove vacuum piston spring (fig. 1J-74).

(5) If main body is to be immersed in cleaning solution, perform following steps:

(a) Rotate bowl vent assembly up out of bowl as far as possible to gain access to rubber valve seal.

(b) Carefully remove valve seal from lever.

Parts Identification—Model BBD

1. DIAPHRAGM CONNECTOR LINK
2. SCREW
3. CHOKE VACUUM DIAPHRAGM
4. HOSE
5. VALVE
6. METERING ROD
7. S-LINK
8. PUMP ARM
9. GASKET
10. ROLLOVER CHECK VALVE
11. SCREW
12. LOCK
13. ROD LIFTER
14. BRACKET
15. NUT
16. SOLENOID
17. SCREW
18. AIR HORN RETAINING SCREW (SHORT)
19. AIR HORN RETAINING SCREW (LONG)
20. PUMP LEVER
21. VENTURI CLUSTER SCREW
22. IDLE FUEL PICK-UP TUBE
23. GASKET
24. VENTURI CLUSTER
25. GASKET
26. CHECK BALL (SMALL)
27. FLOAT
28. FULCRUM PIN
29. BAFFLE
30. CLIP
31. CHOKE LINK
32. SCREW
33. FAST IDLE CAM
34. GASKET
35. THERMOSTATIC CHOKE SHAFT
36. SPRING
37. SCREW
38. PUMP LINK
39. CLIP
40. GASKET
41. LIMITER CAP
42. SCREW
43. THROTTLE BODY
44. CHOKE HOUSING
45. BAFFLE
46. GASKET
47. RETAINER
48. CHOKE COIL
49. LEVER
50. CHOKE ROD
51. CLIP
52. NEEDLE AND SEAT ASSEMBLY
53. MAIN BODY
54. MAIN METERING JET
55. CHECK BALL (LARGE)
56. ACCELERATOR PUMP PLUNGER
57. FULCRUM PIN RETAINER
58. GASKET
59. SPRING
60. AIR HORN
61. LEVER

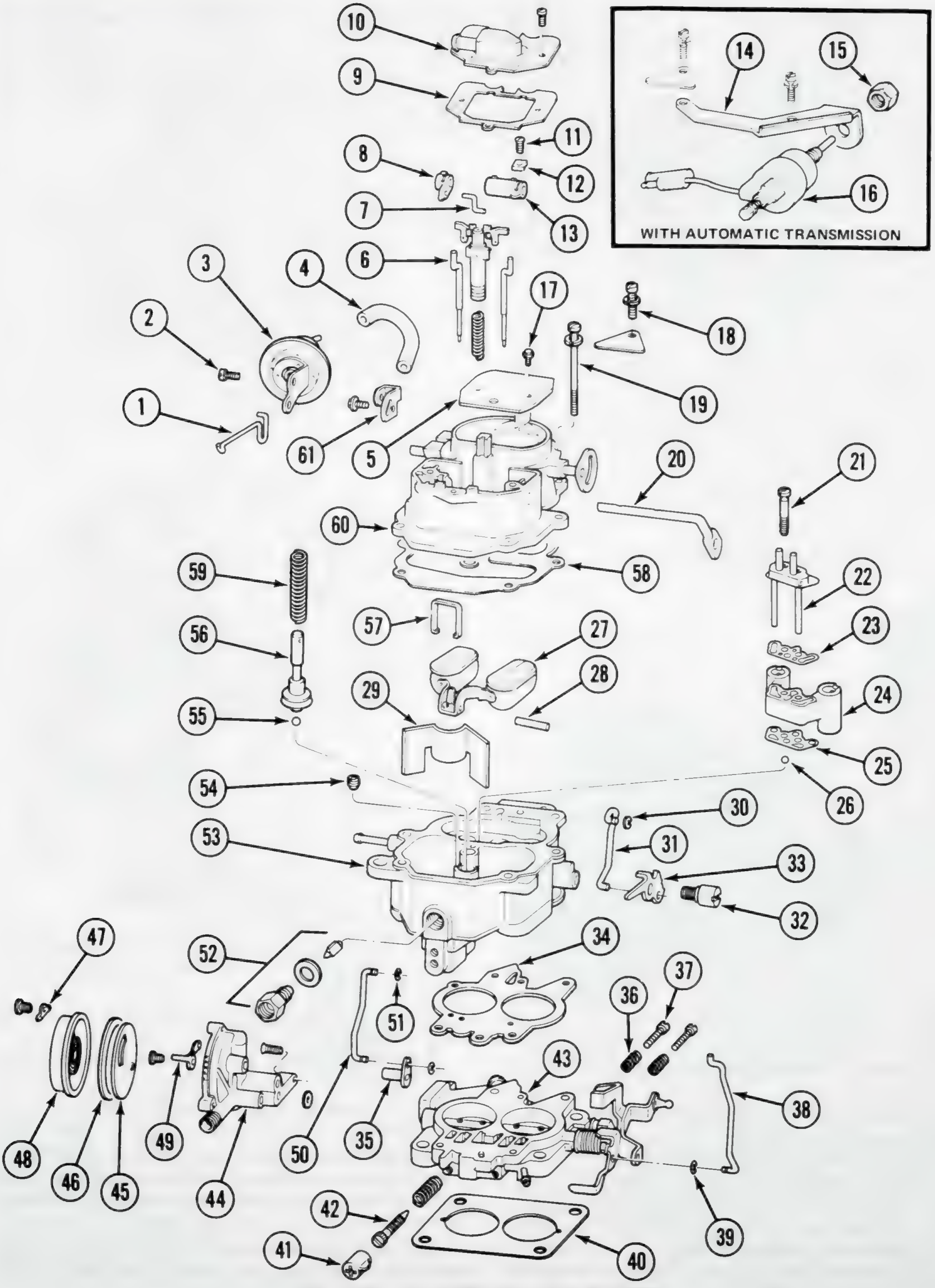


Fig. 1J-72 Parts Identification—Carter Model BBD

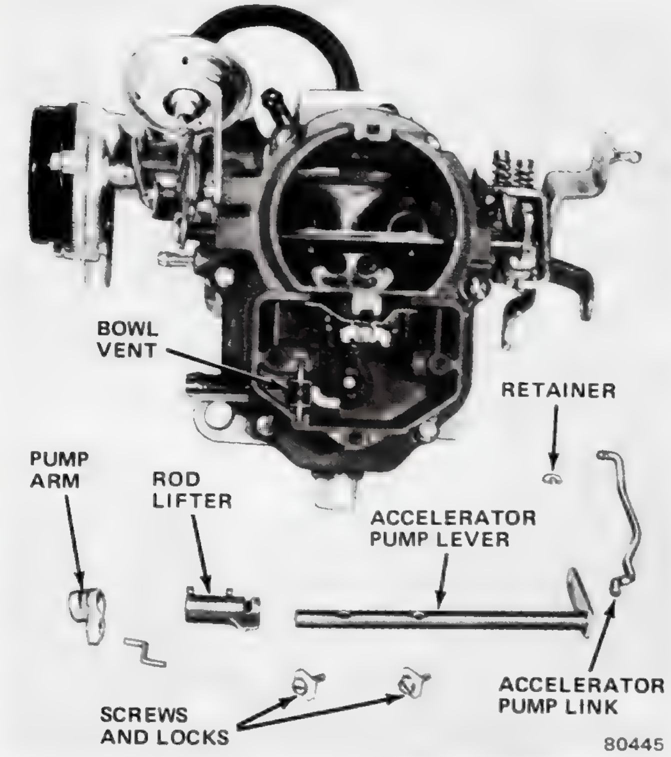


Fig. 1J-73 Accelerator Pump and Lever

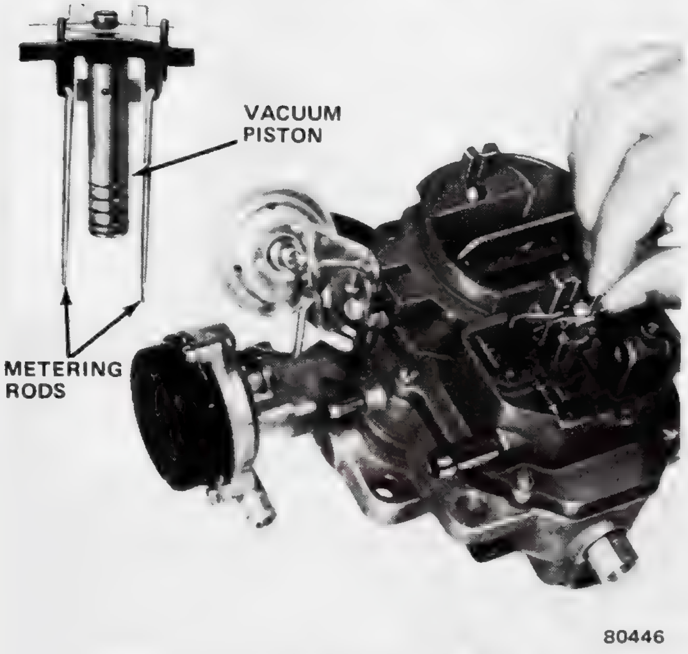


Fig. 1J-74 Removing Piston and Metering Rods

(6) Disconnect clips and remove link from choke housing lever and choke lever.

(7) Remove screw and lever from choke shaft.

(8) Remove vacuum hose between carburetor main body and choke vacuum diaphragm. Remove choke diaphragm, linkage and bracket assembly. Place diaphragm aside to be cleaned separately.

(9) Remove fast idle cam retaining screw. Remove fast idle cam, linkage and clip.

(10) Remove choke housing cover, retainers and screws. Remove gasket and baffle.

(11) Remove choke housing from throttle body.

(12) Remove air horn retaining screws and lift air horn straight up away from main body. Remove solenoid, if equipped. Discard gasket (fig. 1J-75).

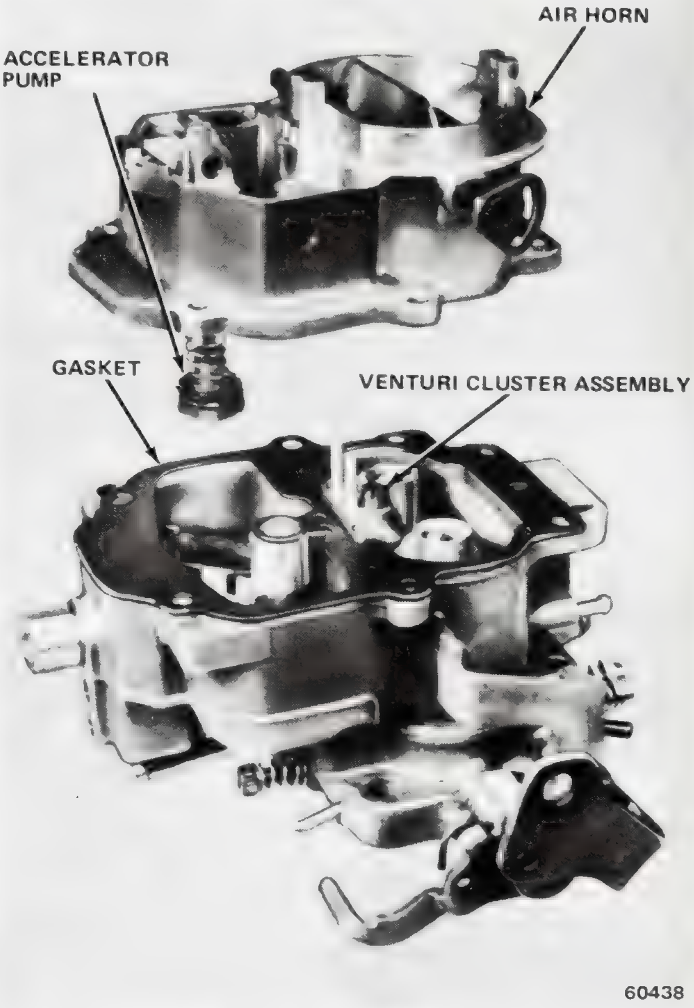


Fig. 1J-75 Removing Air Horn

(13) Invert air horn and compress accelerator pump drive spring. Remove S-link from pump shaft. Remove pump assembly.

(14) Remove fuel inlet needle valve, seat and gasket from main body.

(15) Lift out float fulcrum pin retainer and baffle. Lift out floats and fulcrum pin (fig. 1J-76).

(16) Remove main metering jets (fig. 1J-77).

(17) Remove venturi cluster screws. Lift venturi cluster and gaskets away from main body. Discard gaskets. Do not remove idle orifice tubes or main vent tubes from cluster. Clean tubes in solvent and dry with compressed air.

(18) Invert carburetor main body and drop out accelerator pump discharge and intake check balls (fig. 1J-78).

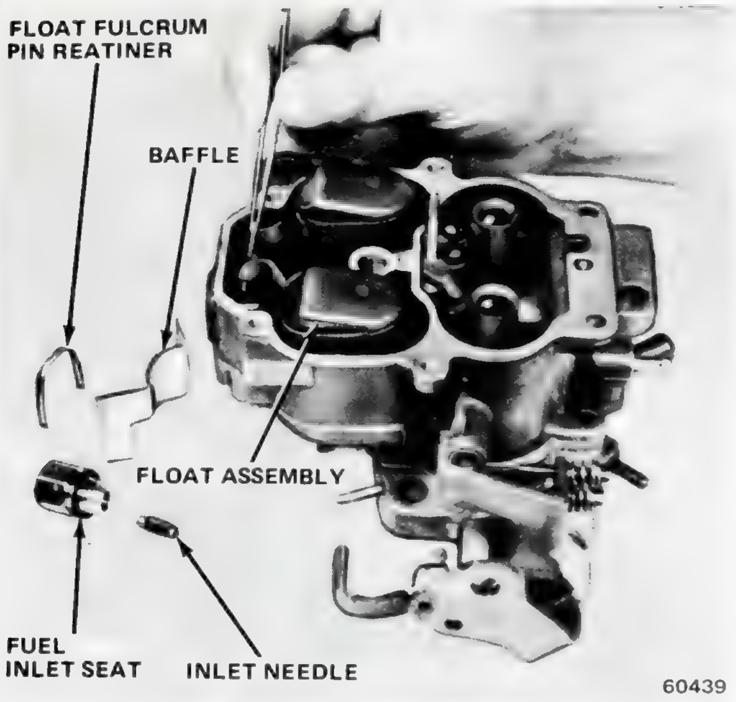


Fig. 1J-76 Float Assembly

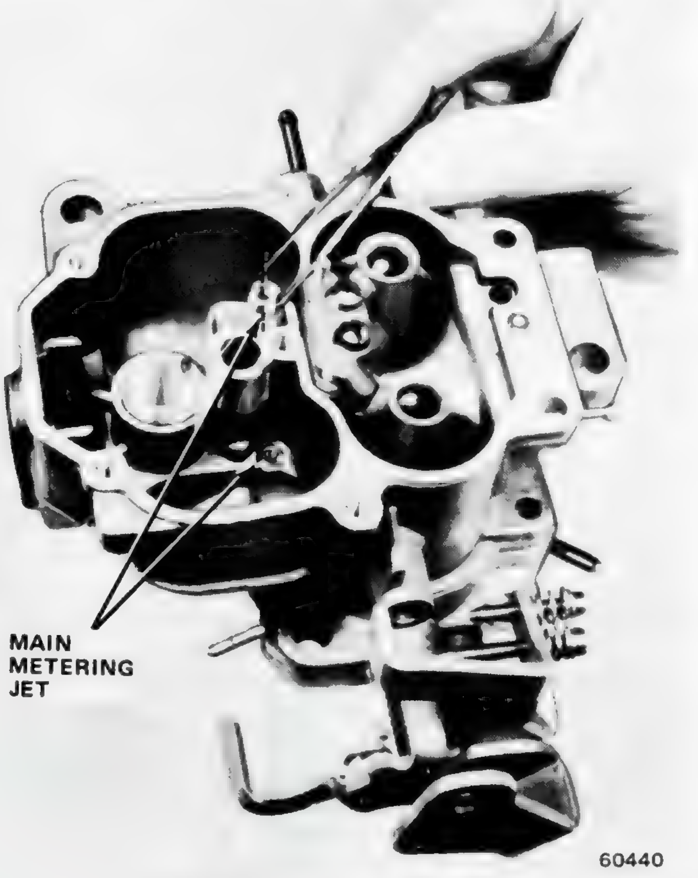


Fig. 1J-77 Main Metering Jets

(19) Turn idle limiter caps to stop. Remove plastic limiter caps from idle air mixture screws by carefully turning No. 10 sheet metal screw into center of cap. Alternately, cut through limiters with soldering gun and pry off. Count number of turns required to seat each screw and make note for use during assembly. Remove screws and springs from throttle body.

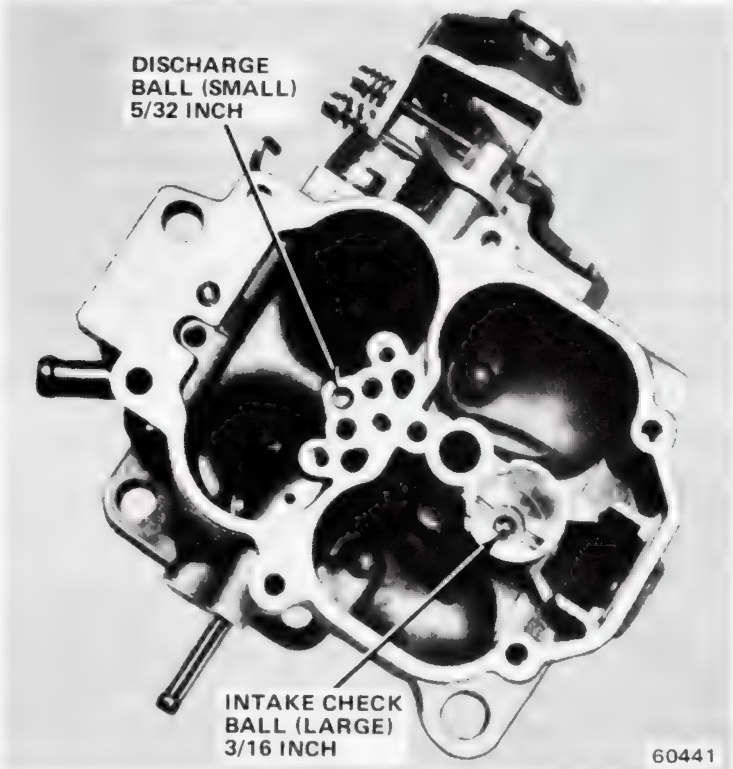


Fig. 1J-78 Check Ball Location

(20) Remove screws attaching throttle body to main body and separate bodies. Discard gasket.

Cleaning and Inspection

Dirt, gum, water or carbon contamination in the carburetor or on exterior moving parts is often responsible for unsatisfactory performance. Efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection procedures here do not cover those parts included in the carburetor overhaul repair kit. Install all gaskets and parts included in the repair kit when the carburetor is assembled. Discard original gaskets and parts.

Wash all parts except vacuum diaphragm and bowl vent seal in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, use mineral spirits, lacquer thinner or denatured alcohol.

If commercial solvent is used, rinse the parts in hot water to remove all traces of the cleaning solvent, then blow dry with compressed air. Wipe the parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon and other foreign matter are removed from all parts.

Force compressed air through all carburetor passages.

CAUTION: *Do not use a wire brush to clean any part. Do not use a drill or wire to clean out openings or passages. This may enlarge the passages and change the calibration of the carburetor.*

Check the choke shaft for excessive looseness or binding. Inspect the choke valve for nicked edges and for ease of operation. Check the throttle shaft for excessive looseness or binding in its bore. Check throttle valve for burrs or nicks which might prevent proper closing. Inspect the main body, throttle body, air horn, venturi assemblies, choke housing and choke cover for cracks.

Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace float shaft if worn. Replace all damaged screws and nuts and all distorted or broken springs. Inspect all gasket mating surfaces for nicks or burrs. Replace any parts that have damaged gasket surfaces.

Assembly

NOTE: *Be sure all holes in the replacement gaskets have been properly punched and that no foreign material has adhered to gaskets.*

(1) Install idle mixture screws and springs in body. Do not use screwdriver. Turn screws lightly against seats with fingers. Back off same number of turns counted at disassembly. Do not install plastic limiter caps at this time.

(2) Invert main body, place throttle body on main body and align. Install screws and tighten securely.

(3) Install accelerator pump discharge check ball (5/32-inch diameter) in discharge passage and accelerator pump intake check ball (3/16-inch diameter) into bottom of pump cylinder.

(4) Check accelerator pump system. Pour clean gasoline into carburetor bowl 1/2 inch deep. Insert pump piston into pump cylinder and work piston up and down gently to expel air from pump passage. With suitable clean brass rod, hold discharge check valve firmly against its seat. Raise piston and press down. No fuel should be emitted from either intake or discharge passages (fig. 1J-79).

(5) Clean passages and ball seats if leakage is evident. If leakage persists, replace main body.

(6) Install replacement gaskets on venturi cluster, install cluster screws and tighten securely.

(7) Install main metering jets.

(8) Install floats with fulcrum pin and pin retainer in main body. Install needle, seat and gasket and tighten securely. Adjust float level. Refer to Service Adjustment Procedures. Install baffle plate.

(9) Place accelerator pump drive spring on pump plunger shaft and insert shaft into air horn. Compress spring and insert S-link.

(10) Place vacuum piston spring in vacuum piston bore. Position replacement gasket on main body and install air horn. Install solenoid, if equipped. Tighten retaining screws alternately to compress gasket evenly.

(11) Check vacuum piston gap. Refer to Service Adjustment Procedures. Carefully install vacuum piston and metering rod assembly into its bore in air horn. Be sure metering rods are in main metering jets. Be sure metering rod springs are installed properly (fig. 1J-80).

(12) Rotate bowl vent assembly up out of bowl and install vent seal, if removed.

(13) Place two lifting tangs of plastic rod lifter under piston yoke. Slide shaft of accelerator pump lever through rod lifter and pump arm. Install locks and adjusting screws, but do not tighten.

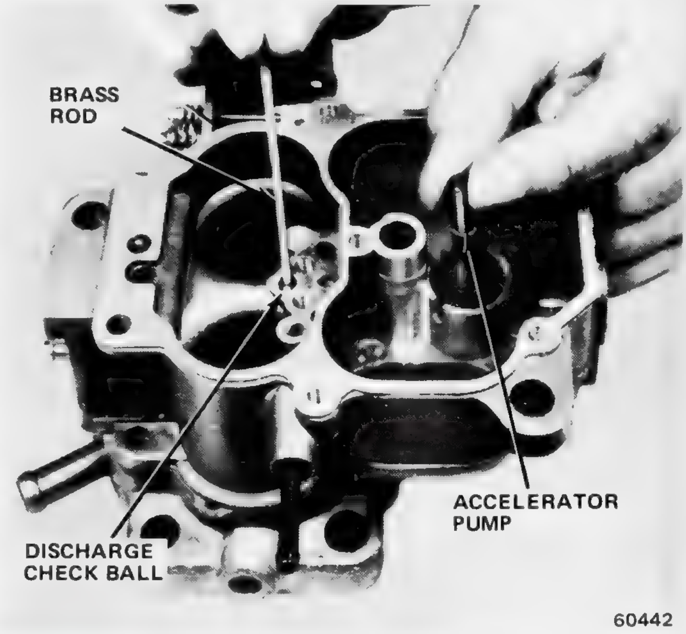


Fig. 1J-79 Accelerator Pump Check

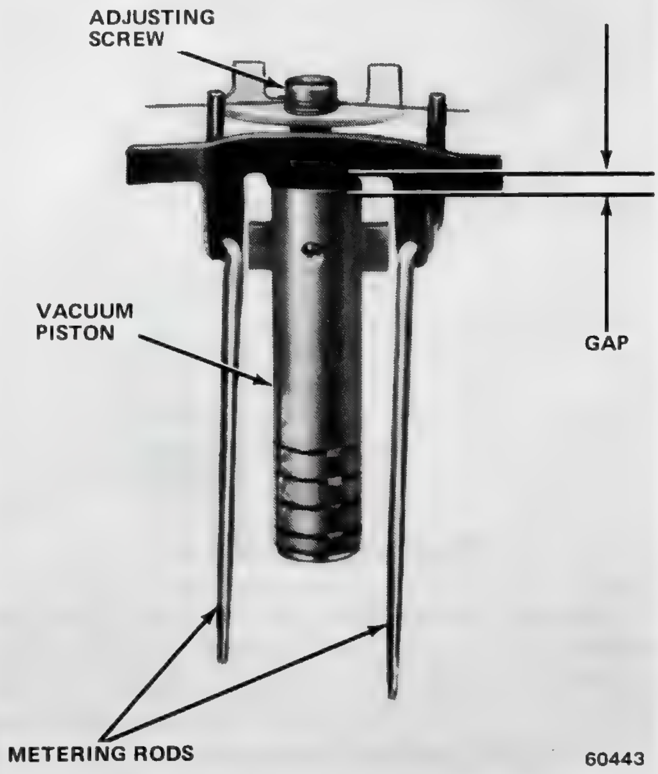


Fig. 1J-80 Vacuum Piston and Metering Rod Assembly

(14) Install fast idle cam and linkage. Tighten retaining screw securely.

(15) Connect accelerator pump linkage to pump lever and throttle lever. Install retaining clip.

(16) Adjust vacuum piston and accelerator pump. Adjust bowl vent. Refer to Service Adjustment Procedures.

(17) Install rollover check valve, using replacement gasket.

(18) Install diaphragm assembly and secure with attaching screws. Do not connect vacuum hose to diaphragm fitting until initial choke valve clearance has been set. Refer to Service Adjustment Procedures.

(19) Engage diaphragm link with slot in choke lever. Install choke lever and screw to choke shaft.

(20) Install choke housing to throttle body.

(21) Install baffle, gasket and cover on housing. Turn cover 1/4 turn rich (clockwise) and tighten one screw.

(22) Install link and retainer between choke lever and choke housing lever.

(23) Install link and retainer to fast idle cam and choke lever.

(24) Adjust initial choke valve clearance. Refer to Service Adjustment Procedures.

(25) Adjust fast idle cam clearance. Refer to Service Adjustment Procedures.

(26) Adjust choke unloader clearance. Refer to Service Adjustment Procedures.

(27) Loosen choke cover screw and set cover index to specification. Tighten all cover screws.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment

(1) Remove air horn.

(2) Hold float **gently** against needle to raise float (fig. 1J-81).

(3) Place straightedge across float bowl to measure float level. Refer to Specifications.

(4) If adjustment is necessary, release floats and bend float lever.

CAUTION: *Never bend float lever while it is resting against needle. Pressure may damage synthetic tip and cause a false setting.*

(5) Install air horn.

Vacuum Piston Gap Adjustment

The vacuum piston gap is a critical adjustment (fig. 1J-80). Turning the adjusting screw clockwise makes the fuel mixture richer. Turning the adjusting screw counterclockwise makes the fuel mixture leaner. Turn adjusting screw to set gap. Refer to Specifications.

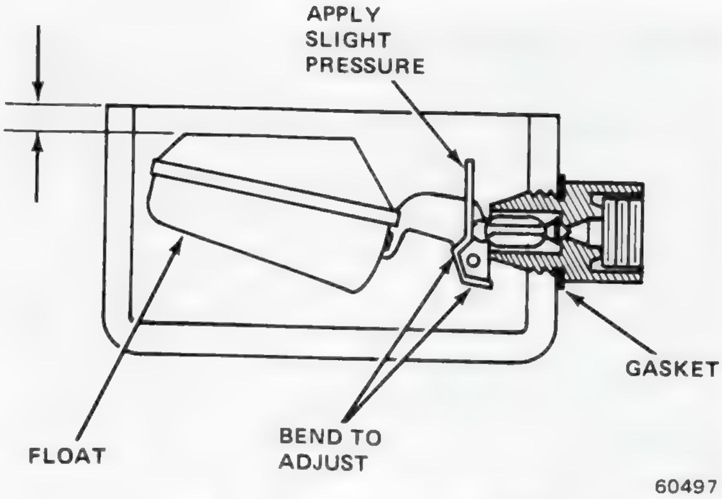


Fig. 1J-81 Float Level Adjustment

Vacuum Piston Adjustment

(1) Adjust gap in vacuum piston to specifications as described above.

(2) Back off curb idle adjustment until throttle valves are completely closed. Count number of turns so screw can be returned to original position. Turn idle screw in until it just contacts stop, then turn in one full turn.

(3) Fully depress vacuum piston while holding moderate pressure on rod lifter tab. While in this position, tighten rod lifter lock screw (fig. 1J-82).

(4) Release piston and rod lifter.

(5) Adjust accelerator pump as outlined below.

(6) Return curb idle screw to its original position.

(7) Install dust cover.

Fig. 1J-82 Vacuum Piston Adjustment

Accelerator Pump Adjustment

(1) Remove dust cover.

(2) Back off curb idle speed adjusting screw to completely close throttle valve. Open choke valve so fast idle cam allows throttle valves to seat in bores.

(3) Turn curb idle adjusting screw in until it just contacts stop. Then continue two complete turns.

(4) Measure distance between surface of air horn and top of accelerator pump shaft (fig. 1J-83). Refer to Specifications for correct dimension.

(5) Loosen pump arm adjusting lock screw and rotate sleeve to adjust pump travel to proper measurement. Tighten lock screw.

(6) Install dust cover.

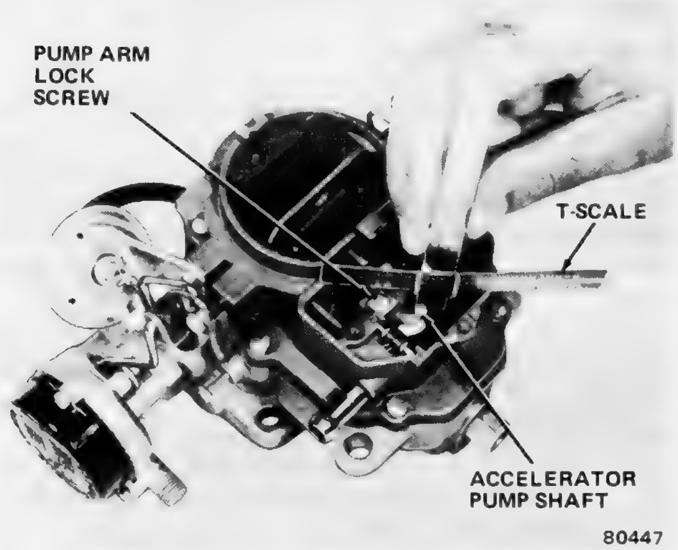


Fig. 1J-83 Accelerator Pump Adjustment

Initial Choke Valve Clearance Adjustment

(1) Loosen choke cover and turn 1/4 turn rich. Tighten one retaining screw.

(2) Open throttle valve slightly and place fast idle screw on high step of cam.

(3) Use Tool J-23738 or any vacuum source which holds at least 19 inches of mercury (Hg) to pull in diaphragm against stop.

(4) Measure clearance between choke plate and air horn wall. Refer to Specifications.

(5) Adjust clearance by bending diaphragm connector link (fig. 1J-84).

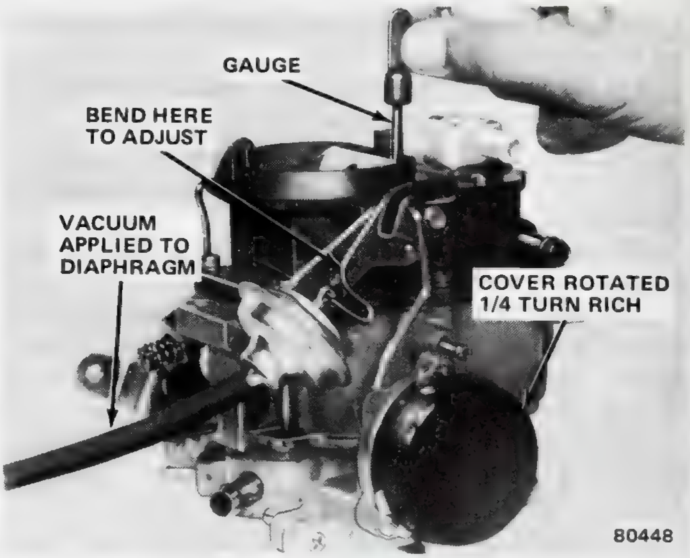


Fig. 1J-84 Initial Choke Valve Clearance

Fast Idle Cam Position Adjustment

(1) Loosen choke housing cover and turn 1/4 turn rich. Tighten one retaining screw.

(2) Open throttle slightly and place fast idle screw on second step of cam.

(3) Measure distance between choke plate and air horn wall (fig. 1J-85). Refer to Specifications for correct dimension.

(4) Adjust by bending fast idle cam link down to increase measurement or up to decrease measurement.

(5) Loosen housing cover screw. Set index to specifications. Tighten all housing retaining screws.

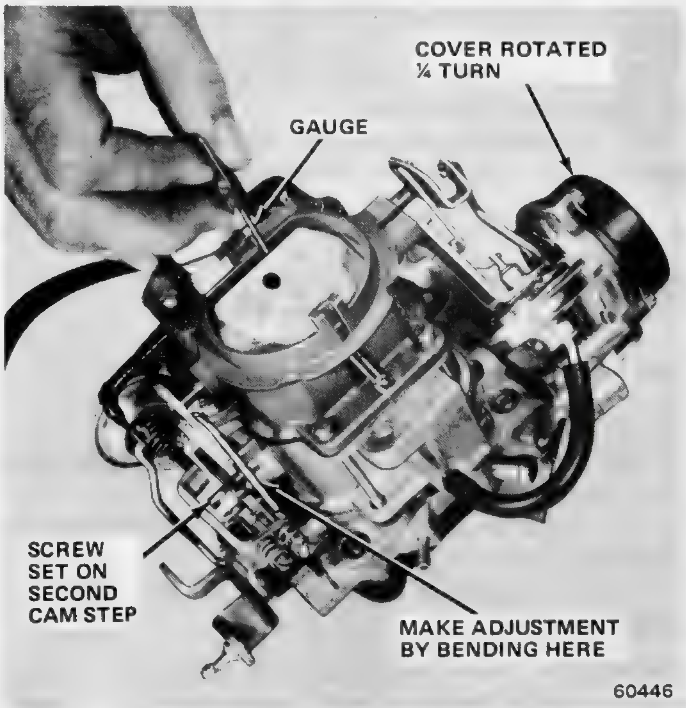


Fig. 1J-85 Fast Idle Cam Adjustment

Choke Unloader Adjustment

(1) Hold throttle wide open (fig. 1J-86).

(2) Insert gauge and apply light pressure to close choke plate.

(3) Measure distance between choke plate and air horn wall. Refer to Specifications.

(4) Adjust by bending unloader tang. Do not bend tang so that it binds or interferes with any other part.

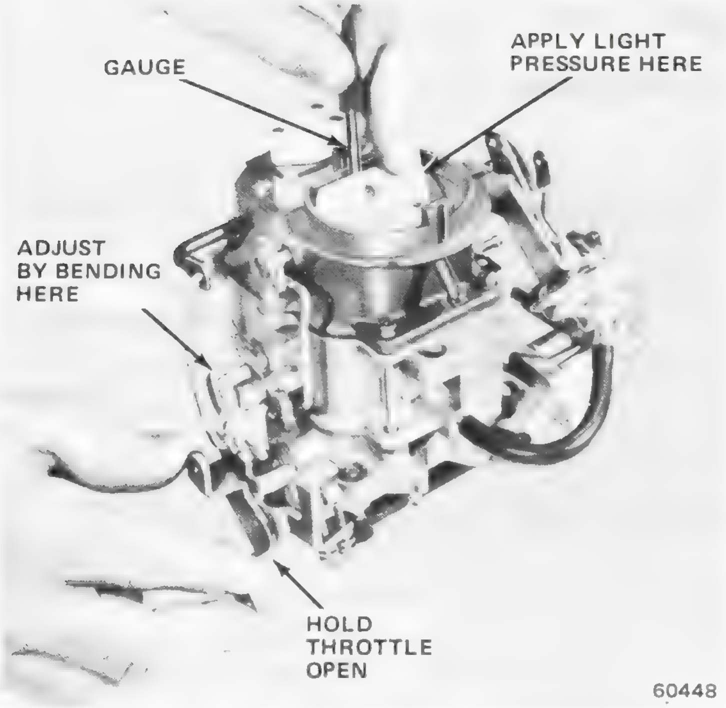


Fig. 1J-86 Choke Unloader Adjustment

Bowl Vent

This is not a precise adjustment. It is made to ensure that the mechanical bowl vent is open at idle and closed at greater throttle openings. It may be performed on-car or off-car.

(1) Remove rollover check valve from air horn to gain access to metering rod area.

(2) Position throttle on high step of fast idle cam.

(3) Observe bowl vent. It should be closed.

(4) Manually move fast idle cam until throttle screw drops to second step of fast idle cam. Bowl vent should just begin to open.

(5) If valve is not closed on high, fourth or third steps of cam, bend tab of valve until it is closed (fig. 1J-87).

(6) If valve is not just beginning to open on second step of cam, bend tab until it is just off its seat.

Automatic Choke Adjustment (On- or Off-Car)

The automatic choke setting is made by loosening coil housing retaining screws and rotating housing in the desired direction as indicated by the arrow on the face of the housing. Refer to Carburetor Service Specifications for the correct setting. The specified setting will be satisfactory for most driving conditions. If stumble or stalls occur on acceleration during engine warm-up, the choke may be set richer or leaner to meet individual engine requirements.

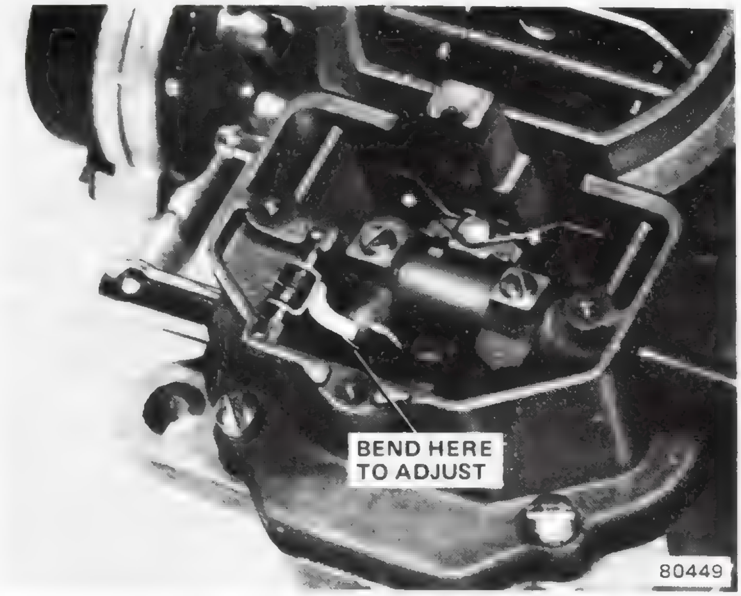


Fig. 1J-87 Bowl Vent Adjustment

Idle Speed and Mixture Adjustment

Refer to procedures outlined in Chapter 1A—General Service and Diagnosis.

Fast Idle Speed Adjustment

Set the fast idle speed with the engine at operating temperature and with EGR and TCS solenoid disconnected. Position the fast idle adjusting screw in contact with the second step and against the shoulder of the fast idle cam. Refer to Specifications for the correct setting. Adjust by turning the fast idle adjustment screw.

CHOKE MECHANISM SERVICE

The choke mechanism may be serviced without removing the carburetor from the engine. If the choke binds, sticks or does not operate smoothly, perform the following:

(1) Remove choke housing cover.

(2) Remove choke lever screw and remove choke lever.

(3) Disconnect choke control rod and remove thermostatic choke shaft from housing.

(4) Polish shaft and shaft bore in housing.

(5) Install shaft to housing. Install choke control rod.

(6) Install choke lever to shaft.

(7) Install housing cover and set to specification.

SPECIFICATIONS

Model BBD Carburetor Specifications

List Number	Application	Float Level		Vacuum Piston Gap		Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Accelerator Pump Dimension		Choke Unloader	Fast Idle① Speed		Bowl Vent Starts To Open	Choke Bimetal ID
		Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range		
8128	258 Automatic 49 State	0.25	0.218 to 0.282	0.040	0.025 to 0.055	0.150	0.135 to 0.165	0.110	0.095 to 0.125	Index	1/2L to 1/2R	0.496	0.476 to 0.516	0.280	1600	1500 to 1700	2 Step	T
8129	258 Manual 49 State	0.25	0.218 to 0.282	0.040	0.025 to 0.055	0.128	0.113 to 0.143	0.095	0.080 to 0.110	1	1/2 to 1-1/2	0.520	0.500 to 0.540	0.280	1500	1400 to 1600	2 Step	T

① Hot with TCS Solenoid and EGR disconnected

80607

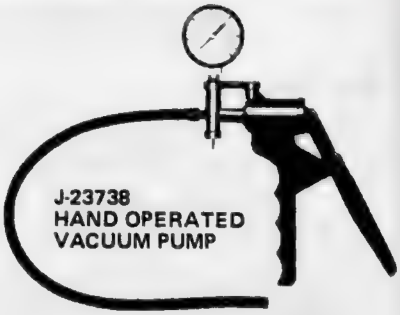
Model BBD Carburetor Calibrations (Inches)

	8128	8129
Throttle Bore Size	1.44	1.44
Main Venturi Size	1.19	1.19
Fuel Inlet Diameter	0.101	0.101
Low Speed Jet (Tube)	0.0295	0.0295
Economizer	0.059	0.059
Idle Air Bleed	0.063	0.063
Main Jet Size	0.089	0.089
Accelerator Pump Jet	0.033	0.033
Main Metering Jet Number	120-389	120-389
Choke Heat Bypass	0.128	0.128
Choke Heat Inlet Restriction	0.078	0.078
Choke Vacuum Restriction	0.078	0.078
Metering Rod	75-2197	75-2197

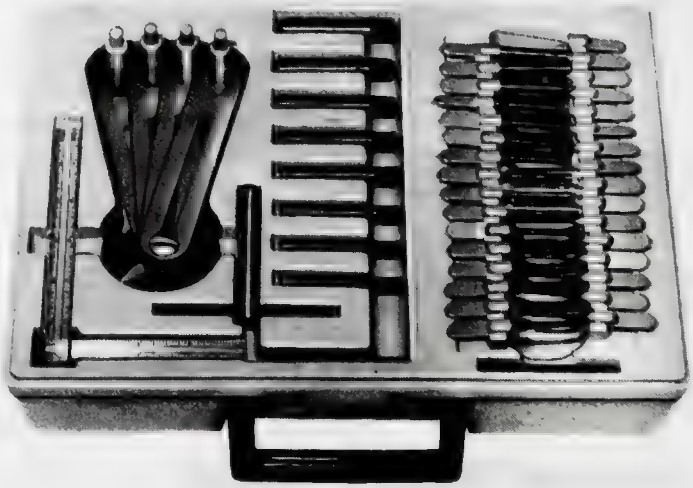
80606

Special Tools

J-1137
BENDING TOOL



J-23738
HAND OPERATED
VACUUM PUMP



J-9789-02
UNIVERSAL CARBURETOR
GAUGE KIT

CARBURETOR MODEL 2100-2 VENTURI

GENERAL

The Motorcraft Model 2100 carburetor is a two-venturi carburetor which incorporates two lightweight aluminum assemblies, the air horn and the main body.

The air horn assembly serves as the main body cover and also contains the choke assembly and fuel bowl vents.

The throttle shaft assembly and all units of the fuel metering systems are contained in the main body assembly. The automatic choke assembly and the solenoid are attached to the main body (fig. 1J-88).

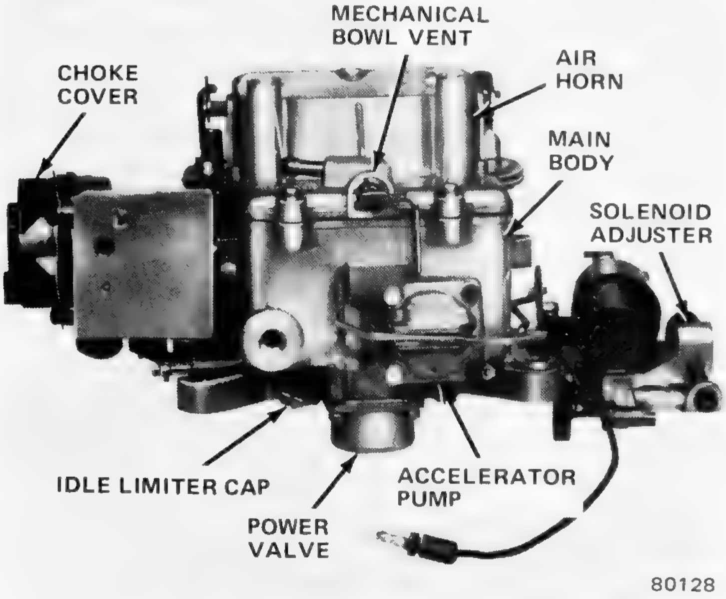


Fig. 1J-88 Model 2100 Carburetor Assembly

Identification

The carburetor is identified by a code number and build date which is stamped on the identification tag. Each carburetor build month is coded alphabetically beginning with the letter A in January and ending with the letter M in December (the letter I is not used). The tag is attached to the carburetor and must remain with the carburetor to assure proper identification (fig. 1J-89).

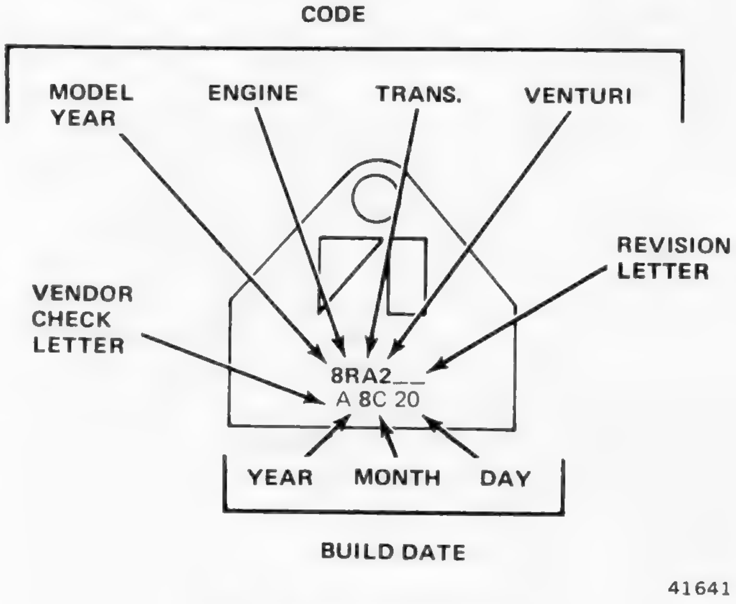


Fig. 1J-89 Identification Tag

CARBURETOR CIRCUITS

The Model 2100 carburetor utilizes five conventional circuits: Float (Fuel Inlet) Circuit, Idle (Low Speed) Circuit, Main (High Speed) Circuit, Pump Circuit and Choke Circuit.

Float (Fuel Inlet) Circuit

Fuel under pressure enters the fuel bowl through the fuel inlet fitting in the main body.

The Viton-tipped fuel inlet needle is controlled by the float and lever assembly which is hinged on the float shaft. A wire retainer is hooked over grooves on opposite ends of the float shaft and into a groove behind the fuel inlet needle seat. The retainer holds the float shaft firmly in the fuel bowl guides and also centers the float assembly in the fuel bowl.

An integral retaining clip is hooked over the end of the float lever and attached to the fuel inlet needle. This assures reaction of the fuel inlet needle during downward movement of the float (fig. 1J-90).

The float circuit maintains a specified fuel level in the bowl, enabling the basic fuel metering circuits to deliver the proper mixture to the engine. The float drops as the fuel level drops and raises the fuel inlet needle off its

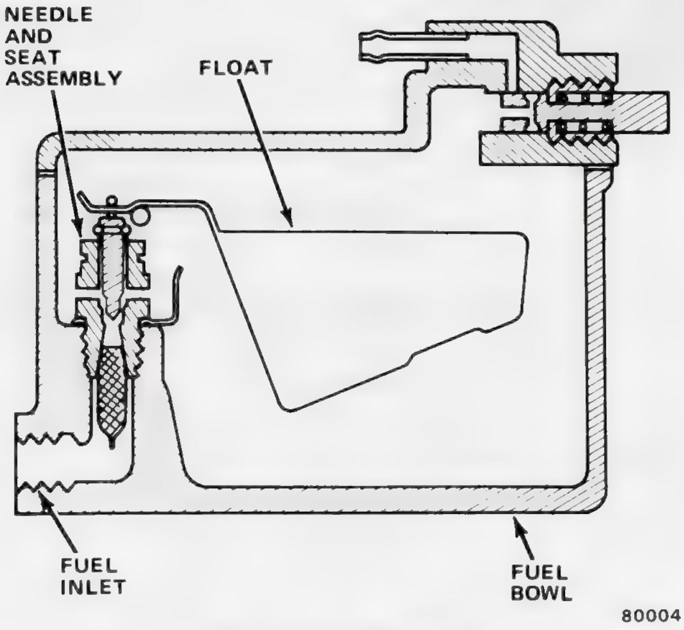


Fig. 1J-90 Float Circuit

seat. This permits additional fuel to enter the bowl past the fuel inlet needle. When the fuel reaches a preset level, the fuel inlet needle is lowered to admit only enough fuel to replace that being used.

Bowl Vent

Two bowl vents are provided. The internal vent is used to balance air pressure in the fuel bowl when the engine is running. The external vent provides a method of controlling fuel vapors in the bowl when the engine is not running.

The external fuel bowl vent permits vapors to move from the carburetor to the fuel vapor storage canister. A bellcrank attached to the accelerator pump housing actuates the bowl vent (fig. 1J-91). At idle or solenoid OFF position, if equipped, the vent opens permitting vapors to pass. At any throttle position above idle, the vent is mechanically closed.

Idle (Low Speed) Circuit

Fuel for idle and low speed operation flows from the fuel bowl through the main jets into the main wells (fig. 1J-92). From the main wells, the fuel is metered as it passes through calibrated restrictions at the lower end of the idle tubes. After flowing through the idle tubes, the fuel enters diagonal passages above the tubes. The fuel is metered again as it flows downward through restrictions at the lower end of the diagonal passages and then enters the idle passages in the main body.

Air enters the idle system through air bleeds which are located in the main body directly below the booster venturi. The air bleeds serve as anti-siphon vents during off-idle, high speed operation and when the engine is stopped.

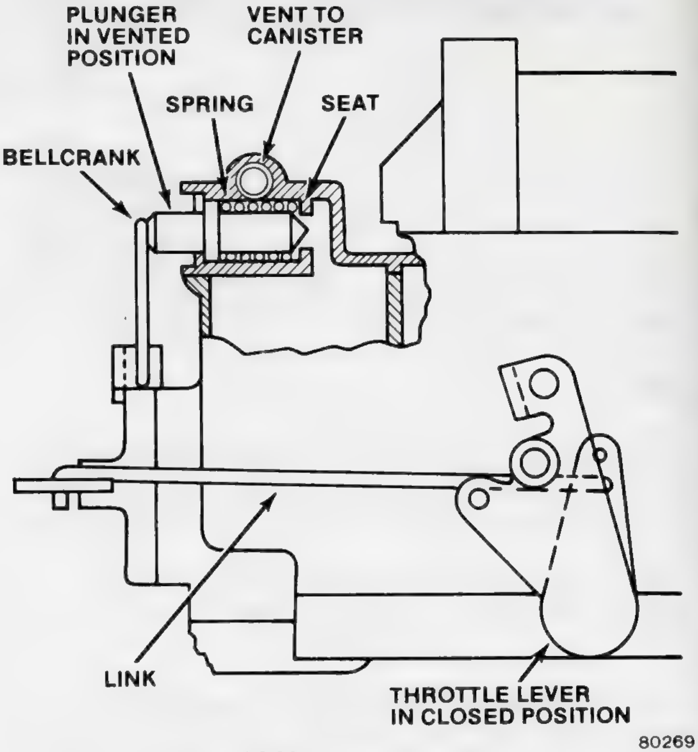


Fig. 1J-91 External Bowl Vent

The fuel-air mixture moves down the idle passages past the idle transfer slots which serve as additional air bleeds during curb idle operation. The fuel-air mixture then moves past the idle mixture adjusting screw tips which control the amount of discharge. From the adjusting screw ports, the fuel-air mixture moves through short horizontal passages and is discharged below the throttle valves.

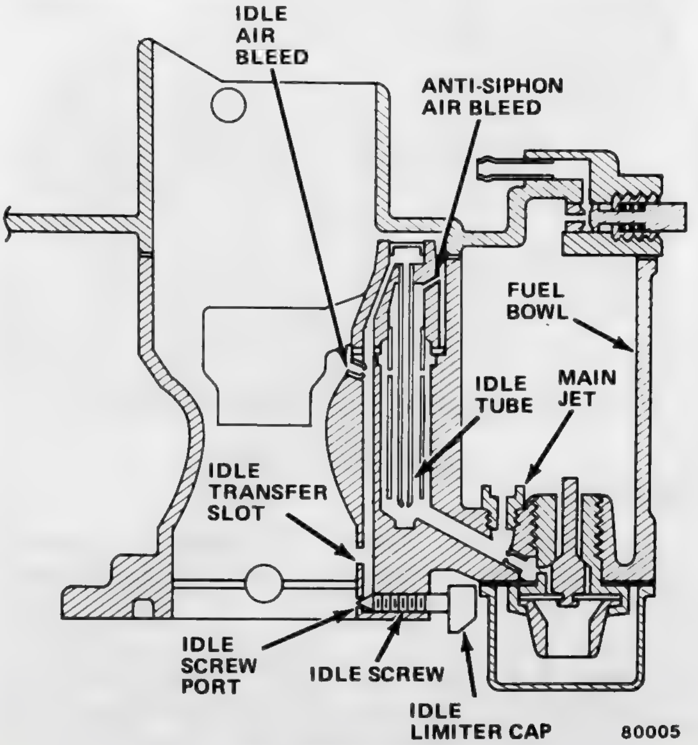


Fig. 1J-92 Idle Circuit

At speeds slightly above idle, the idle transfer slots begin discharging the fuel-air mixture as the throttle valves expose them to manifold vacuum. As the throttle valves continue opening and engine speed increases, the airflow through the carburetor increases proportionally. This increased airflow creates a partial vacuum in the venturi and the main metering system begins discharging a fuel-air mixture. The discharge from the idle circuit tapers off as the main metering circuit begins discharging.

Main Metering (High Speed) Circuit

As engine speed increases, the air velocity through the booster venturi creates a low pressure area. Fuel flow through the main metering circuit is caused by atmospheric pressure in the fuel bowl and low pressure at the main discharge ports (fig. 1J-93). Fuel flows from the fuel bowl, through the main jets and into the main wells. The fuel then moves up the main well tubes where it is mixed with air. The air, supplied through the main air bleeds, mixes with the fuel through small holes in the sides of the main well tubes. The main air bleeds meter an increasing amount of air, whenever venturi vacuum increases, to maintain the proper fuel-air ratio. The mixture of fuel and air, being lighter than raw fuel, responds quickly to changes in venturi vacuum. It also atomizes more readily than raw fuel.

The fuel-air mixture moves from the main well tubes to the discharge ports and is discharged into the booster venturi.

Anti-siphon air bleeds, located near the top of the main well tubes, prevent siphoning of fuel from the main well when decelerating.

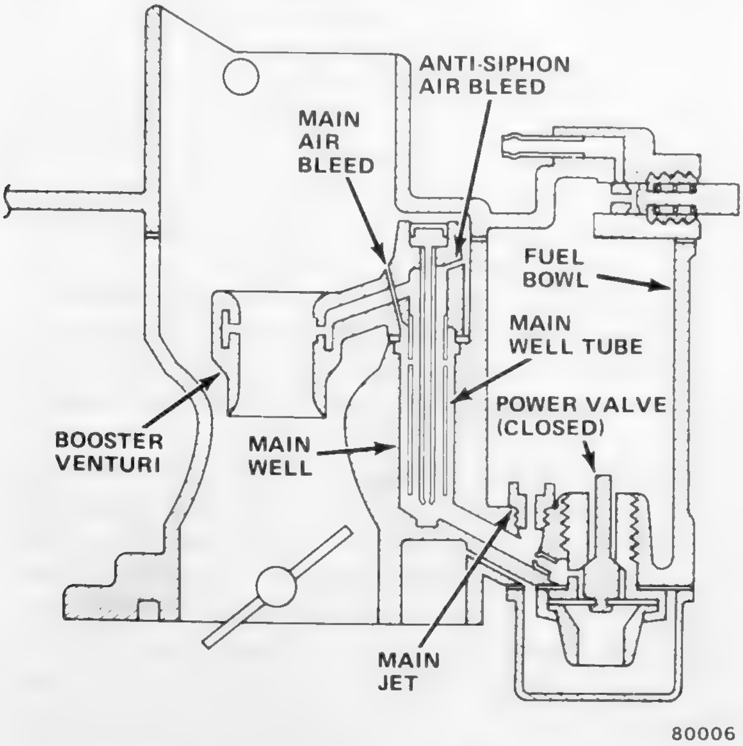


Fig. 1J-93 Main Metering Circuit

Power Enrichment Circuit

During heavy load conditions or high speed operation, the fuel-air ratio must be increased for higher engine output. The power enrichment circuit supplies extra fuel during this period and is controlled by intake manifold vacuum (fig. 1J-94).

Manifold vacuum is applied to the power valve diaphragm from an opening in the base of the main body, through a passage in the main body and power valve chamber to the power valve diaphragm. During idle and normal driving conditions, manifold vacuum is high enough to overcome the power valve spring tension and holds the valve closed. When higher engine output is required, the increased load on the engine results in decreased manifold vacuum. The power valve spring opens the first stage of the power valve when manifold vacuum drops below a predetermined value and a small amount of fuel flows through the valve.

When manifold vacuum drops to a lower value, the power valve spring opens the second stage of the power valve and allows a greater amount of fuel to flow through the valve.

The fuel which flows through the power valve is added to the fuel in the main metering circuit to enrich the mixture. As engine load requirements decrease, manifold vacuum increases and overcomes the tension of the power valve spring, closing the power valve.

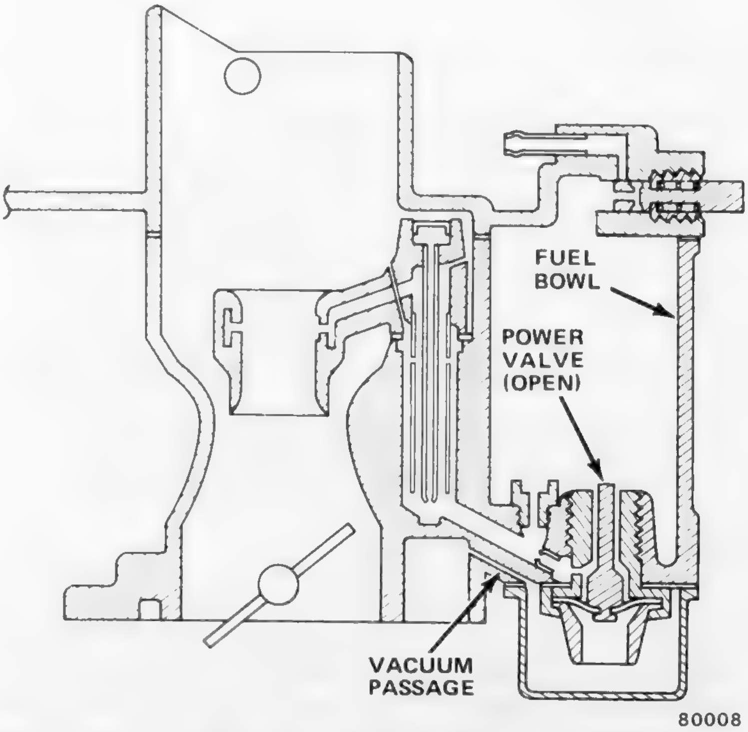


Fig. 1J-94 Power Enrichment Circuit

Pump Circuit

When the throttle valves are opened quickly, the airflow through the carburetor responds almost immediately. Since the flowing fuel is heavier than air, there is a brief lag in time before the fuel flow can gain sufficient speed to maintain the proper fuel-air ratio. During this lag, the pump circuit supplies the required fuel until the proper fuel-air ratio can be maintained by the other metering circuits (fig. 1J-95).

The pump is charged when the throttle valves are closed. The diaphragm return spring exerts force against the diaphragm and pushes it against the cover. Fuel is drawn through the inlet, past the Elastomer valve, and into the pump chamber. A discharge check ball and weight at the pump outlet prevent air from being drawn into the pump chamber.

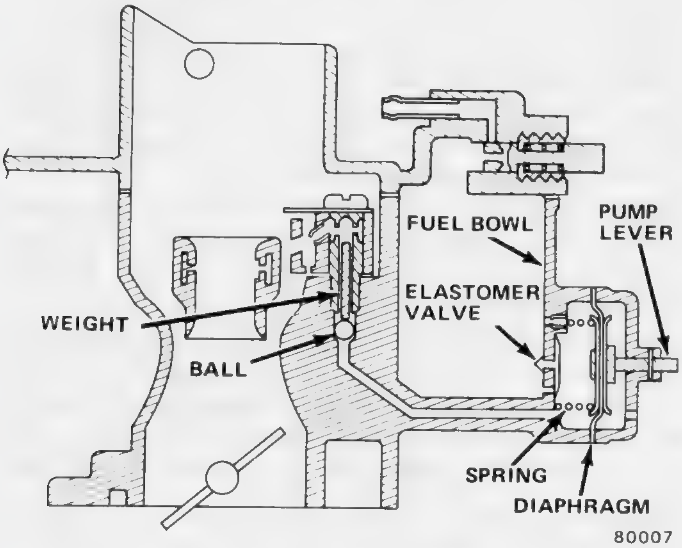


Fig. 1J-95 Pump Circuit

When the throttle valves are opened, the diaphragm rod is pushed inward, forcing fuel from the pump chamber into the discharge passages. The Elastomer valve seals the inlet hole during pump operation, preventing fuel from returning to the fuel bowl. Fuel under pressure unseats the discharge check ball and weight and is forced through the pump discharge screw. The fuel is then sprayed into the main venturi through discharge ports.

An air bleed is provided in the pump chamber to prevent vapor accumulation and pressure buildup.

Choke Circuit

The choke valve, located in the air horn assembly, provides a high vacuum above as well as below the throttle valves when closed. During cranking, vacuum above the throttle valves causes fuel to flow from the main metering and idle circuits. This provides the richer fuel-air mixture required for cold engine starting.

The choke shaft is connected by linkage to a thermostatic coil which winds up when cold and unwinds when warm.

The position of the choke valve is controlled by the action of a vacuum modulator exerting force against the tension of the thermostatic coil (fig. 1J-96).

When the engine is cold, tension of the thermostatic coil holds the choke valve closed. When the engine is started, manifold vacuum is channeled through an opening at the base of the carburetor through a passage of the bottom side of the modulator diaphragm assembly, moving the diaphragm downward against the set screw.

At the same time, the modulator arm contacts a tang on the choke shaft. The downward movement of the diaphragm assembly compresses the piston spring and exerts a pulling force on the modulator arm, causing the choke valve to open slightly. This opening is known as initial choke valve clearance.

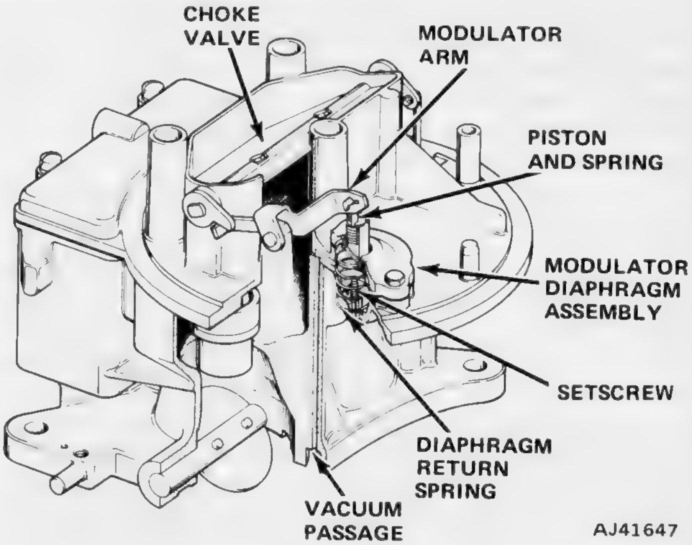


Fig. 1J-96 Choke Circuit

As the engine begins to warm up, heated air from the exhaust crossover is routed through a heat tube to the choke housing. A thermostatic bypass valve, which is integral with the choke heat tube, helps prevent premature choke valve opening during the early part of the warmup period. The valve regulates the temperature of the hot airflow to the choke housing by allowing outside unheated air to enter the heat tube. A thermostatic disc is incorporated in the valve which is calibrated to close the valve at 75°F and open it at 55°F.

The heated air entering the choke housing causes the thermostatic coil to begin unwinding and decreases the closing force exerted against the choke valve. The coil gradually loses its tension and allows the choke valve to open.

When the engine reaches operating temperature, the thermostatic coil continues unwinding and exerts pressure against the choke linkage, forcing the choke valve fully open. A continual flow of warm air passes through the choke housing and is exhausted into the intake manifold. The thermostatic coil remains heated and the choke valve remains fully open until the engine is stopped and allowed to cool.

Air flowing through the choke housing must be filtered to minimize contamination of the choke coil and associated parts. The air is supplied by a tube originating inside the air cleaner.

A fast idle is required to prevent engine stalling during the warmup period. The fast idle cam, actuated by the choke rod, contacts the fast idle speed adjustment screw and increases engine speed in proportion to the choke valve opening. When the choke valve reaches the fully open position, the fast idle cam rotates free of the fast idle speed adjusting screw, allowing the throttle lever to return to curb idle.

If the engine is accelerated during the warmup period, the resulting drop in manifold vacuum allows the thermostatic coil to momentarily close the choke valve. This provides a richer mixture to prevent engine stalling.

If the engine floods during the starting period, the choke valve may be opened manually to purge excess fuel from the intake manifold. This is accomplished by depressing the accelerator pedal to the floor and cranking the engine. With the accelerator linkage in this position, a tang on the fast idle lever contacts the fast idle cam, causing the choke valve to open a predetermined amount. This is referred to as choke unloader clearance.

CARBURETOR REPLACEMENT

Removal

(1) Remove air cleaner.

(2) Code all lines attached to carburetor for aid during installation.

(3) Remove accelerator cable from accelerator lever and disconnect distributor vacuum hose, vacuum hoses, pullback spring, transmission throttle linkage, choke clean air tube, solenoid wire (if equipped), PCV hose, in-line fuel filter and choke heat tube at carburetor.

(4) Remove carburetor retaining nuts. Remove carburetor and gasket.

Installation

(1) Clean gasket mounting surfaces of spacer and carburetor. Position gasket on spacer. Position carburetor on spacer and gasket and install nuts. To prevent leakage, distortion or damage to carburetor body flange, alternately tighten nuts in criss-cross pattern to 13 foot-pounds torque.

(2) Connect in-line fuel filter, throttle cable, choke heat tube, PCV hose, pullback spring, solenoid wire (if equipped), transmission throttle linkage, choke clean air tube, vacuum hoses and distributor vacuum line.

(3) Adjust engine idle speed and idle fuel mixture. Refer to Chapter 1A—General Service and Diagnosis.

NOTE: *Adjust transmission throttle linkage after completing carburetor installation.*

(4) Install air cleaner.

CARBURETOR OVERHAUL

A complete disassembly is not necessary when performing adjustments. In most cases, service adjustments of individual systems may be completed without removing the carburetor from the engine. Refer to Service Adjustment Procedures.

A complete carburetor overhaul includes disassembly, thorough cleaning, inspection, and replacement of all gaskets and worn or damaged parts. Refer to figure 1J-97 for parts identification.

NOTE: *When using an overhaul kit, use all parts included in kit.*

NOTE: *In many instances, flooding, stumble on acceleration and other performance problems are caused by the presence of dirt, water or other foreign matter in the carburetor. To aid in diagnosing the cause of the problem, carefully remove the carburetor from the engine without removing the fuel from the bowl. Examine the contents of the bowl for contamination as the carburetor is disassembled.*

Disassembly

(1) Remove air cleaner anchor screw.

(2) Remove automatic choke rod retainer from thermostatic choke shaft lever.

(3) Remove air horn attaching screws, lockwashers and carburetor identification tag. Remove air horn and air horn gasket.

(4) Remove choke rod by loosening screw that secures choke shaft lever to choke shaft. Remove rod and plastic dust seal from air horn.

(5) Remove choke modulator assembly (fig. 1J-98).

(6) Remove fast idle cam retainer (fig. 1J-99).

(7) Remove choke shield.

(8) Remove thermostatic choke spring housing retaining screws and clamp, housing and gasket.

(9) Remove fast idle cam rod from fast idle cam lever.

(10) Remove choke housing assembly retaining screws, housing assembly and gasket.

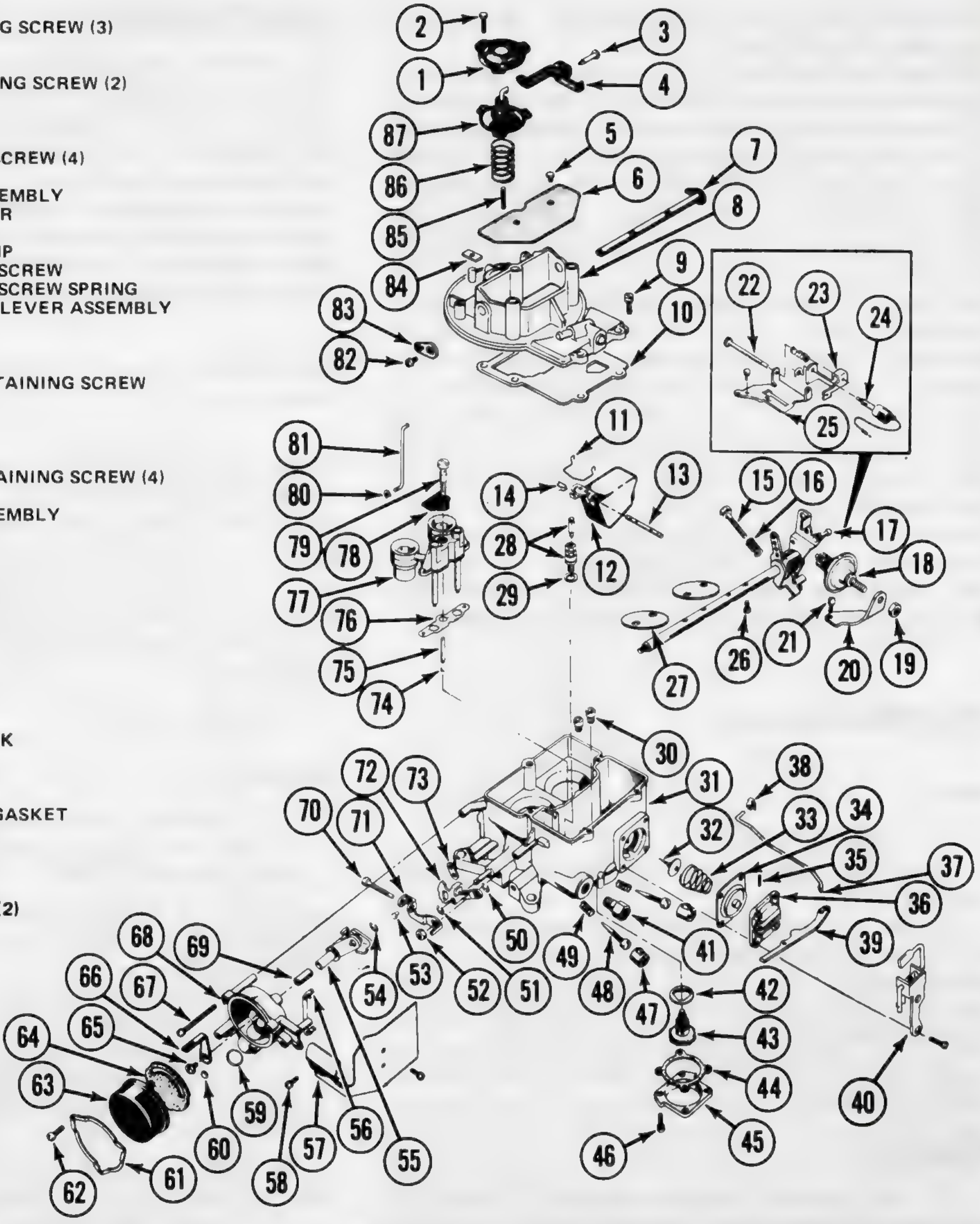
(11) Remove fast idle cam.

(12) Remove thermostat lever retaining screw and washer. Remove thermostatic choke shaft and fast idle cam lever from choke housing.

(13) Pry float shaft retainer from fuel inlet seat (fig. 1J-100). Remove float, float shaft retainer and fuel inlet needle assembly. Remove retainer and float shaft from float lever.

(14) Remove fuel inlet needle seat and gasket. Remove main jets with Main Metering Jet Wrench J-10174-01 (fig. 1J-101).

1. MODULATOR COVER
2. MODULATOR RETAINING SCREW (3)
3. PIVOT PIN
4. MODULATOR ARM
5. CHOKE VALVE RETAINING SCREW (2)
6. CHOKE VALVE
7. CHOKE SHAFT
8. AIR HORN
9. AIR HORN RETAINING SCREW (4)
10. AIR HORN GASKET
11. FLOAT AND LEVER ASSEMBLY
12. FLOAT SHAFT RETAINER
13. FLOAT SHAFT
14. NEEDLE RETAINING CLIP
15. CURB IDLE ADJUSTING SCREW
16. CURB IDLE ADJUSTING SCREW SPRING
17. THROTTLE SHAFT AND LEVER ASSEMBLY
18. DASHPOT
19. DASHPOT LOCKNUT
20. DASHPOT BRACKET
21. DASHPOT BRACKET RETAINING SCREW
22. ADJUSTING SCREW
23. CARRIAGE
24. ELECTRIC SOLENOID
25. MOUNTING BRACKET
26. THROTTLE VALVE RETAINING SCREW (4)
27. THROTTLE VALVE (2)
28. NEEDLE AND SEAT ASSEMBLY
29. NEEDLE SEAT GASKET
30. MAIN JET (2)
31. MAIN BODY
32. ELASTOMER VALVE
33. PUMP RETURN SPRING
34. PUMP DIAPHRAGM
35. PUMP LEVER PIN
36. PUMP COVER
37. PUMP ROD
38. PUMP ROD RETAINER
39. PUMP LEVER
40. BOWL VENT BELLCRANK
41. FUEL INLET FITTING
42. POWER VALVE GASKET
43. POWER VALVE
44. POWER VALVE COVER GASKET
45. POWER VALVE COVER
46. POWER VALVE COVER RETAINING SCREW (4)
47. IDLE LIMITER CAP (2)
48. IDLE MIXTURE SCREW (2)



49. IDLE MIXTURE SCREW SPRING (2)
50. RETAINER
51. RETAINER
52. FAST IDLE LEVER RETAINING NUT
53. FAST IDLE LEVER PIN
54. RETAINER
55. LEVER AND SHAFT
56. FAST IDLE CAM ROD
57. CHOKE SHIELD
58. CHOKE SHIELD RETAINING SCREW (2)
59. PISTON PASSAGE PLUG
60. HEAT PASSAGE PLUG
61. CHOKE COVER RETAINING CLAMP
62. CHOKE COVER RETAINING SCREW (3)
63. CHOKE COVER
64. CHOKE COVER GASKET
65. THERMOSTAT LEVER RETAINING SCREW
66. THERMOSTAT LEVER
67. CHOKE HOUSING RETAINING SCREW (3)
68. CHOKE HOUSING
69. CHOKE SHAFT BUSHING
70. FAST IDLE SPEED ADJUSTING SCREW
71. FAST IDLE LEVER
72. FAST IDLE CAM
73. CHOKE HOUSING GASKET
74. PUMP DISCHARGE CHECK BALL
75. PUMP DISCHARGE WEIGHT
76. BOOSTER VENTURI GASKET
77. BOOSTER VENTURI ASSEMBLY
78. AIR DISTRIBUTION PLATE
79. PUMP DISCHARGE SCREW
80. RETAINER
81. CHOKE ROD
82. CHOKE LEVER RETAINING SCREW
83. CHOKE PLATE LEVER
84. CHOKE ROD SEAL
85. STOP SCREW
86. MODULATOR RETURN SPRING
87. MODULATOR DIAPHRAGM ASSEMBLY

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Fig. 1J-97 Parts Identification—Motorcraft Model 2100

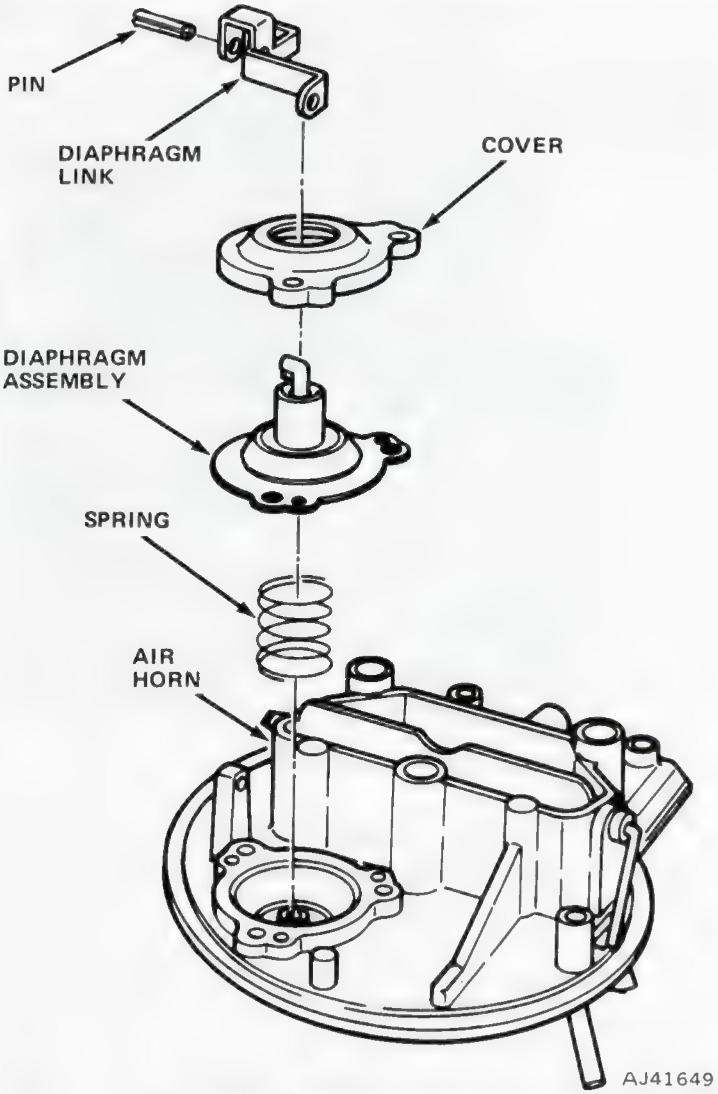


Fig. 1J-98 Choke Modulator Assembly

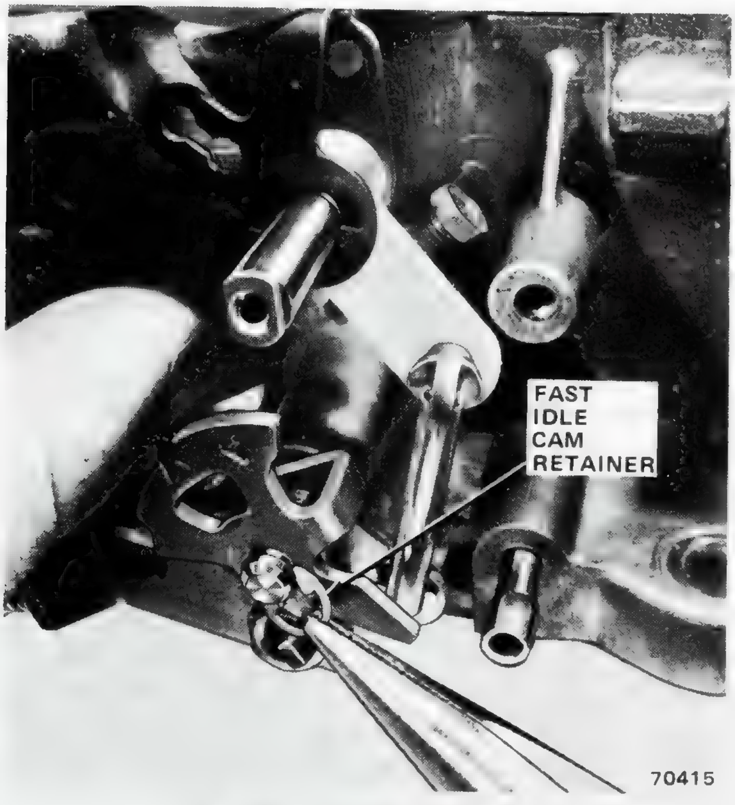


Fig. 1J-99 Fast Idle Cam Retainer

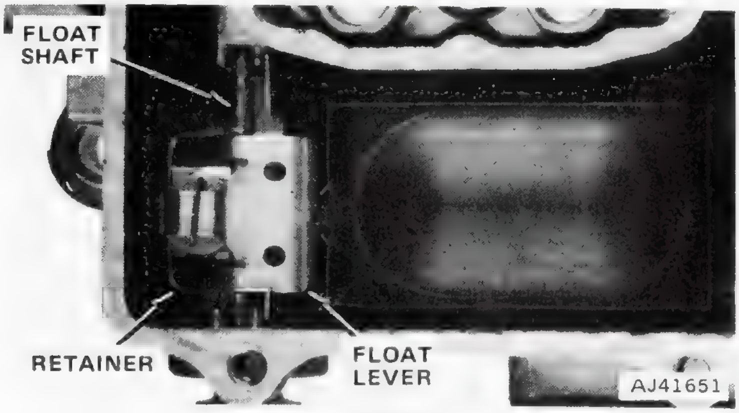


Fig. 1J-100 Float Assembly

(15) Remove accelerator pump discharge screw, air distribution plate, booster venturi and gasket (fig. 1J-102). Do not attempt to remove tubes from venturi assembly. Invert main body and catch accelerating pump discharge weight and ball in hand.

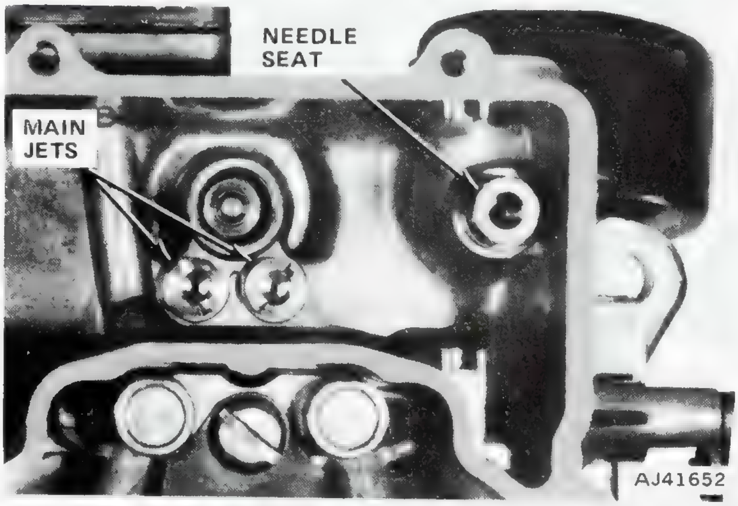


Fig. 1J-101 Interior View of Fuel Bowl

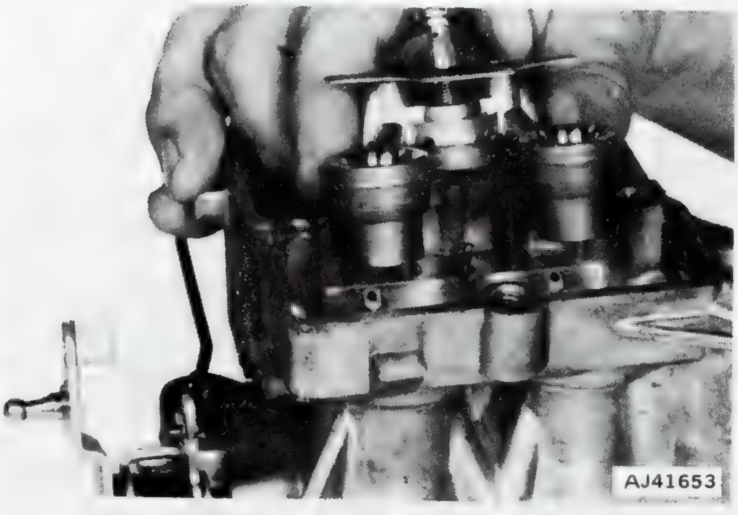


Fig. 1J-102 Removing Booster Venturi Assembly

(16) Disconnect accelerator pump operating rod from overtravel lever. Remove rod and retainer.

(17) Remove accelerating pump cover attaching screws. Remove bowl vent bellcrank and braket assembly, accelerating pump cover, diaphragm assembly and spring (fig. 1J-103).

(18) Remove Elastomer valve by grasping firmly and pulling out.

NOTE: *If the Elastomer valve tip breaks off during removal, be sure to remove the tip from the fuel bowl. Elastomer valve must be replaced whenever it has been removed from the carburetor.*

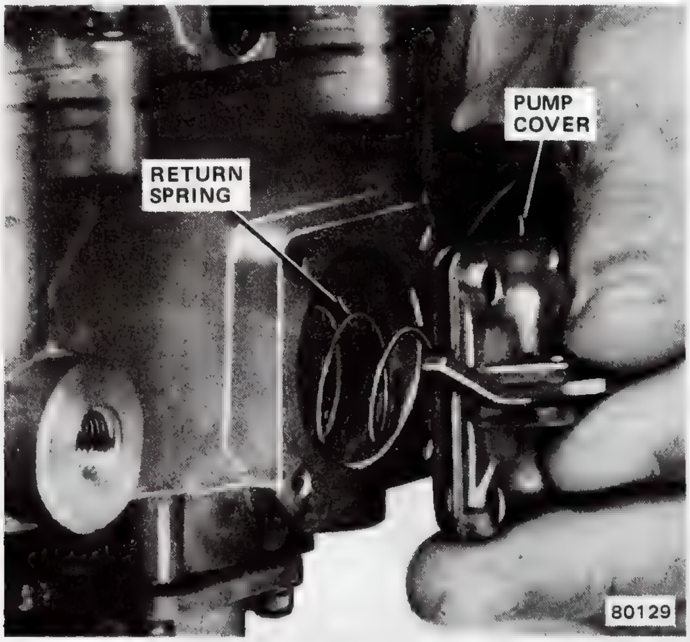


Fig. 1J-103 Removing Accelerator Pump Assembly

(19) Invert main body and remove power valve cover, gasket and screws. Remove power valve (fig. 1J-104). Remove and discard power valve gasket.

(20) Remove limiter caps from idle mixture adjusting screws. Use soldering gun to cut through limiter caps. Remove idle mixture adjusting screws and springs.

(21) Remove solenoid, if equipped.

Cleaning and Inspection

Dirt, gum, water or carbon contamination in the carburetor or the exterior moving parts of the carburetor are often responsible for unsatisfactory performance. Efficient carburetion depends upon careful cleaning and inspection.

The cleaning and inspection procedures here do not cover those parts included in the carburetor overhaul repair kit. Use all gaskets and parts included in the repair kit when the carburetor is assembled. Discard original gaskets and parts.

Fig. 1J-104 Removing Power Valve

Wash all the carburetor parts except accelerator pump diaphragm, power valve, modulator diaphragm and solenoid in clean commercial carburetor cleaning solvent. If a commercial solvent is not available, use lacquer thinner or denatured alcohol. If commercial carburetor cleaner is used, rinse the parts in hot water, then dry them with compressed air. Wipe all parts that cannot be immersed in solvent with a clean, soft, dry cloth. Be sure all dirt, gum, carbon and other foreign matter are removed from all parts.

Force compressed air through all passages of the carburetor.

CAUTION: *Do not use a wire brush to clean any parts. Do not use a drill or wire to clean out any openings or passages in the carburetor. A drill or wire may enlarge the hole or passage, changing the calibration of the carburetor.*

Check the choke shaft for excessive looseness or binding. Inspect thermostatic choke shaft and polish with fine crocus cloth or steel wool. Inspect the choke valve for nicked edges and for ease of operation and free it if necessary. Be sure all carbon and foreign material has been removed from the automatic choke housing. Check the throttle shaft for excessive looseness or binding in its bore. Check the throttle valves for burrs which prevent proper closure. Inspect the main body, air horn, booster venturi assemblies, choke housing and choke cover, power valve cover and accelerator pump cover for cracks. Replace the float if the arm needle contact surface is grooved. If the float is serviceable, polish the needle contact surface of the arm with crocus cloth or steel wool. Replace float shaft if worn. Replace all screws and nuts that have stripped threads. Replace all distorted or broken springs. Inspect all gasket mating surfaces for nicks and burrs. Repair or replace any parts that have a damaged gasket surface.

Assembly

NOTE: *Be sure all holes in the replacement gaskets have been properly punched and that no foreign material has adhered to the gaskets. Inspect diaphragms for tears or cuts.*

(1) Install fast idle speed adjusting screw and spring on fast idle lever.

(2) Install solenoid, if removed.

(3) Place fast idle lever assembly on throttle shaft and install retaining washer and nut.

(4) Lubricate tip of replacement Elastomer valve and insert tip into accelerator pump cavity center hole.

(a) Using needlenose pliers, reach into fuel bowl and grasp valve tip.

(b) Pull valve in until it seats in pump cavity wall. Cut off tip forward of retaining shoulder.

(c) Remove tip from bowl.

(5) Install accelerator pump diaphragm return spring in depression in chamber. Insert diaphragm assembly in cover, place cover and diaphragm assembly into position on main body and install two right-side cover screws.

(6) Position bowl vent bellcrank and bracket assembly over accelerator pump cover left-side holes. Be sure vent lever is positioned behind pump lever. Install retaining screws.

(7) Insert accelerator pump operating rod into inboard hole of accelerator pump actuating lever.

(8) Position accelerator pump operating rod retainer in hole 3 in overtravel lever (fig. 1J-111).

(9) Invert main body and install power valve and replacement gasket. Tighten valve securely.

(10) Install power valve cover and replacement gasket.

NOTE: *Install the power valve cover with the limiter stops on the cover in position to provide a positive stop for the tabs on the idle mixture limiter caps.*

(11) Install idle mixture adjusting screws and springs. Turn screws in gently with fingers until they just touch seat, then back off two turns for preliminary idle fuel mixture adjustment.

NOTE: *Do not install idle mixture limiter caps at this time.*

(12) Install main jets.

(13) Install fuel inlet seat and replacement gasket. Install fuel inlet needle assembly in fuel inlet seat. Fuel inlet needles and seats are matched assemblies. Be sure correct needle and seat are assembled together.

(14) Slide float shaft into float lever. Position float shaft retainer on float shaft.

(15) Insert float assembly into fuel bowl and hook float lever tab under fuel inlet needle assembly. Insert float shaft into its guides at sides of fuel bowl.

(16) Press float shaft retainer into groove on fuel inlet needle seat and check float setting. Refer to Service Adjustment Procedures.

(17) Drop accelerator pump discharge ball into passage in main body.

(18) Position replacement booster venturi gasket and booster venturi in main body.

(19) Drop weight into opening of booster onto discharge ball.

(20) Install air distribution plate and accelerator pump discharge screw and tighten screw.

(21) Position fast idle cam lever on thermostatic choke shaft. Install retainer.

NOTE: *The bottom of the fast idle cam lever adjusting screw must rest against the tang on the choke shaft.*

(22) Insert choke shaft into rear of choke housing. Position choke shaft so that choke hole in shaft is to left side of choke housing.

(23) Install fast idle cam rod on fast idle cam lever.

(24) Install fast idle cam and retainer to hub on main body.

(25) Place choke housing vacuum pickup port-to-main body gasket on choke housing flange.

(26) Wipe choke shaft bushing clean (small piece of plastic material) and install in choke shaft bore in choke housing.

(27) Position choke housing on main body and install choke housing attaching screws.

(28) Install retainer to fast idle cam rod at fast idle cam.

(29) Install thermostat lever.

(30) Install choke cover, gasket, retainer and screws. Turn choke housing 1/4-turn rich and tighten one retaining screw.

(31) Install choke shield.

(32) Insert choke rod into choke plate lever. Lower end of rod must protrude through air horn.

(33) Install choke plate lever to choke shaft and tighten screw.

(34) Install plastic dust shield to choke rod.

(35) Position main body gasket on main body.

(36) Position air horn on main body and gasket so that choke plate rod fits through opening in main body. Be sure plastic seal is free to slide.

(37) Insert end of choke valve rod into choke valve lever.

(38) Install air horn attaching screws and carburetor identification tag, and tighten attaching screws.

(39) Attach choke plate rod and retainer to thermostatic choke shaft lever.

(40) Install air cleaner anchor screw.

(41) Install modulator diaphragm return spring in recess of air horn. Position modulator cover over diaphragm assembly and engage piston rod with keyed slot of modulator arm. Place diaphragm and cover over return spring and install cover retaining screws.

(42) Adjust initial choke valve clearance. Refer to Service Adjustment Procedures.

(43) Adjust fast idle cam linkage. Refer to Service Adjustment Procedures.

(44) Adjust choke unloader clearance. Refer to Service Adjustment Procedures.

(45) Loosen choke cover screw and set cover index to specification. Tighten all cover screws.

SERVICE ADJUSTMENT PROCEDURES

Float Level Adjustment—Dry

(1) Remove air horn assembly and gasket. Raise float by pressing down on float tab until fuel inlet needle is lightly seated.

(2) Use T-scale to measure distance from fuel bowl machined surface to flat surface of either corner of float at free end. Refer to Specifications for correct setting.

(3) Bend float tab to adjust. Hold fuel inlet needle off its seat while adjusting to prevent damage to Viton-tipped needle (fig. 1J-105).

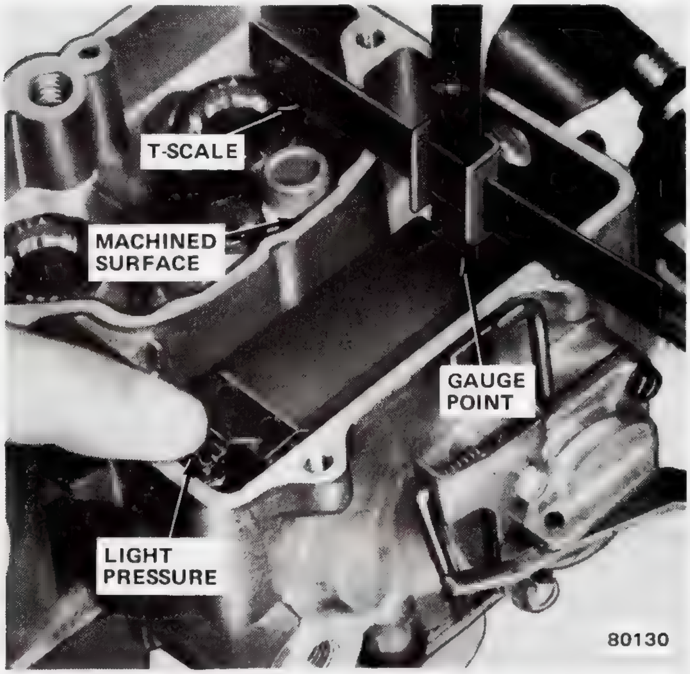


Fig. 1J-105 Dry Float Adjustment

Float Level Adjustment—Wet

WARNING: *Exercise extreme caution when performing this procedure. Fuel vapor is present when carburetor air horn is removed. Extinguish cigarettes and other smoking materials.*

(1) Position vehicle on flat, level surface and engine at normal operating temperature and turn engine OFF. Remove carburetor air cleaner assembly and anchor screw.

(2) Remove air horn attaching screws and carburetor identification tag. Temporarily place air horn and gasket in position on carburetor main body and start engine. Let engine idle one minute, then turn engine off and move air horn aside. Remove air horn gasket to provide access to float assembly.

(3) Use T-scale to measure vertical distance from top machined surface of carburetor main body to level of fuel in fuel bowl (fig. 1J-106). Make measurement at least 1/4 inch away from any vertical surface to assure accurate reading, because surface of fuel is concave (higher at edges than in center). Care must be exercised to measure fuel level at point of contact between scale and fuel. Refer to Specifications for correct fuel level (wet) setting.

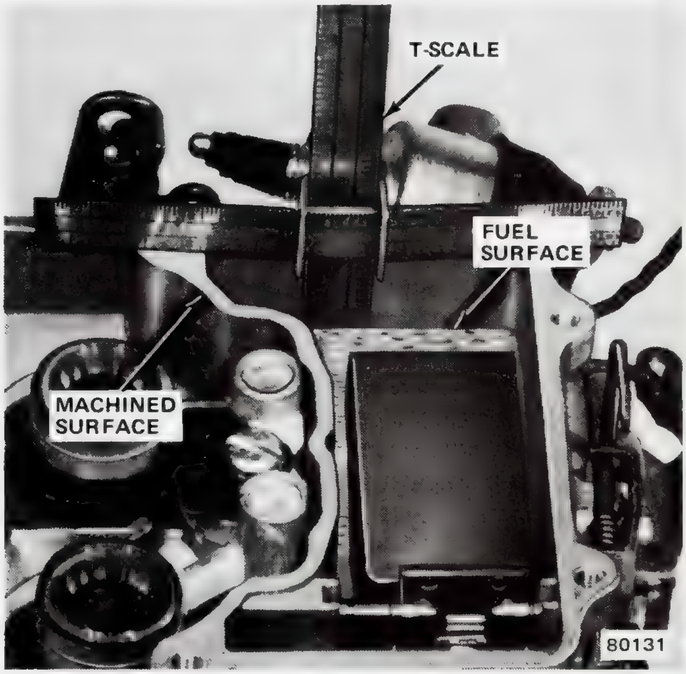


Fig. 1J-106 Wet Float Level Adjustment

(4) To adjust fuel level, bend float tab (contacting fuel inlet valve) upward in relation to original position to raise fuel level, and downward to lower it. Each time an adjustment is made to float tab to alter fuel level, place gasket and air horn on carburetor, start engine and permit to idle one minute to stabilize fuel level. Turn engine off and check fuel level after each adjustment until specified level is obtained.

(5) Install replacement air horn gasket, air horn assembly, carburetor identification tag and attaching screws. Be sure plastic dust seal on choke operating rod is positioned correctly and does not cause rod to bind. Tighten screws. Install air cleaner anchor screw and tighten.

(6) Check idle fuel mixture and idle speed adjustments. Adjust carburetor as required. Refer to Chapter 1A—General Service and Diagnosis.

(7) Install air cleaner.

Initial Choke Valve Clearance Adjustment

(1) Loosen choke cover retaining screws and rotate choke cover 1/4-turn counterclockwise (rich). Tighten one screw.

(2) Disconnect choke heat inlet tube. Align fast idle speed adjusting screw with second step (index) of fast idle cam.

(3) Start engine without moving accelerator linkage. Turn fast idle cam lever adjusting screw out (counterclockwise) three (3) full turns. Measure clearance between lower edge of choke valve and air horn wall. Refer to Specifications for correct setting.

(4) Adjust by turning set screw on bottom of modulator. Turn screw in to decrease clearance. Turn screw out to increase clearance (fig. 1J-107).

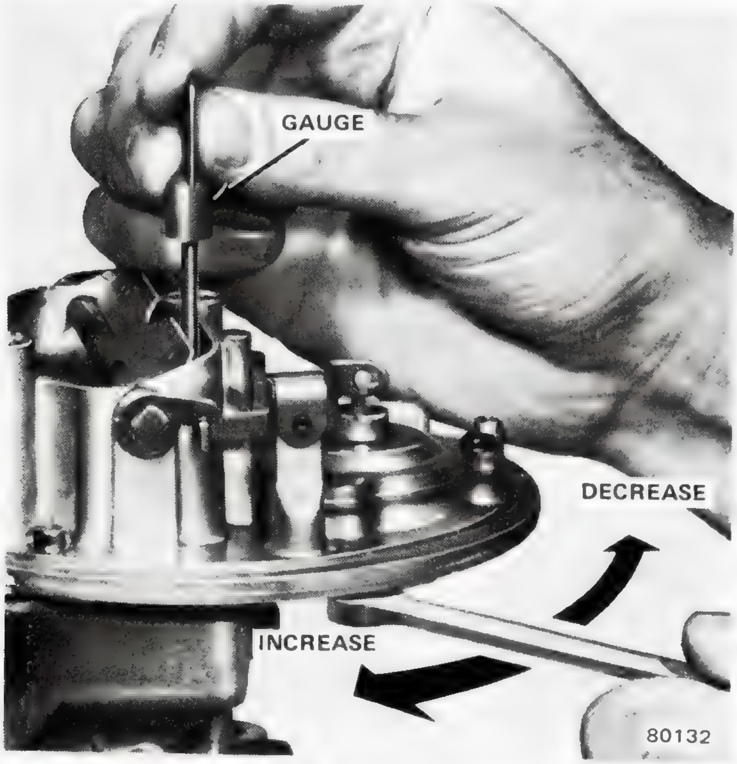


Fig. 1J-107 Initial Choke Valve Clearance Adjustment

(5) After completing adjustment, turn engine OFF and connect choke heat tube. Do not reset choke cover until fast idle cam linkage adjustment has been performed.

Fast Idle Cam Linkage Adjustment

(1) Push down on fast idle cam lever until fast idle speed adjusting screw is in contact with second step (index) and against shoulder of high step of fast idle cam.

(2) Measure clearance between lower edge of choke valve and air horn wall (fig. 1J-108). Refer to Specifications for correct setting.

(3) Adjust by turning fast idle cam lever screw.

(4) Loosen choke cover retaining screws and adjust choke as outlined under Automatic Choke Adjustment.

(5) Install choke shield clamp and retaining screws.

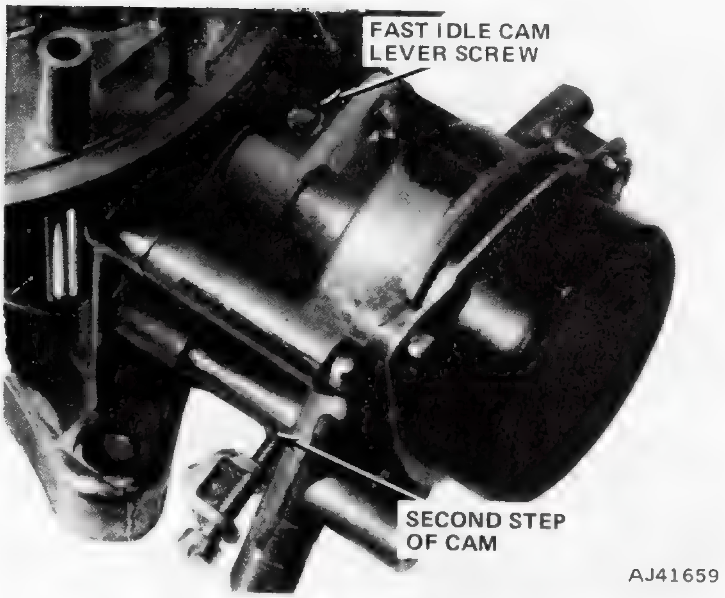


Fig. 1J-108 Fast Idle Cam Linkage Adjustment

Choke Unloader Adjustment

(1) Hold throttle fully open and apply pressure on choke valve toward closed position.

(2) Measure clearance between lower edge of choke valve and air horn wall. Refer to Specifications for correct setting.

CAUTION: *Do not bend the unloader tang downward from a horizontal plane.*

(3) Adjust by bending unloader tang which contacts fast idle cam (fig. 1J-109). Bend toward cam to increase clearance and away from cam to decrease clearance.

(4) After making adjustment, open throttle until unloader tang is directly below fast idle cam pivot. There must be exactly 0.070-inch clearance between unloader tang and edge of fast idle cam (fig. 1J-110).

(5) Operate throttle and check unloader tang to make sure it does not bind, contact or stick on any part of carburetor casting or linkage. After carburetor installation, check for full throttle opening when throttle is operated from inside vehicle. If full throttle opening is not obtainable, it may be necessary to remove excess padding under floormat or reposition throttle cable bracket located on engine.

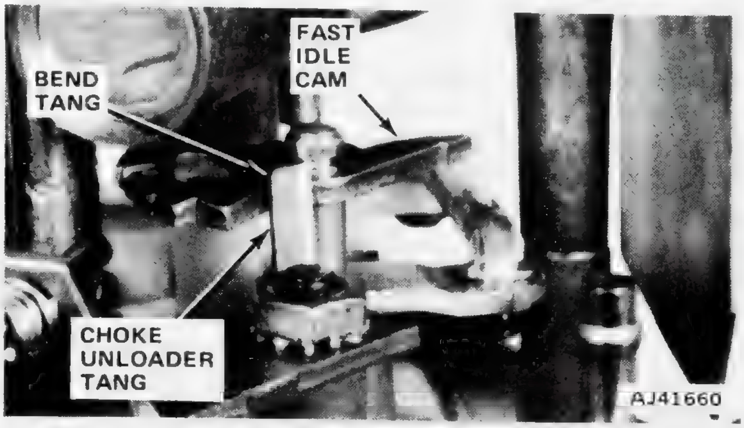


Fig. 1J-109 Unloader Adjustment

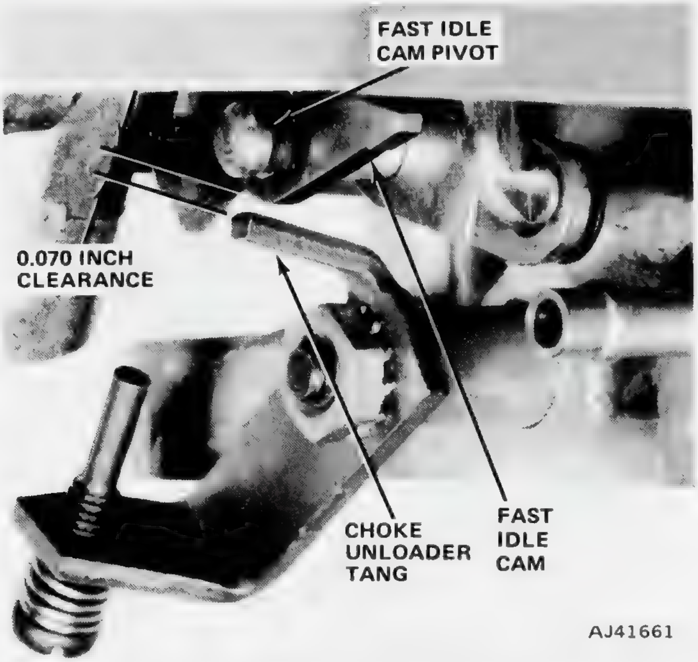


Fig. 1J-110 Unloader to Fast Idle Cam Clearance

Automatic Choke Adjustment

Loosen choke cover retaining screws and rotate cover in the desired direction as indicated by the arrow on the face of the cover. Refer to Specifications for the correct setting. The specified setting will be satisfactory for most driving conditions. In the event that stumbles or stalls occur on acceleration during engine warmup, set the choke richer or leaner using the tolerance provided to meet individual engine requirements.

Accelerator Pump Stroke Adjustment

The specified accelerator pump stroke has been selected to help keep the exhaust emission level of the engine within Federal limits. The unused adjustment holes permit adjusting the stroke for specific engine and climate applications. The primary throttle shaft lever (overtravel lever) has four holes and the accelerator pump link has two holes (fig. 1J-111).

For normal operating conditions, the accelerator pump operating rod should be in the third hole (away from the lever pivot) of the overtravel lever and the inboard hole (closest to the pump plunger) in the accelerating pump link. In extremely hot climate regions, the pump stroke may be shortened to provide smoother acceleration by placing the pump rod in the second hole of the overtravel lever. In extremely cold climate regions, the pump stroke may be increased to provide smoother acceleration by placing the pump rod in the fourth hole of the overtravel lever.

(1) Remove operating rod from retaining clip.

(2) Position clip over specified hole in overtravel lever. Insert operating rod through clip and overtravel lever. Snap clip over rod.

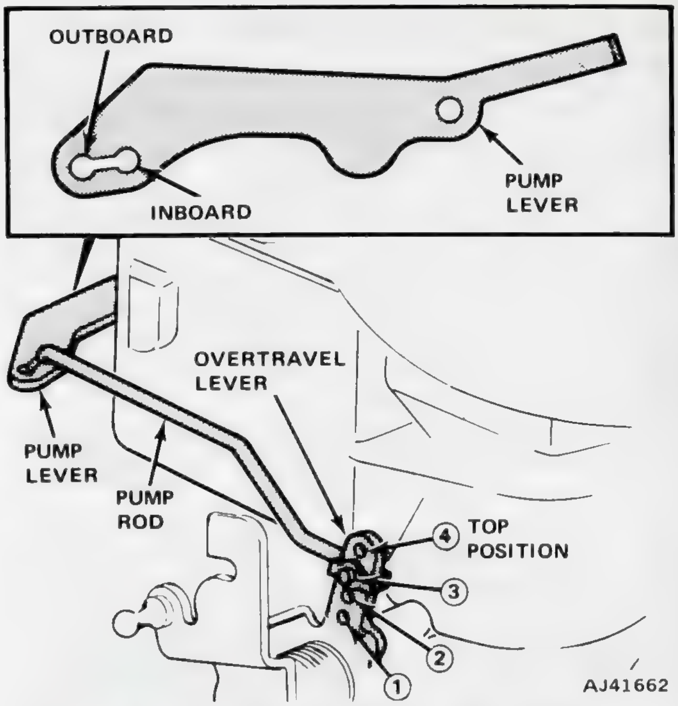


Fig. 1J-111 Accelerator Pump Stroke Adjustment

Idle Speed and Mixture Adjustment

Refer to procedures outlined in Chapter 1A—General Service and Diagnosis.

Bowl Vent

This is not a precise adjustment. It is made to ensure that the mechanical bowl vent is open at idle and closed at greater throttle openings. It may be performed on-car or off-car.

(1) If on-car, turn ignition OFF. Be sure throttle is completely off fast idle cam.

(2) Manually depress stem of bowl vent valve and insert gauge between valve stem and flat on end of bellcrank. Refer to Specifications for clearance.

(3) If clearance is not correct, bend bellcrank as required. Do not bend lever on accelerator pump.

Fast Idle Speed Adjustment

Set the fast idle speed with the engine at operating temperature and with EGR and TCS solenoid disconected. Position fast idle screw in contact with the second step and against shoulder of high step of the fast idle cam. Refer to Specifications for the correct setting. Adjust by turning the fast idle adjustment screw.

CHOKE MECHANISM SERVICE

The choke mechanism may be serviced without removing the carburetor from the engine. If the choke binds, sticks, or does not operate smoothly, perform the following.

(1) Remove choke cover.

(2) Remove choke lever and screw.

(3) Remove choke housing. Slide off thermostatic choke shaft. Remove thin plastic bearing material.

(4) Polish shaft with crocus cloth. Wipe bearing material clean and insert into housing.

(5) Wipe fast idle cam clean.

(6) Install choke housing to thermostatic choke shaft and install housing screws.

(7) Install choke lever and screw.

(8) Install housing cover and set to specification.

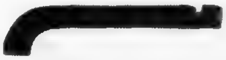
SPECIFICATIONS

Model 2100 Carburetor Calibrations (Inches)

	8DA2	8RA2	8RA2C
Throttle Bore Size	1.562	1.562	1.562
Main Venturi Size	1.080	1.080	1.080
Fuel Inlet Diameter	0.101	0.101	0.101
Low Speed Jet (Tube)	0.032	0.031	0.029
Economizer	0.046	0.046	0.052
Idle Air Bleed	0.101	0.101	0.101
Main Jet Number	47	47	48
High Speed Bleed	0.052	0.052	0.052
Power Valve Timing (inches Hg)			
— First Stage	9.0	9.0	9.0
— Second Stage	5.0	5.0	4.0
Accelerator Pump Jet	0.024	0.024	0.024
Vacuum Spark Port			
— Width	0.050	0.050	0.050
— Height	0.085	0.085	0.085
Spark Port Location Above Closed Throttle	0.042	0.057	0.057
Choke Heat Bypass	0.114	0.114	0.114
Choke Heat Inlet Restriction	0.076	0.059	0.076
Choke Vacuum Restriction	0.089	0.089	0.089

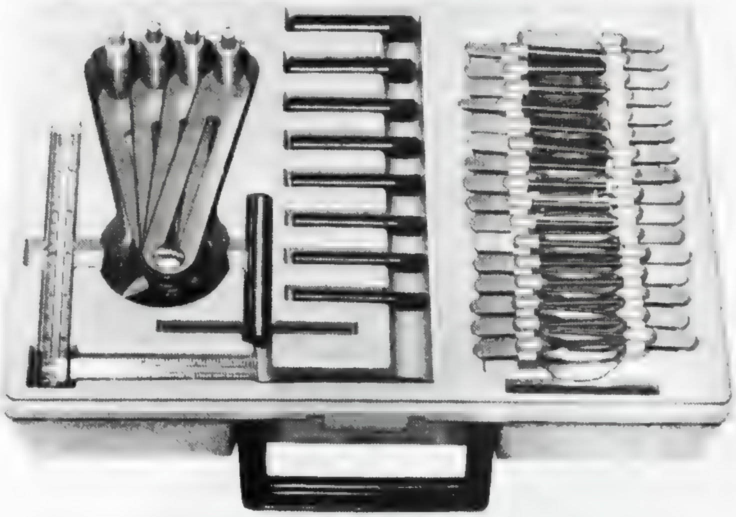
80598

Special Tools



J-1137
BENDING TOOL

J-10174-01
MAIN JET REMOVER
AND INSTALLER



J-9789-02
UNIVERSAL CARBURETOR
GAUGE SET

Model 2100 Carburetor Specifications

List Number	Application	Float Level (Wet)		Float① Level (Dry)	Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Choke Unloader	Fast Idle ② Speed		Bowl Vent Clearance	Choke Bimetal ID
		Set To	OK Range		Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range		
8DA2	304 Automatic 49 State	0.780	0.713 to 0.847	Set to 0.555 OK Range 0.493 to 0.617	0.136	0.113 to 0.159	0.126	0.111 to 0.141	Index	1/2L to 1/2R	0.250 min.	1600	1500 to 1700	0.120	TFA
8RA2	360 Automatic 49 State	0.780	0.713 to 0.847		0.136	0.113 to 0.159	0.126	0.111 to 0.141	1	1/2 to 1-1/2	0.250 min.	1600	1500 to 1700	0.120	TFA
8RA2C	360 Automatic California	0.780	0.713 to 0.847		0.136	0.113 to 0.159	0.120	0.105 to 0.135	1	1/2 to 1-1/2	0.250 min.	1800	1700 to 1900	0.120	EKL

① Measure from machined surface to a point on float 1/8-inch from tip. Needle Seated.

② Hot with TCS Solenoid and EGR Valve disconnected.

80599

CARBURETOR MODEL 2150-2 VENTURI WITH ALTITUDE COMPENSATION

GENERAL

The Motorcraft Model 2150 carburetor with altitude compensation is installed on eight-cylinder engines in vehicles sold for use at elevations of 4000 feet or more.

This carburetor features a compensation circuit which mixes a metered amount of additional air into the fuel/air mixture to prevent an over-rich condition at higher altitudes. An automatic device (aneroid) senses atmospheric pressure and overrides the compensation feature at lower altitudes (fig. 1J-112).

NOTE: *At extremely low barometric pressure levels, the aneroid may open the bleed valve at sea level. This is normal and does not indicate a faulty component.*

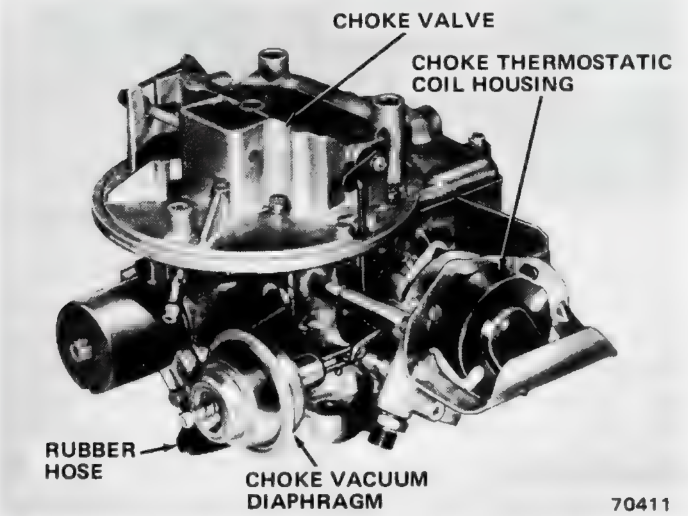


Fig. 1J-112 Model 2150 Carburetor Assembly

The Model 2150 carburetor uses a choke diaphragm to provide initial choke valve clearance. The vacuum modulator used in the Model 2100 is not used on the Model 2150.

The Model 2150 Carburetor operates and is serviced the same as the Model 2100 except for the altitude compensation device and the choke circuit. This section covers only operational differences. Service procedures and adjustment procedures are provided only for the compensation device and choke diaphragm. All other information is covered in the preceding section, Model 2100 Carburetor—2V.

CARBURETOR CIRCUITS

Altitude Compensation Circuit

The altitude compensation circuit supplies the extra air necessary to lean out the fuel/air mixture at high altitudes. The compensation circuit parallels the main carburetor intake circuit (fig. 1J-113). At the top, a small choke valve controls the airflow when the main choke is closed. Air flows down through a passage in the main body into a plenum chamber located adjacent to the two main venturi bores. A spring-loaded valve regulates the amount of air passed from the plenum into the compensator body. Air flows from the compensator body through two air passages bored into the main venturis.

The opening and closing of the valve in the compensator body is controlled by an aneroid which is sensitive to atmospheric pressure. At the lower atmospheric pressure of high altitudes, the aneroid pushes on the end of the compensator valve stem, opening the valve. At lower altitudes, the aneroid relaxes, automatically closing the valve.

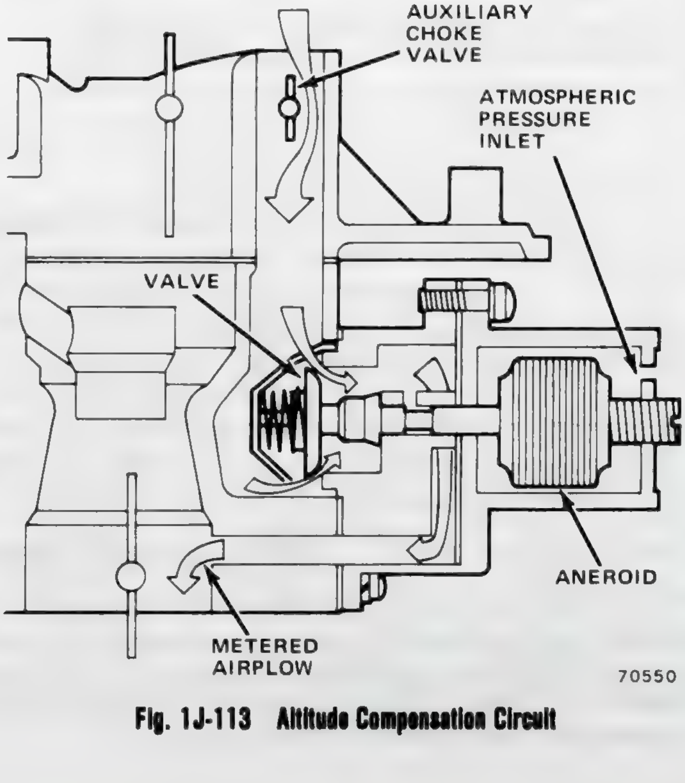


Fig. 1J-113 Altitude Compensation Circuit

The aneroid is factory calibrated and is not adjustable. Do not tamper with the hex-head plug on the aneroid.

Choke Circuit

The compensation circuit is provided with a separate choke valve linked directly to the main choke valve (fig. 1J-114). It is not adjustable.

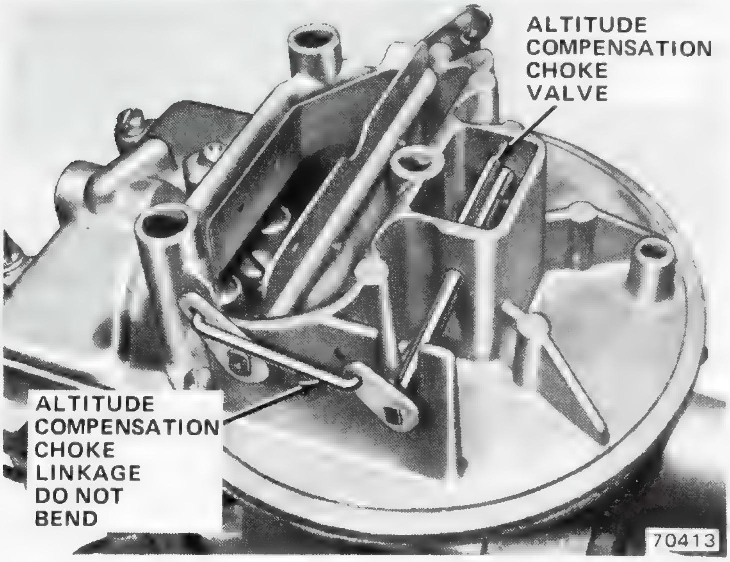


Fig. 1J-114 Compensation Circuit Choke Valve

A thermostatic coil is used to operate the choke valve for cold engine start-up. The bimetal coil winds up when cold and unwinds when warm. Exhaust-heated air is provided to warm the coil as the engine warms up. An electric coil supplies additional heat to open the choke valve more quickly. The electric choke consists of a ceramic heater in the choke coil housing. Current to operate the heater is supplied through an oil pressure sensing switch. When the engine is operating, oil pressure closes the switch to operate the choke. If the engine should stall, current to the heater coil is interrupted until the engine is restarted.

When the engine starts, manifold vacuum is applied to the choke vacuum diaphragm to open the choke valve slightly. This is called the initial choke valve clearance.

If the engine is accelerated during the warm-up period, the corresponding drop in manifold vacuum allows the thermostatic coil to momentarily close the choke valve to provide a richer mixture.

CARBURETOR OVERHAUL

In addition to Model 2100 overhaul procedures, perform the following:

Disassembly

(1) Remove attaching screws and remove compensation assembly and gasket from carburetor body.

(2) Remove aneroid-to-chamber screws. Remove gasket and aneroid from chamber.

Cleaning and Inspection

CAUTION: *Do not immerse any part of the altitude compensation assembly in cleaning solvent. Wipe all parts with clean, lint-free cloths.*

With the aneroid removed from the chamber, spring tension should push the air valve fully shut. Check the position of the spring in the retainer to be sure it is properly seated (fig. 1J-115). Inspect the rubber seal on the valve stem. Check the aneroid assembly to be sure that the atmospheric pressure inlet hole is free of debris.

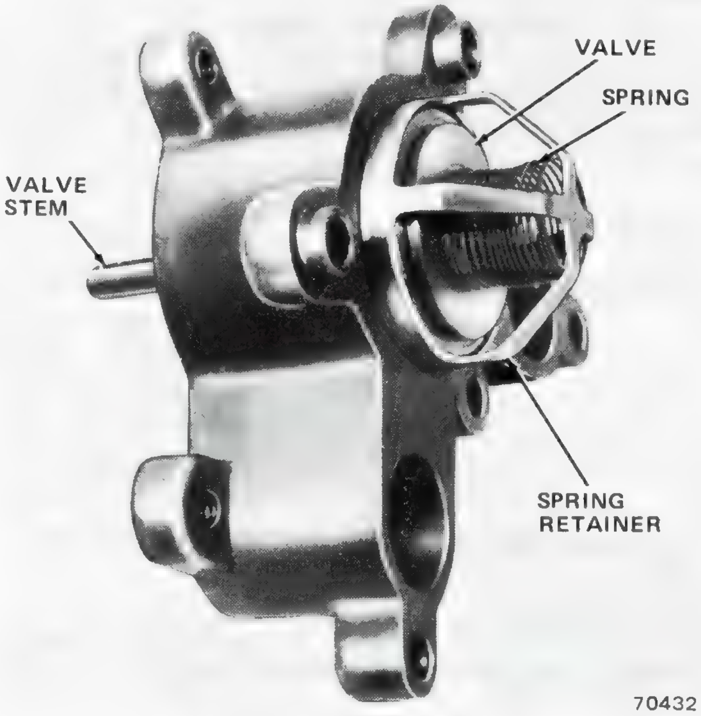


Fig. 1J-115 Inspecting Compensator

Assembly

(1) Install aneroid to chamber using replacement gasket. Install screws.

(2) Install assembly to carburetor body using replacement gasket. Install screws.

SERVICE ADJUSTMENT PROCEDURES

In addition to the Model 2100 adjustment procedures, perform the following.

Altitude Compensation Assembly Adjustment

There are no adjustments to this assembly. **Do not** attempt to turn the fitting on the aneroid. It is set and sealed at the factory.

Initial Choke Valve Clearance Adjustment

(1) Loosen choke cover retaining screws.

(2) Open throttle and rotate choke cover until choke valve is held closed. Tighten one retaining screw.

(3) Close throttle with fast idle speed screw on top step of cam.

(4) Apply vacuum to hold choke diaphragm against setscrew. Do not press on links.

NOTE: *If vacuum is applied to the choke diaphragm with a hand pump, a vacuum leak may be noticed. This is normal.*

(5) Measure clearance between lower edge of choke valve and air horn (fig. 1J-116).

(6) Adjust clearance by turning screw located at rear of diaphragm housing.

(7) Adjust fast idle cam linkage.

(8) Loosen choke cover screw and rotate cover to relieve tension on choke bimetallic coil. Set choke cover to specifications and tighten choke cover retaining screws.

NOTE: *Do not reset the choke cover until fast idle cam linkage adjustment has been performed.*

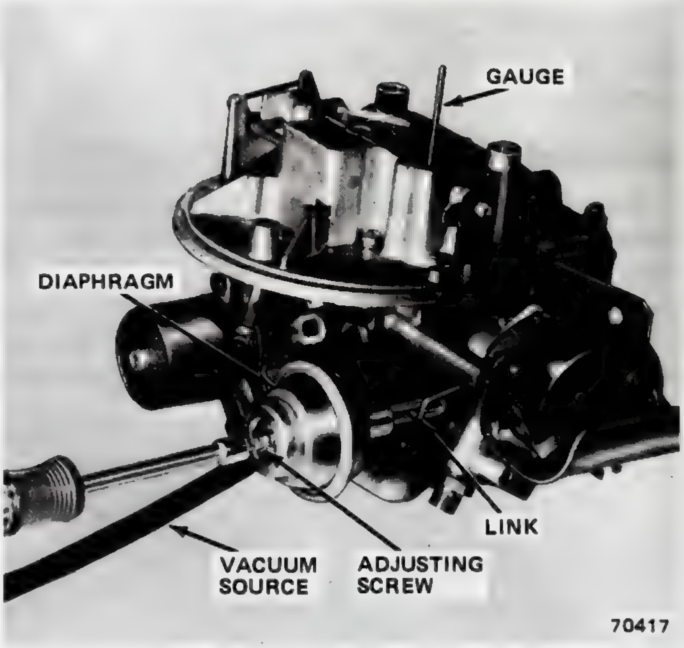


Fig. 1J-116 Initial Choke Valve Clearance Adjustment

SPECIFICATIONS

Model 2150 Carburetor Calibrations (Inches)

	8DA2A	8RA2A
Throttle Bore Size	1.562	1.562
Main Venturi Size	1.080	1.080
Fuel Inlet Diameter	0.101	0.101
Low Speed Jet (Tube)	0.029	0.028
Economizer	0.052	0.049
Idle Air Bleed	0.101	0.101
Main Jet Number	48	48
High Speed Bleed	0.052	0.052
Power Valve Timing (inches Hg) — First Stage — Second Stage	 7.5 2.0	 7.5 2.0
Accelerator Pump Jet	0.024	0.028
Accelerator Spark Port — Width — Height	 0.050 0.085	 0.050 0.085
Spark Port Location Above Closed Throttle	0.042	N.A.
Choke Heat Bypass	0.114	0.114
Choke Heat Inlet Restriction	0.076	0.076
Choke Vacuum Restriction	0.089	0.089

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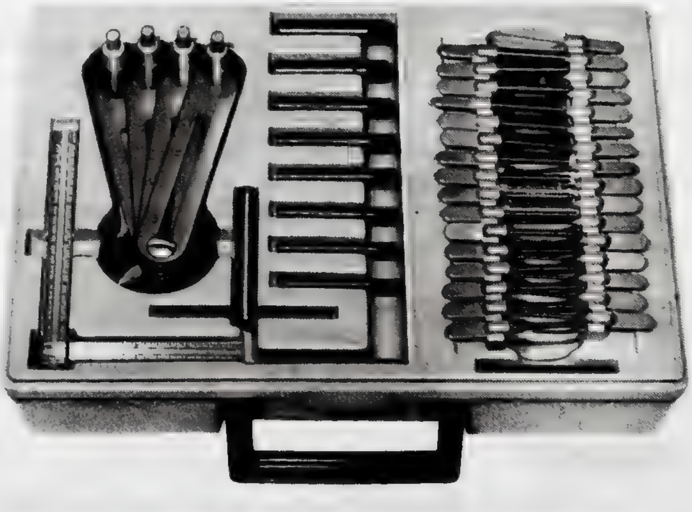
Special Tools

J-1137
BENDING TOOL



J-9789-02
UNIVERSAL CARBURETOR
GAUGE SET

Model 2150 Carburetor Specifications

List Number	Application	Float Level		Float Drop	Initial Choke Valve Clearance		Fast Idle Cam Setting		Automatic Choke Cover Setting (Notches Rich)		Choke Unloader	Fast Idle ① Speed		Bowl Vent Clearance	Choke Bimetal ID
		Set To	OK Range		Set To	OK Range	Set To	OK Range	Set To	OK Range		Set To	OK Range		
8RA2A	360 Automatic Altitude	0.780	0.713 to 0.847	Measure from machined surface to a point on float 1/8-inch from tip. Needle Seated	0.089	0.066 to 0.112	0.078	0.063 to 0.093	2	1-1/2 to 2-1/2	0.170 min.	1800	1700 to 1900	0.120	EKL
8DA2A	304 Automatic Altitude	0.930	0.863 to 0.997	Set to 0.555 OK Range 0.493 to 0.617	0.089	0.066 to 0.112	0.078	0.063 to 0.093	2	1-1/2 to 2-1/2	0.170 min.	1600	1500 to 1700	0.120	EKL

① Hot with TCS Solenoid and EGR Disconnected

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EXHAUST GAS RECIRCULATION (EGR) SYSTEM

GENERAL

The EGR system consists of a diaphragm-actuated flow control valve (EGR valve), coolant temperature override switch (EGR CTO) and connecting hoses (fig. 1J-117, 1J-118 and 1J-119).

Oxides of nitrogen (NOx) are formed by high heat created during combustion. The EGR system limits the formation of NOx by diluting the intake charge with a metered amount of exhaust gas.

Exhaust gas enters the combustion chamber with the intake charge. The exhaust gas introduced is inert (will not burn) and much cooler than combustion temperature. Since the exhaust gas will not burn, the peak temperature of the gases in the engine combustion chambers are lower.

EGR does not take place until engine operating temperature has reached a preset level and engine load is sufficient to permit proper EGR operation.

EGR VALVE

The EGR valve is mounted on the side of the intake manifold on four- and six-cylinder engines and on a machined surface at the rear of the intake manifold on eight-cylinder engines. The valve is calibrated to control the amount of exhaust gas allowed to enter the intake manifold.

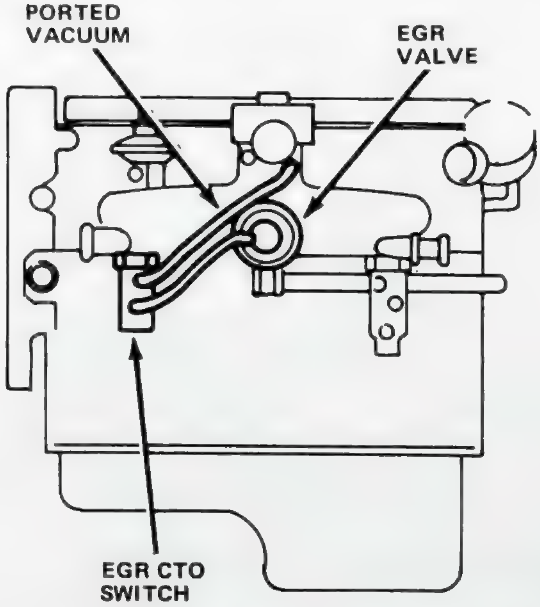

Fig. 1J-117 EGR System—Four-Cylinder

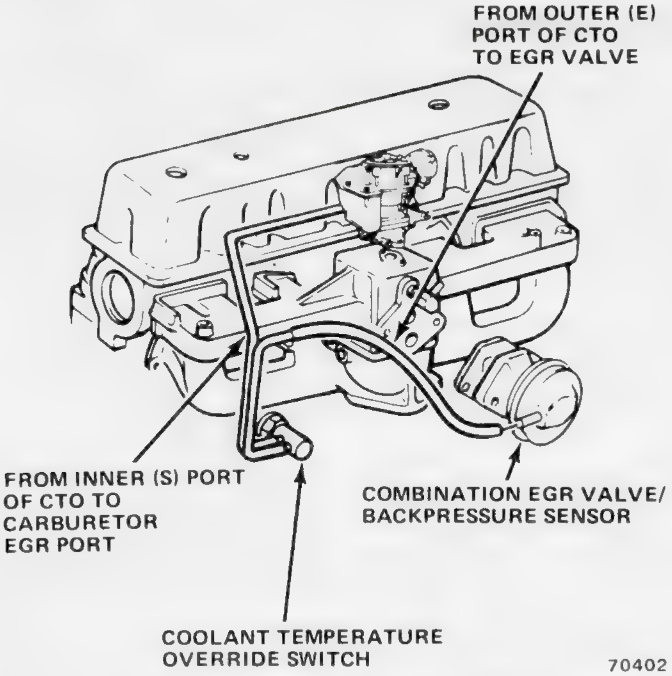

Fig. 1J-118 EGR System—Six-Cylinder

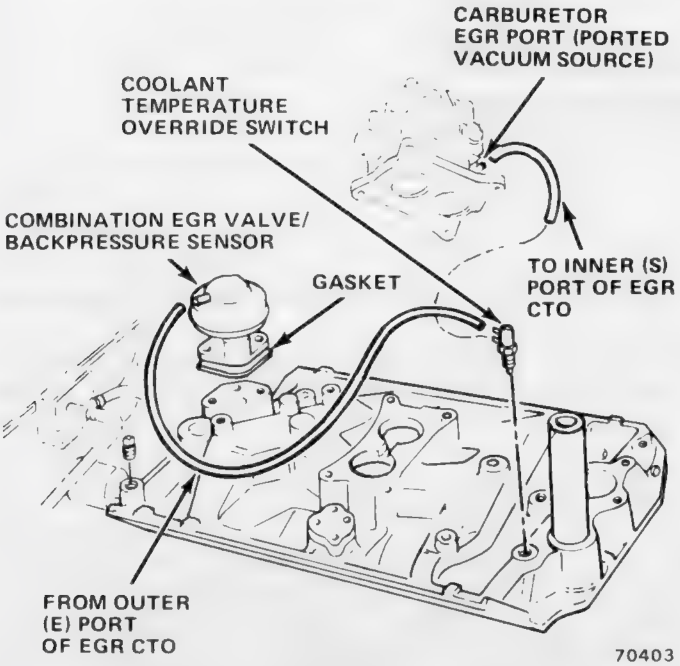

Fig. 1J-119 EGR System—Eight-Cylinder

Two types of EGR valves are used. The four-cylinder engine uses a valve with no back-pressure sensor. A restrictor plate is used on all four-cylinder applications except altitude. All six- and eight-cylinder engines use an EGR valve with integral back-pressure sensor. No restrictor plate is used with these engines.

EGR Valve Without Back-Pressure Sensor

The EGR valve is normally held closed by a spring located above the diaphragm (fig. 1J-120). The valve opens when sufficient vacuum is applied through hoses connecting the CTO switch to the EGR vacuum port at the carburetor.

When vacuum overcomes the diaphragm spring pressure, a pintle within the valve is lifted off its seat and exhaust gas, which reaches the EGR valve through special tubing, is metered into the intake manifold.

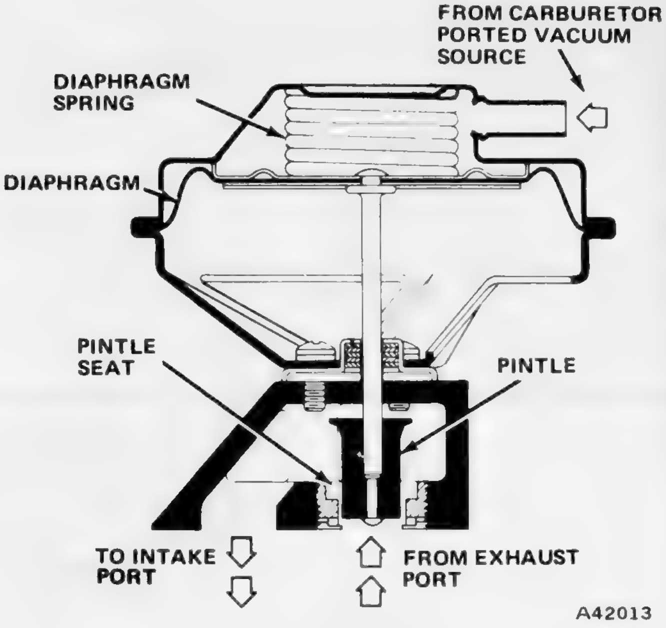

Fig. 1J-120 EGR Valve Without Back-Pressure Sensor

EGR Valve With Integral Back-Pressure Sensor

Calibration is accomplished by the selective use of different diaphragm spring loads and flow control orifices. The unit combines the functions of the EGR valve and back-pressure transducer into a single component.

Refer to figure 1J-121. The flow (recirculation) of exhaust gas is controlled by a movable pintle. In the relaxed position, spring pressure holds the pintle against its seat, confining exhaust gases to the exhaust manifold. Carburetor vacuum is available at the power diaphragm to pull the pintle from its seat, but this cannot happen while the vacuum bleed valve in the power diaphragm is open.

Exhaust gas exerts pressure (back-pressure) inside the exhaust manifold whenever the engine is running. This pressure is conducted throught the hollow pintle stem into the control diaphragm chamber. If this pressure is great enough to overcome control spring pressure, the control diaphragm is moved against the bleed valve. Full vacuum is now applied to the power diaphragm and the pintle moves. EGR now begins. If back-pressure drops sufficiently, the control diaphragm moves away from the bleed valve. The power diaphragm again relaxes and EGR stops.

System pressure remains constant, within the range of the unit. Recirculation is a function of the exhaust manifold backpressure level. EGR is dependent on backpressure and is a fixed percentage of the incoming charge.

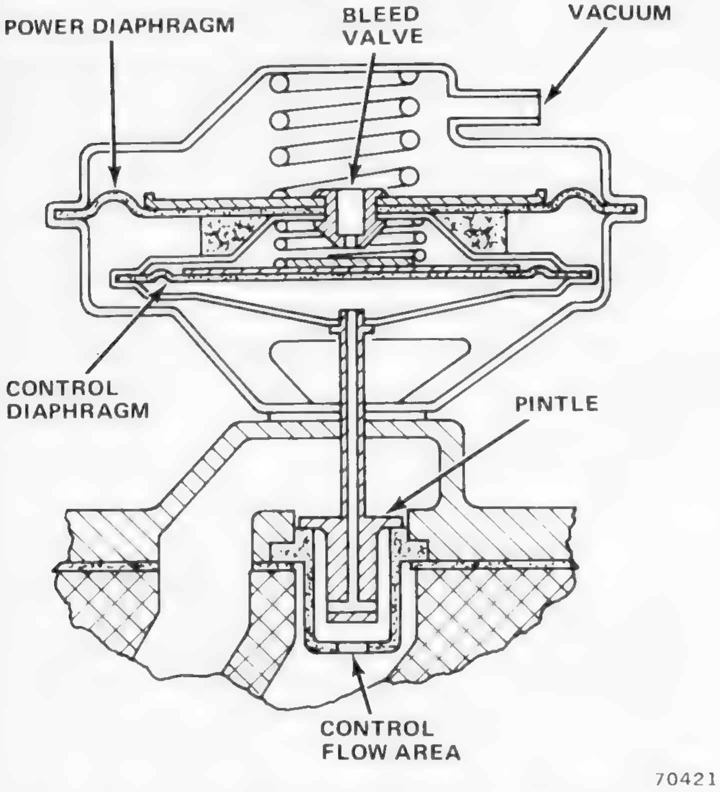

Fig. 1J-121 EGR Valve/Back-Pressure Sensor Unit

Exhaust gas is drawn from an area near the heat riser on six-cylinder engines and from the exhaust crossover passage on eight-cylinder engines.

EGR Valve Test

On vehicles with back-pressure sensor, the condition of the exhaust system may affect EGR operation. Excessive back-pressure from exhaust system restrictions may create driveability problems. Refer to Chapter 1K—Exhaust Systems for Restricted Exhaust System Diagnosis. Leaks in the exhaust system may decrease back-pressure enough to prevent proper EGR operation. This will increase exhaust emissions. Visually inspect exhaust system if leaks are suspected.

Valve Opening Test

With engine at operating temperature and curb idle, rapidly open and close throttle. Throttle should be opened sufficiently for engine to reach 1500 rpm. A definite movement should be noticed in the EGR diaphragm.

If the diaphragm does not move, the probable causes are: faulty vacuum signal to EGR, defective EGR diaphragm or defective back-pressure sensor diaphragm. Check vacuum lines for leaks.

Valve Closing Test

With the engine at operating temperature and curb idle, manually depress the EGR valve diaphragm. This should cause an immediate engine speed drop, indicating that the EGR valve had been properly cutting off the flow of exhaust gas at idle.

If there is no change in engine rpm and the engine is idling properly, exhaust gases do not reach the combustion chamber, and the probable difficulty is a plugged passage between the EGR valve and the intake manifold.

If the engine idles poorly and rpm is not greatly affected by compressing the EGR diaphragm, the EGR valve is not closing off the flow of exhaust gases. There is a fault in the hoses, hose routings or the valve itself.

EGR Valve Replacement

Removal

(1) Remove air cleaner assembly on eight-cylinder engines.
(2) Disconnect vacuum hoses.
(3) Remove retaining nuts from manifold.
(4) Remove EGR valve, gaskets and restrictor plate or spacer, if equipped.
(5) Discard gasket and clean mating surface.

Installation

(1) Install EGR valve and replacement gasket. If restrictor plate is used, sandwich between two replacement gaskets.
(2) Install retaining nuts and tighten.
(3) Connect all vacuum hoses. For hose routings, refer to figures 1J-117, 1J-118 or 1J-119.
(4) Replace air cleaner assembly, if removed.

EGR CTO SWITCH

The EGR CTO switch is located in the coolant passage on the bottom of the intake manifold on four-cylinder engines, at the left side of the cylinder block on six-cylinder engines and in the coolant passage of the intake manifold adjacent to the oil filler tube on eight-cylinder engines. The inner port (S) connects to a hose to the EGR port at the carburetor. The outer port (E) connects by hose to the exhaust back-pressure sensor (fig. 1J-122).

When coolant temperature is below the rating of the CTO switch, there is no vacuum signal to the EGR system. On some engines, the CTO switch opens at 115°F and has a black body or paint dab. On other engines, the CTO switch opens at 160°F and has a yellow body or paint dab.

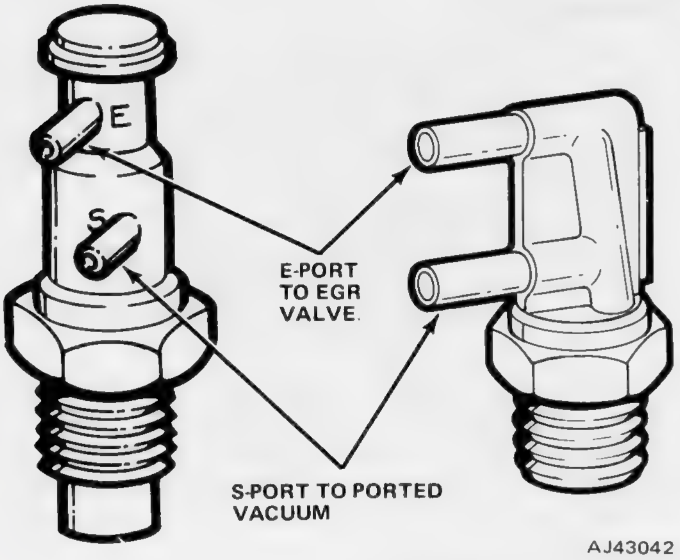

Fig. 1J-122 EGR CTO Switch

EGR CTO Test

NOTE: *Engine coolant temperature must be below 100°F.*

(1) Check vacuum lines for leaks and correct routings (fig. 1J-117, 1J-118 and 1J-119).

(2) Disconnect vacuum line at EGR valve and connect line to vacuum gauge.

(3) Operate engine at approximately 1500 rpm. No vacuum should be indicated on gauge. If vacuum is indicated, replace EGR CTO switch.

(4) Idle engine until coolant temperature exceeds 115°F (black color code) or 160°F (yellow color code). The temperature gauge needle is approximately halfway between the cold mark and the beginning of the band at 115°F and is about at the beginning of the band at 160°F.

(5) Accelerate engine to 1500 rpm. Carburetor ported vacuum should be indicated on vacuum gauge. If not, replace EGR CTO switch.

EGR CTO Replacement

Removal—Four-Cylinder

(1) Drain coolant from radiator.

(2) Disconnect vacuum lines.

WARNING: *Serious burns can result if hot coolant is not drained before removing switch*

(3) Use open-end wrench to remove switch from intake manifold.

Installation—Four-Cylinder

(1) Install EGR CTO switch to intake manifold.

(2) Connect vacuum lines.

(3) Install coolant and purge air from cooling system.

Removal—Six-Cylinder

(1) Drain coolant from radiator.

(2) Disconnect vacuum lines.

WARNING: *Serious burns can result if hot coolant is not drained before removing switch from block.*

(3) Use open-end wrench to remove switch from block.

Installation—Six-Cylinder

(1) Install EGR CTO switch in block.

(2) Connect vacuum lines.

(3) Install coolant and purge air from cooling system. Removing temperature sending unit permits trapped air to escape.

Removal—Eight-Cylinder Engine

(1) Drain coolant from radiator.

(2) Remove air cleaner assembly.

(3) Remove coil bracket attaching screw and position coil away from EGR CTO switch.

(4) Disconnect vacuum hoses from CTO switch.

(5) Remove switch from intake manifold with open-end wrench.

Installation—Eight-Cylinder Engine

(1) Install EGR CTO switch in intake manifold.

(2) Install coil and bracket with attaching screw.

(3) Connect vacuum hoses to switch.

(4) Install air cleaner assembly.

(5) Install coolant and purge cooling system of air.

RESTRICTOR PLATE

The restrictor plate is used on certain four-cylinder engines (fig. 1J-123). The plate is sandwiched between two gaskets and mounts between the EGR valve and intake manifold. The stainless steel plate is calibrated for a particular engine-exhaust system combination and must never be altered or replaced with a restrictor plate of different calibration.

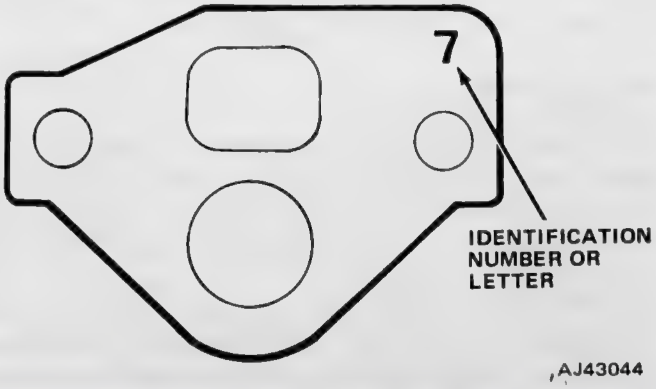

Fig. 1J-123 Restrictor Plate

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

GENERAL

The PCV system prevents crankcase vapors from entering the atmosphere. Filtered air is directed into the crankcase and vapors are drawn out, channeled into the intake manifold and burned in the combustion chambers.

In addition to controlling crankcase vapors, the PCV system also constantly ventilates the crankcase. The free movement of air helps prevent the formation of sludge.

COMPONENTS

The PCV system consists of an air inlet filter, a flow-control (PCV) valve and associated hoses (fig. 1J-124, 1J-125 and 1J-126).

The air inlet filter is located inside the air cleaner housing on four- and six-cylinder engines. It is contained in the oil filler cap on eight-cylinder engines.

Positive Crankcase Ventilation (PCV) Valve

Two PCV valves with different flow rates are used. Flow rate is measured in cubic feet per minute (cfm). The yellow valve is used on all four- and six-cylinder engines and the black valve is used on all eight-cylinder engines (fig. 1J-127).

Replace the PCV valve at the intervals specified in the Maintenance Schedule. Inspect all hoses in the PCV system at this time for leaks or restrictions and clean or replace as required. PCV valve replacement may be required more often under adverse operating conditions.

OPERATION

Air flow through the PCV system is controlled primarily by manifold vacuum. There are two basic operating modes. When manifold vacuum is relatively high, as at idle or at cruising speed, fresh air is drawn through the air intake filter into the crankcase. After circulating through the crankcase, the vapor-filled air is drawn through the PCV valve into the intake manifold. The vapors mix with fuel/air mixture and are burned in the combustion chambers. The PCV valve is calibrated to control airflow to a rate acceptable to the intake system.

If crankcase vapor pressures (blowby) exceed the flow capacity of the PCV valve, airflow in the system reverses. Crankcase vapors are drawn through the air cleaner element and carburetor and burned along with the fuel-air mixture.

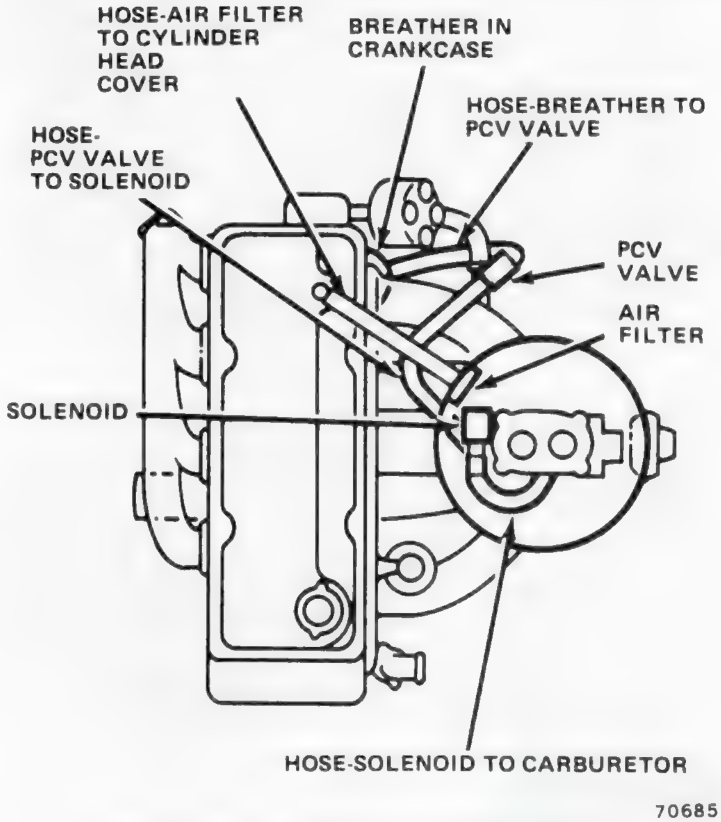

Fig. 1J-124 PCV System—Four-Cylinder Engine

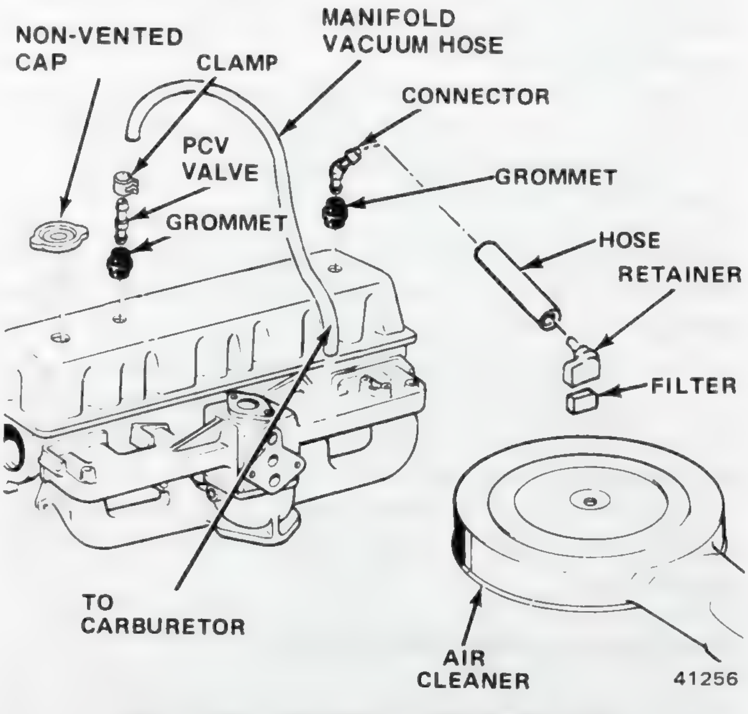

Fig. 1J-125 PCV System—Six-Cylinder Engine

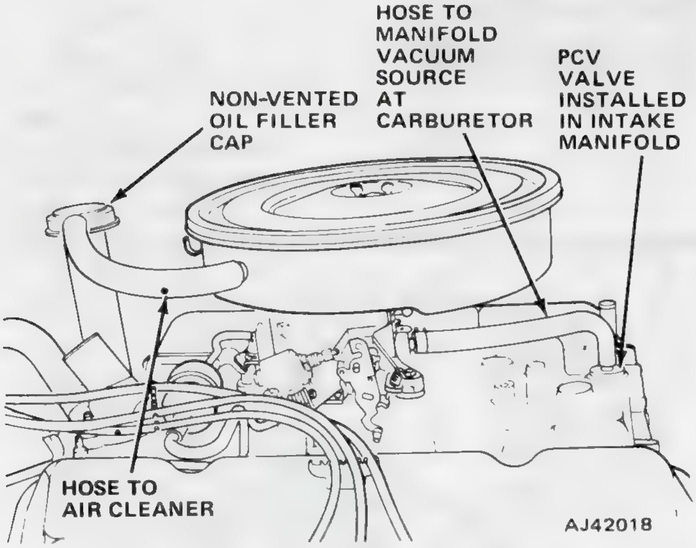

Fig. 1J-126 PCV System—Eight-Cylinder Engine

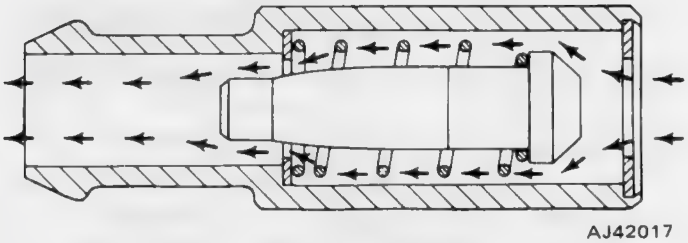

Fig. 1J-127 Positive Crankcase Ventilation Valve

PCV VALVE TEST

Test the valve at idle speed for correct flow rate (cfm) providing the engine manifold vacuum is at least 14 inches Hg. When checking vacuum, connect the gauge to a fitting which is as centrally located as possible on the intake manifold.

(1) Remove valve from hose (four-cylinder), grommet in cylinder head cover (six-cylinder) or intake manifold (eight-cylinder). Connect plastic hose of PCV Valve Tester J-23111 to valve (fig. 1J-128).

NOTE: *Hold the PCV valve in a horizontal position and tap lightly during the test. Hold the tester in a vertical position.*

(2) Start engine and allow it to idle. Observe flow rate (cfm). Refer to PCV Valve Flow Rate Chart. At low vacuum readings, it may be necessary to load engine while checking flow rate.

(3) Replace valve which flows above or below specification. Be sure to use correct PCV valve for replacement.

PCV AIR INLET FILTER MAINTENANCE

Perform air inlet filter maintenance at the intervals specified in the Maintenance Schedule in Chapter B.

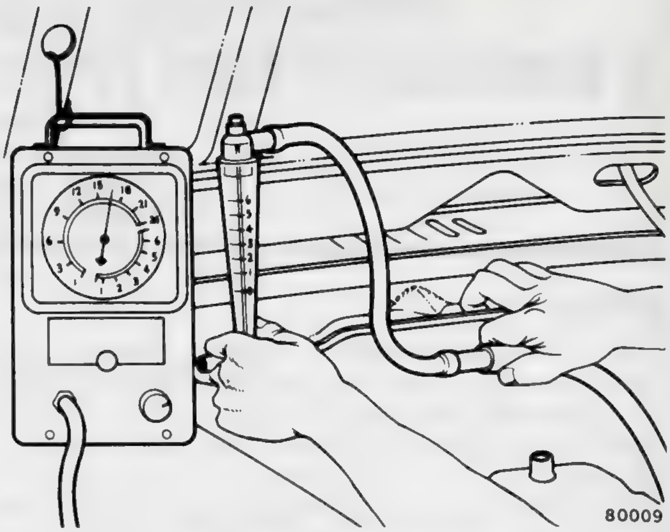

Fig. 1J-128 PCV Valve Test

PCV Valve Flow Rate

Engine Manifold Vacuum (in. Hg.)	Air Flow (CFM)	
	Yellow Four-Cylinder Six-Cylinder	Black Eight-Cylinder
16		1.34-1.63
13	1.30-1.90	
7		2.70-3.79
5	1.21-2.26	
3		3.30-4.39
2	1.28-2.56	

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Four- and Six-Cylinder

A polyurethane foam PCV air inlet filter is located in a filter retainer in the air cleaner.

(1) Rotate retainer to remove from air cleaner (fig. 1J-129).

(2) Clean filter in kerosene.

(3) Lightly oil filter with clean engine oil.

(4) Install filter and retainer to air cleaner.

Eight-Cylinder

A polyurethane foam PCV air inlet filter is located in the sealed oil filler cap.

(1) Remove oil filler cap.

(2) Apply light air pressure in reverse direction of normal flow (through filler tube opening of cap).

(3) Install oil filler cap and connect PCV hose between air cleaner and filler cap.

NOTE: *Replace the filler cap if filter is deteriorated.*

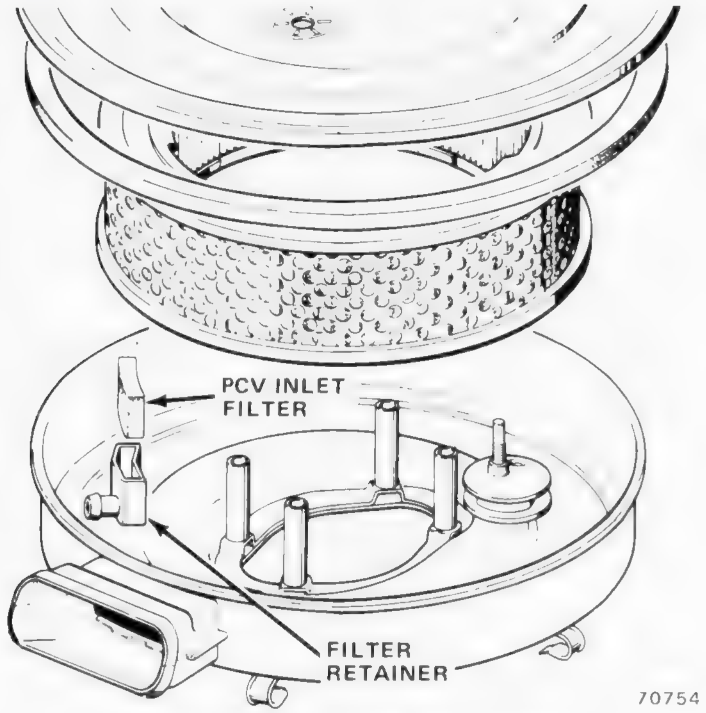

Fig. 1J-129 PCV Air Inlet Filter—Typical

PCV SOLENOID VALVE

All manual transmission four-cylinder engines are equipped with a PCV anti-diesel solenoid valve activated by the same circuit as the throttle solenoid. When the ignition switch is turned OFF, the throttle solenoid closes the carburetor throttle plates and the PCV solenoid blocks airflow in the hose leading from the PCV valve to the intake manifold.

Testing

Operation of the PCV solenoid is checked by observing the solenoid while turning the ignition switch ON and OFF. Remove PCV valve-to-solenoid hose from solenoid to observe valve movement.

THERMOSTATICALLY CONTROLLED AIR CLEANER (TAC) SYSTEM

GENERAL

The Thermostatically Controlled Air Cleaner (TAC) system provides pre-warmed air to the carburetor air cleaner during engine warm-up. Warm intake air permits the carburetor to be calibrated leaner, reducing hydrocarbon emissions. It also improves engine warm-up and minimizes carburetor icing.

All AMC cars are equipped with a TAC system. For 1978, all cars have the vacuum-operated type system. Ambient air induction which was introduced mid-year on 1977 1/2 four-cylinder engines is used on all engines for 1978.

OPERATION

This system consists of a heat shroud (positioned over the exhaust manifold on four- and six-cylinder engines and integral with the right-hand exhaust manifold on eight-cylinder engines), a hot air tube, a special air cleaner assembly equipped with a thermal sensor, and a vacuum motor and air valve assembly. On four-cylinder engines, the air cleaner is mounted to the carburetor, the vacuum motor and valve assembly are attached to the inner fender, and a flexible hose connects them (fig. 1J-130). On six- and eight-cylinder engines, the vacuum motor and valve assembly is integral with the air cleaner snorkel (fig. 1J-131).

The thermal sensor incorporates a bleed valve which regulates the amount of vacuum applied to the vacuum motor and controls air valve position to supply either air heated by the exhaust manifold or ambient air from outside the engine compartment (fig. 1J-132).

During the warmup period, the air bleed valve is closed and sufficient vacuum is applied to the vacuum motor to hold the air valve in the heat ON position.

As the temperature of the air entering the air cleaner approaches the calibrated temperature, the bleed valve opens to decrease the amount of vacuum applied to the vacuum motor. The diaphragm spring in the vacuum motor then moves the air valve into the heat OFF position, allowing only ambient air to enter the air cleaner.

During hard acceleration, manifold vacuum drops. This moves the TAC valve to the heat OFF position, regardless of the temperature, to obtain maximum airflow through the air cleaner.

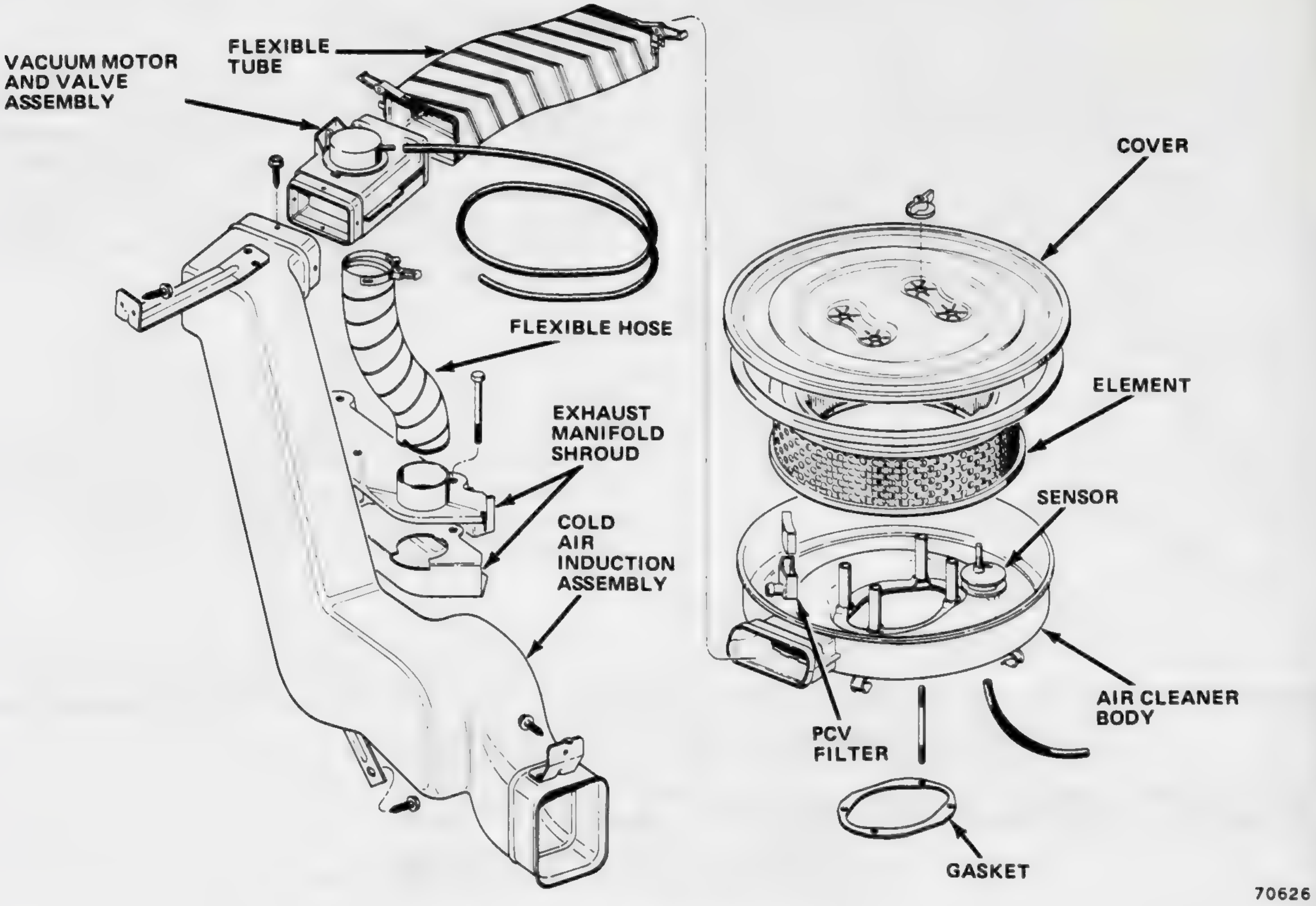

Fig. 1J-130 TAC System—Four-Cylinder

TESTING

Operational Test

(1) Remove air cleaner assembly from engine. Allow four-cylinder air cleaner to cool to a temperature below 100°F. Six- and eight-cylinder air cleaners must cool to a temperature below 83°F.

(2) After cooling, sight through air cleaner snorkel to observe position of air valve. It should be fully open to outside air (heat OFF position).

(3) Install air cleaner assembly to engine and connect hot air tube and manifold vacuum hose.

(4) Start engine and observe position of air valve. It should be fully closed to outside air (heat ON position).

(5) Move throttle lever rapidly to approximately 1/2 to 3/4 opening and release. Air valve should open and then close again.

(6) Loosely install ambient air hose and allow engine to warm to operating temperature. Move ambient air hose aside and observe position of air valve. It should be fully open to outside air.

If air valve does not close at temperature outlined in step (1) with vacuum applied, check for a mechanical bind in the snorkel, vacuum motor linkage disconnected, vacuum leaks in hoses or connections at the vacuum motor, thermal sensor and intake manifold.

If air valve mechanism is operating freely and no vacuum leaks are detected, connect a hose from an intake manifold vacuum source directly to vacuum motor.

If air valve now closes, thermal sensor is defective and must be replaced.

If air valve does not close, vacuum motor is defective and must be replaced.

THERMAL SENSOR

Replacement

(1) Remove air cleaner and disconnect vacuum hoses from sensor.

(2) Break vacuum nipples off sensor. Remove sensor and gasket from air cleaner.

(3) Install replacement sensor and gasket. Press retainers over vacuum nipples.

(4) Connect vacuum hoses and install air cleaner.

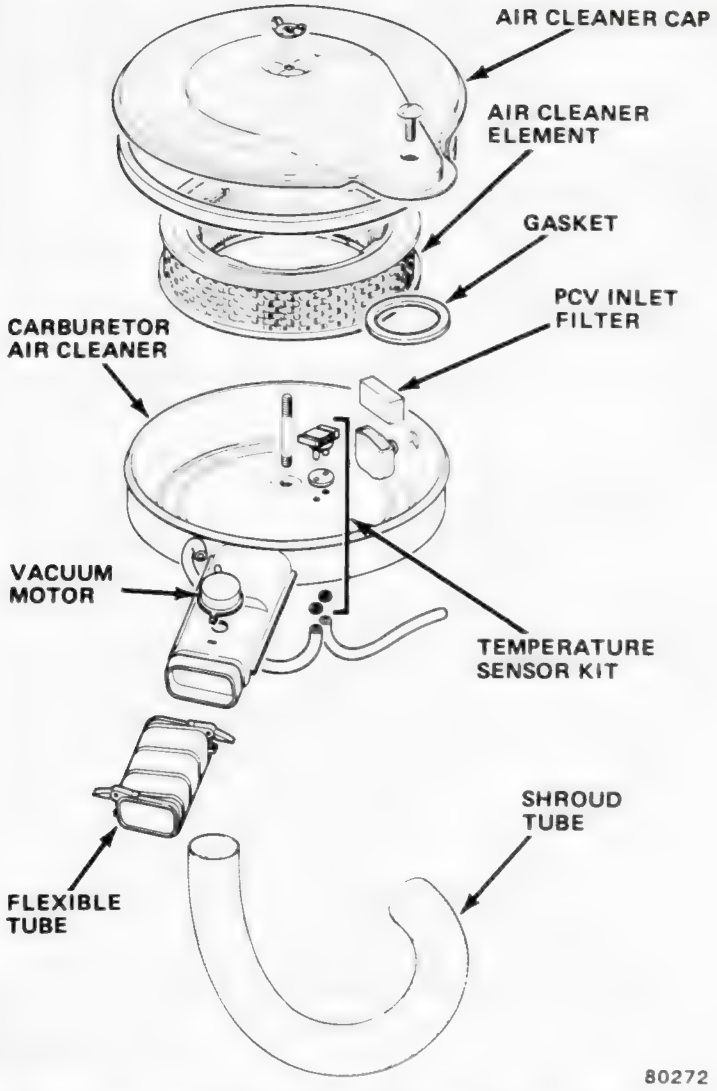

Fig. 1J-131 TAC System—Six-Cylinder (Eight-Cylinder Similar)

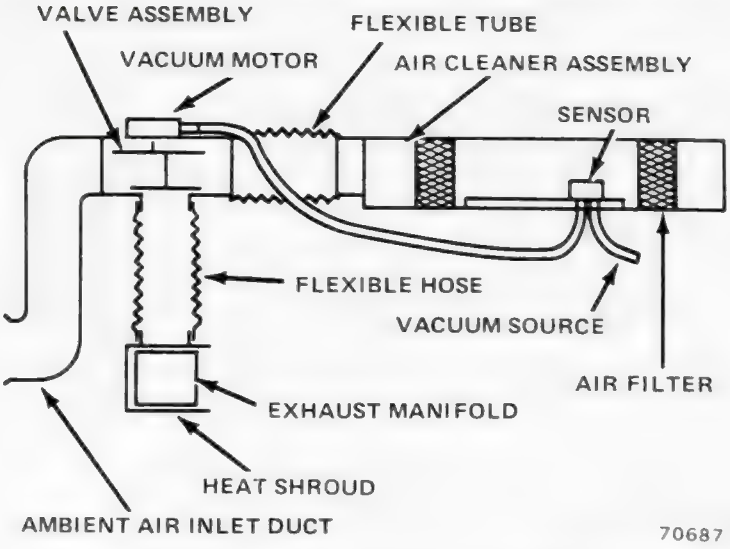

Fig. 1J-132 TAC System Schematic—Four-Cylinder Shown

NOTES

EXHAUST SYSTEMS

1K

SECTION INDEX

EXHAUST MANIFOLDS, MUFFLERS, AND PIPES

GENERAL

The basic exhaust system on all cars consists of exhaust manifold(s), front exhaust pipe, rear exhaust pipe, muffler, and tailpipe.

All 49-state cars with four- or six-cylinder engines use a single muffler exhaust system with a single catalytic converter (fig. 1K-1 and 1K-2). California four-cylinder cars use a single catalytic converter (fig. 1K-1). All California six-cylinder cars have a catalytic converter plus a warm-up converter (fig. 1K-3).

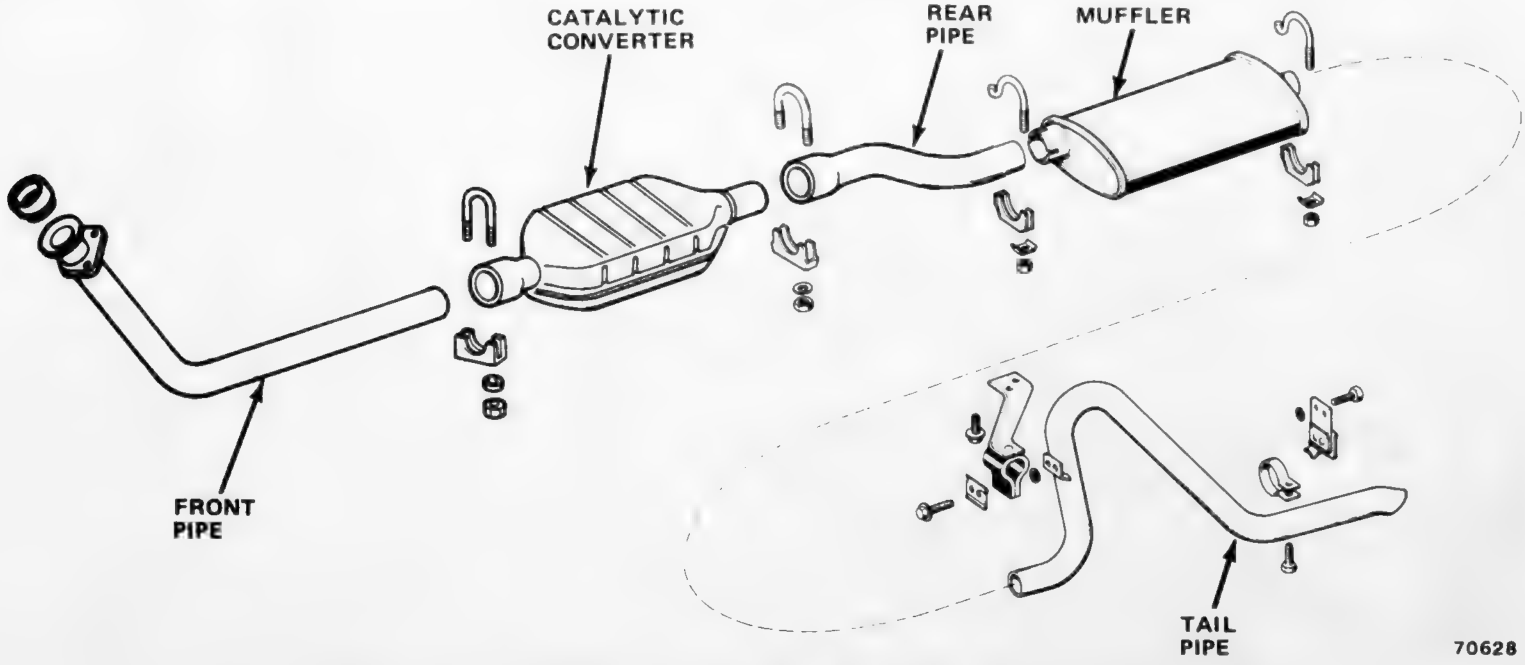

Fig. 1K-1 Exhaust System—Four-Cylinder with Converter

Eight-cylinder 49-state cars use a single muffler exhaust system with a single converter (fig. 1K-4). California cars with eight-cylinder engines use a single muffler exhaust system with dual converters plus warm-up converter(s). Concords have one warm-up converter (fig. 1K-5) and Matadors have two warm-up converters.

The exhaust system must be properly aligned to prevent stress, leakage, and grounding. If the system grounds on any body panel, it may amplify objectionable noises originating from the engine or the body. When inspecting an exhaust system, check for cracked or loose joints, stripped screw threads, and corrosion damage. Check for worn or broken hangers. Replace all parts that are badly corroded or damaged. Do not attempt to repair.

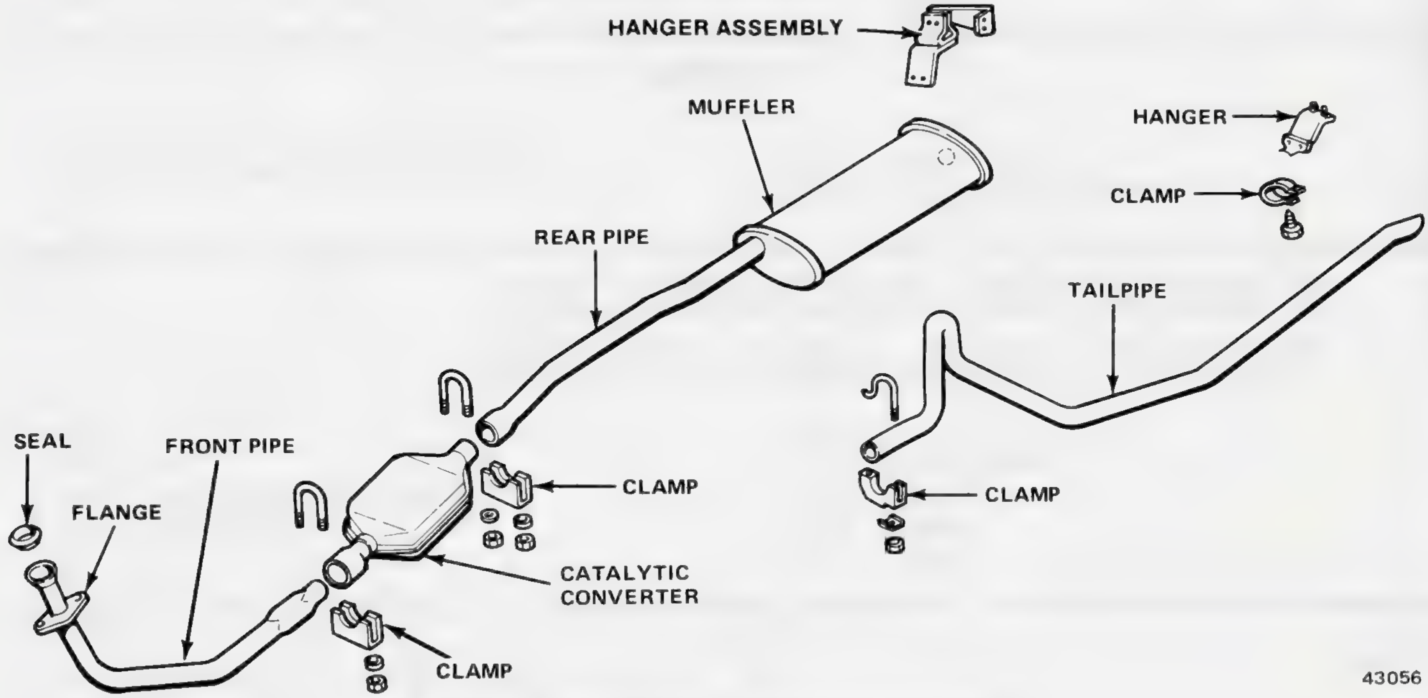

Fig. 1K-2 Exhaust System—Six-Cylinder with Converter

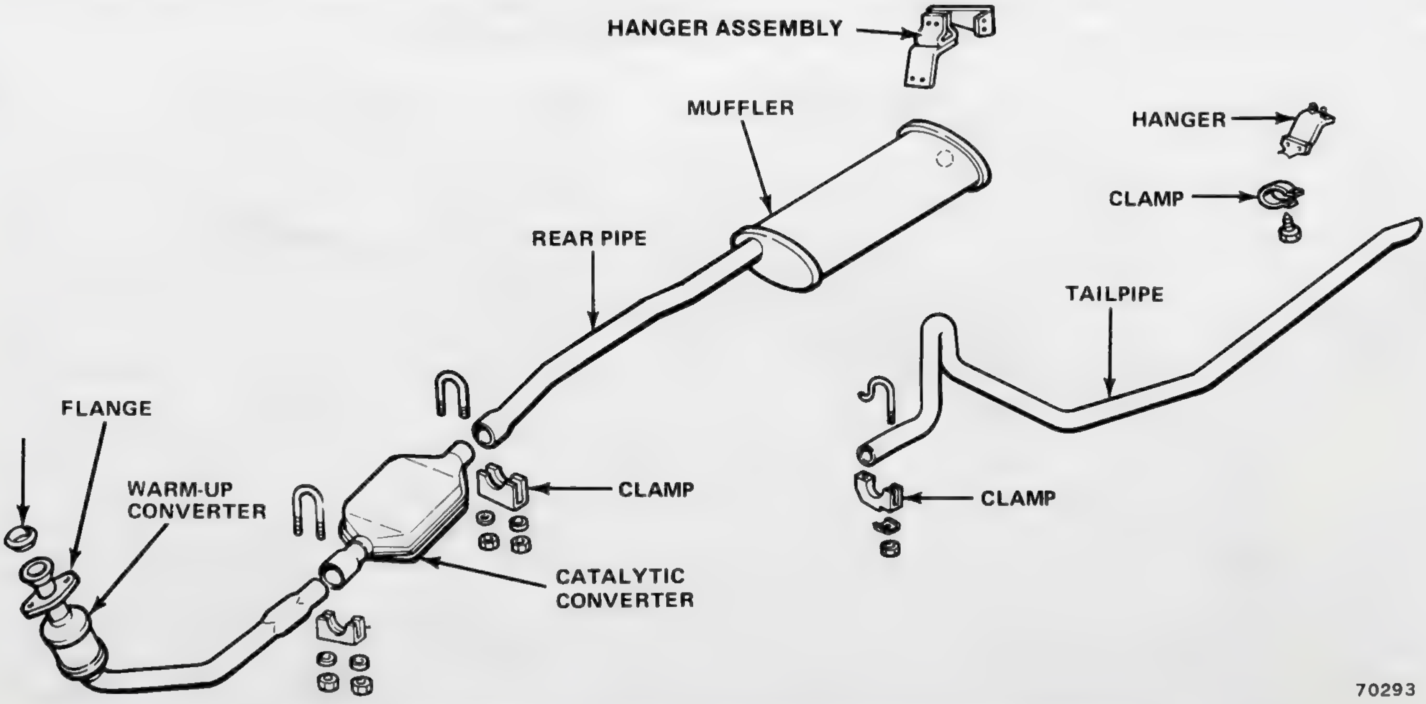

Fig. 1K-3 Exhaust System—Six-Cylinder with Single Converter and Warm-Up Converter

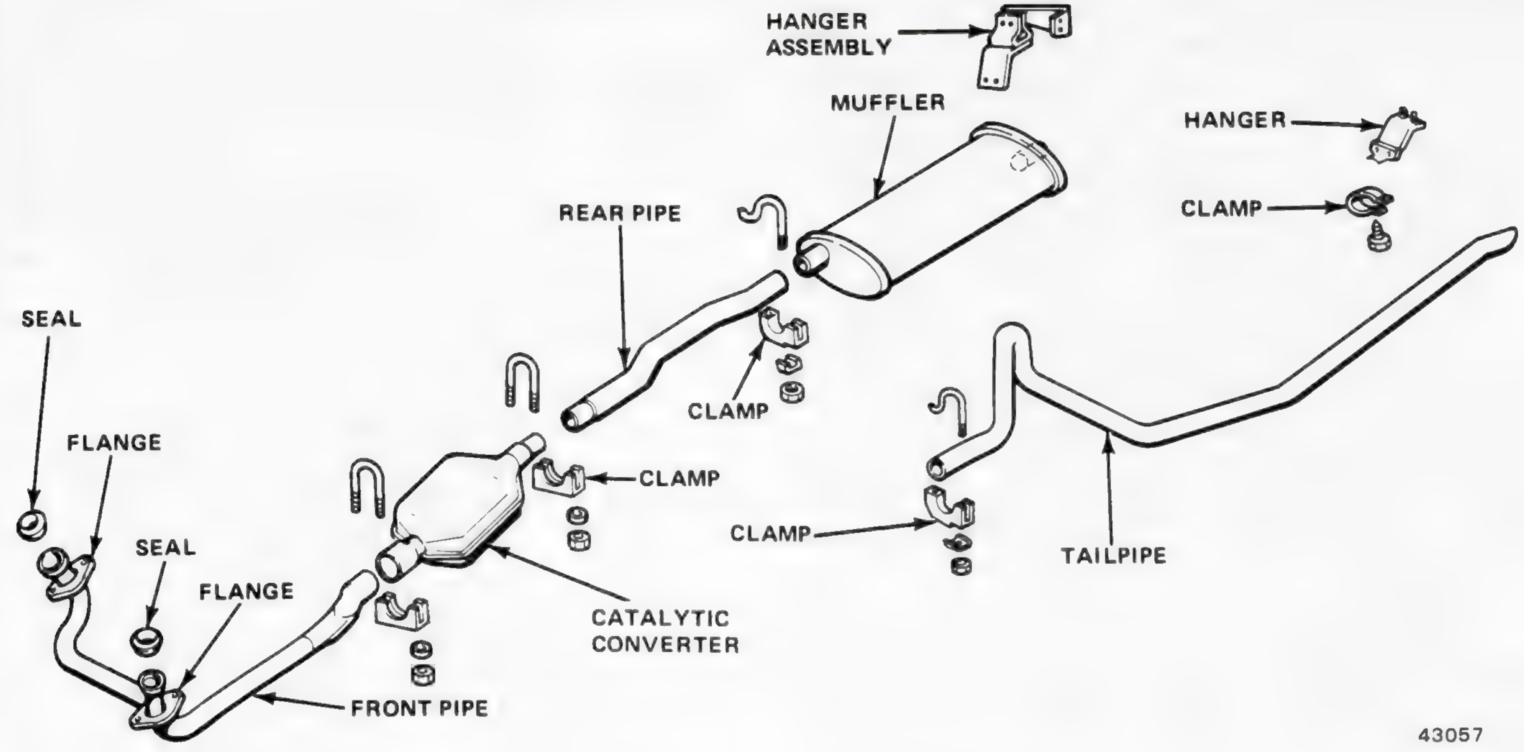

Fig. 1K-4 Exhaust System—Eight-Cylinder with Single Converter

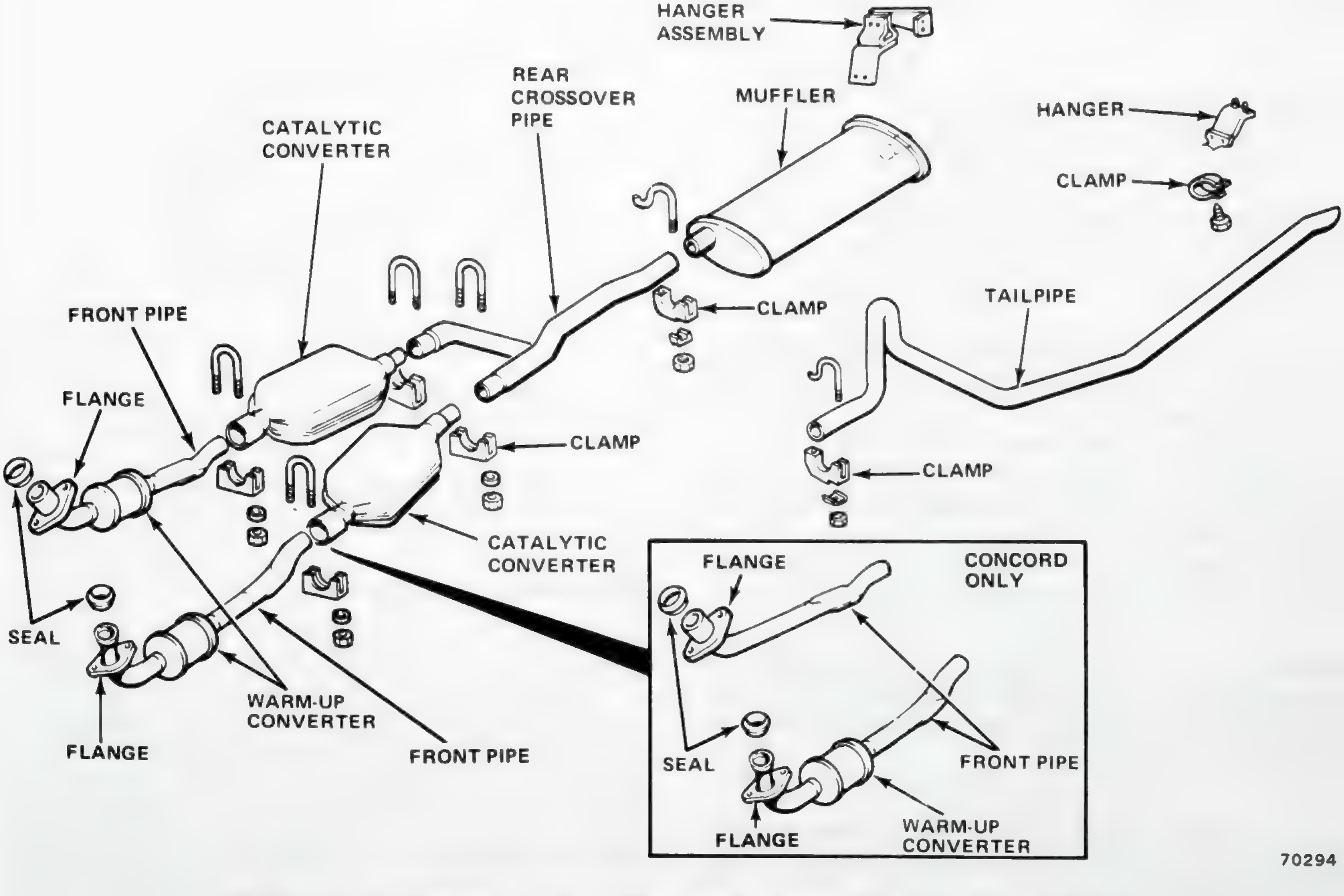

Fig. 1K-5 Exhaust System—Eight-Cylinder with Dual Convertors and Warm-Up Converter(s)

RESTRICTED EXHAUST SYSTEM DIAGNOSIS

A restricted or blocked exhaust system usually results in loss of power or popping through the carburetor. Verify that the condition is not caused by ignition or timing problems, then perform a visual inspection of the exhaust system. If the restriction cannot be located by visual inspection, perform the following procedure.

(1) Attach vacuum gauge to intake manifold.

(2) Connect tachometer.

(3) Start engine and observe vacuum gauge. Gauge should indicate 16 to 21 inches of vacuum.

(4) Increase engine speed to 2,000 rpm and observe vacuum gauge. Vacuum will drop when speed is increased rapidly, but should settle at 16 to 21 inches and remain steady. If vacuum settles below 16 inches, exhaust system is restricted or blocked. Stop engine and proceed to step (5).

(5) Disconnect exhaust pipe at manifold.

(6) Start engine and increase speed to 2,000 rpm. Observe vacuum gauge.

(a) If vacuum settles at 16 to 21 inches, restriction or blockage is in exhaust pipe, catalytic converter or muffler.

NOTE: *If car is equipped with a catalytic converter, connect exhaust pipe, remove muffler and check vacuum gauge.*

(b) If vacuum settles below 16 inches, restriction or blockage is in catalytic converter.

(c) If vacuum is normal, muffler is restricted.

NOTE: *In the event of a converter failure, always check muffler to be sure converter debris has not entered muffler.*

(d) If vacuum settles below 16 inches with exhaust pipe disconnected, exhaust manifold is restricted.

(7) Stop engine.

(8) Disconnect tachometer and vacuum gauge.

(9) On four- and six-cylinder engines, remove exhaust manifold. On eight-cylinder engines, remove both exhaust manifolds.

(10) Inspect ports of exhaust manifold for casting flash by dropping length of chain into each port.

NOTE: *Do not use a wire or a light to check ports. The restricted opening may be large enough for them to pass through but small enough to cause excessive back pressure at high engine rpm.*

(11) Remove casting flash. If flash is at lower end of port, it can usually be chipped out. If flash cannot be removed, replace manifold.

(12) Install exhaust manifold.

EXHAUST MANIFOLD

Replacement—Four-Cylinder

Removal

(1) Remove TAC ambient air induction manifold, vacuum motor and valve assembly and flexible hoses. Disconnect vacuum line.

(2) Disconnect EGR tube from rear of exhaust manifold.

(3) Remove TAC shroud from manifold.

(4) Disconnect exhaust pipe from manifold.

(5) Remove manifold-to-head nuts and washers.

(6) Remove manifold and gaskets (fig. 1K-6).

(7) Clean surfaces of manifold and head.

Installation

(1) Install replacement gaskets to studs on head.

(2) Position manifold on head and connect EGR tube to manifold.

(3) Install nuts and washers and tighten.

(4) Attach exhaust pipe to manifold.

(5) Install TAC shroud to manifold.

(6) Install TAC ambient air induction manifold, vacuum motor and valve assembly and flexible hoses. Attach vacuum line.

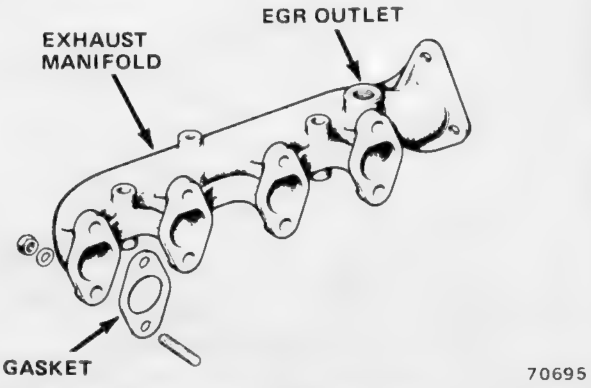

Fig. 1K-6 Exhaust Manifold—Four-Cylinder

Replacement—Six-Cylinder

Removal

The intake and exhaust manifolds are attached as a unit to the cylinder head on the left side of the engine. A gasket is used between the intake manifold and the cylinder head. None is used between the exhaust manifold and cylinder head. An asbestos gasket is used at the mating surfaces of the intake manifold to exhaust manifold and also betweeen the exhaust manifold and exhaust pipe (fig. 1K-7).

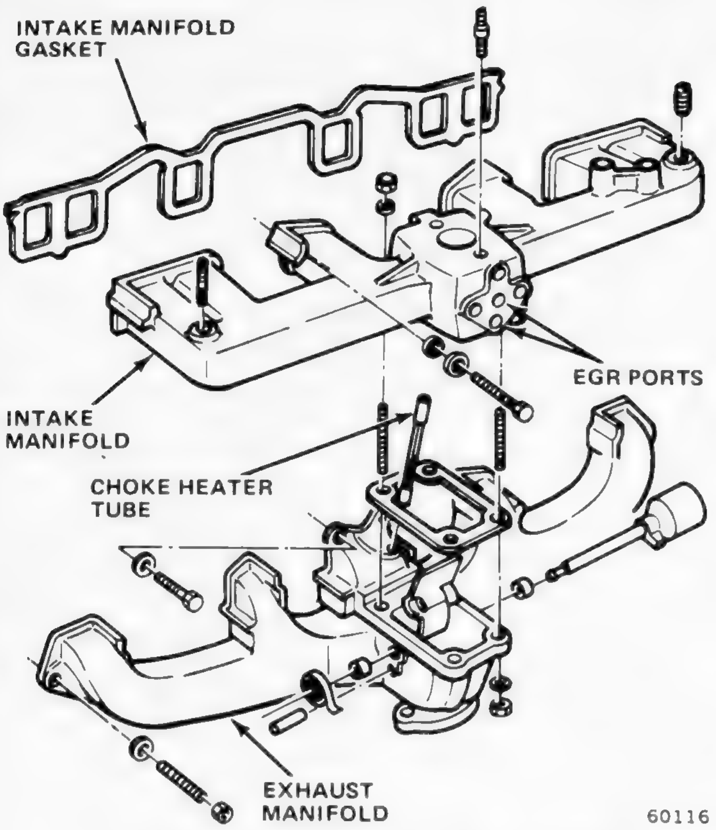

Fig. 1K-7 Exhaust Manifold Assembly—Six-Cylinder

NOTE: *It is necessary to remove intake and exhaust manifold assembly from the engine before separating the manifolds. It is not necessary to remove the carburetor from the vehicle. After removing the carburetor from the intake manifold, set it to one side with vacuum lines still attached.*

(1) Remove air cleaner and ambient air hose.

(2) Disconnect choke heater tube from choke coil housing. Disconnect clean air tube from carburetor.

(3) Disconnect carburetor control shaft from carburetor.

(4) Remove carburetor from intake manifold and set aside. On 1V carburetor, diverter valve is attached by carburetor mounting nut.

(5) Remove EGR valve.

(6) Disconnect accelerator cable from accelerator bell crank.

(7) Disconnect PCV vacuum hose from intake manifold.

(8) Remove spark CTO vacuum tubes and disconnect TCS solenoid vacuum valve wiring, if equipped.

(9) Disconnect vacuum hose from EGR valve.

(10) Disconnect Air Guard hoses at air pump and air injection manifold check valve. Disconnect diverter vacuum hose from manifold and remove diverter valve with hoses attached.

(11) Remove air pump/power steering mounting bracket, if equipped.

(12) Remove air pump.

(13) Detach power steering pump and set aside, if equipped. Do not remove hoses.

(14) Remove air conditioning drive belt idler assembly from cylinder head, if equipped.

(15) Disconnect throttle valve linkage, if equipped with automatic transmission.

(16) Disconnect exhaust pipe from manifold flange.

(17) Remove manifold attaching screws, nuts and clamps. Remove intake and exhaust manifold as an assembly. Discard gasket.

(18) Remove accelerator control bracket.

(19) Separate manifolds.

(20) Remove EGR valve studs and install in replacement manifold.

(21) Remove distributor CTO tube clamp and install on replacement manifold.

(22) Remove air injection manifold and screws and install on replacement manifold.

Installation

(1) Install replacement gasket between manifolds. Install accelerator control bracket. Tighten nuts to 5 foot-pounds (7 Nm) torque.

CAUTION: *Do not over-torque. Manifolds must be held together loosely enough to slide when manifolds are attached to cylinder head.*

(2) Install choke clean air tube into bottom of exhaust manifold and install tube clip.

(3) Position replacement intake manifold gasket on cylinder head and install manifold assembly. Tighten manifold attaching bolts and nuts in sequence (fig. 1K-8) to 23 foot-pounds (31 Nm) torque.

(4) Install flange gasket and connect exhaust pipe to manifold flange.

(5) Install carburetor to intake manifold. Connect fuel line and hose from vapor canister.

(6) Install air conditioning idler assembly, if removed.

(7) Install air pump, if removed.

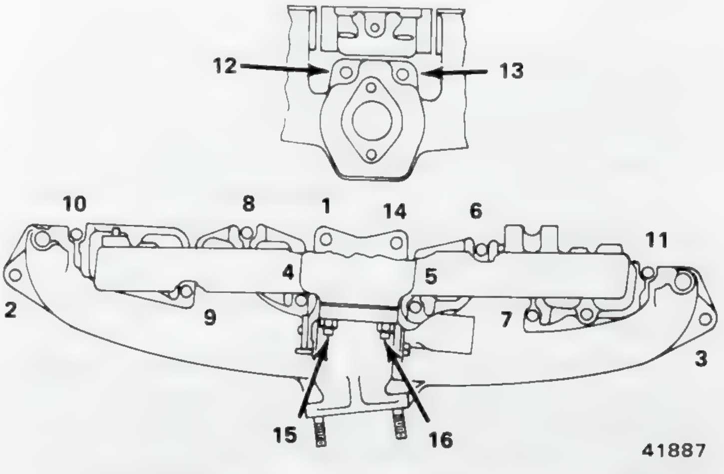

Fig. 1K-8 Six-Cylinder Manifold Torque Sequence

(8) Install air pump/power steering pump mounting bracket, if removed.

(9) Install diverter valve. Connect hoses to air pump and check valve. Connect vacuum hose to manifold.

(10) Connect throttle valve linkage and adjust (automatic transmission only).

(11) Install drive belts and tighten to specification. Refer to Chapter 1C—Cooling.

(12) Install spark CTO vacuum tubes. Connect TCS wiring, if removed.

(13) Connect vacuum line to EGR valve.

(14) Install throttle return spring and carburetor control shaft.

(15) Connect accelerator cable and PCV hose.

(16) Install choke heater tube and clean air tube to carburetor.

(17) Start engine and check for vacuum or exhaust leaks.

(18) Install air cleaner and ambient air hose.

Replacement—Eight-Cylinder

Removal

(1) Tag ignition wires for identification and disconnect from spark plugs.

(2) Disconnect air delivery hose at injection manifold.

(3) Remove air injection manifold, attaching screws and washers.

(4) Disconnect exhaust pipe at exhaust manifold.

(5) To remove right side manifold on Concord only:

(a) Remove converter housing screw attaching transmission filler tube.

(b) Remove filler tube from transmission.

(6) Remove exhaust manifold retaining screws.

(7) Separate exhaust manifold from cylinder head.

Installation

(1) Clean mating surfaces of exhaust manifold and cylinder head. **Do not nick or scratch.**

(2) Install exhaust manifold and retaining screws. Tighten screws to 25 foot-pounds (34 Nm) torque.

(3) After installing right side manifold on Concord:

(a) Install filler tube to transmission, using replacement O-ring.

(b) Install converter housing screw to secure filler tube.

(4) Connect exhaust pipe using replacement seal if required. Tighten nuts to 20 foot-pounds (27 Nm) torque.

(5) Connect air delivery hose to air injection manifold.

(6) Connect ignition wires to spark plugs.

HEAT VALVE

NOTE: *The four-cylinder engine does not have a heat valve. Instead, hot engine coolant is directed through a passage in the intake manifold to prevent fuel condensation.*

Six-Cylinder Engine

A thermostatically controlled heat valve in the exhaust manifold directs exhaust heat to the floor of the intake manifold for rapid fuel vaporization during engine warmup. The valve is in the heat ON position, directing exhaust heat to the intake manifold when the counterweight is in the extreme counterclockwise position when viewed from the counterweight end (fig. 1K-9). As the engine reaches operating temperature, the thermostatic spring heats up and loses tension, allowing the counterweight to move the valve to the heat OFF position (fig. 1K-10).

The manifold heat valve must operate freely. Check and lubricate every 30,000 miles with American Motors Heat Valve Lubricant, or equivalent.

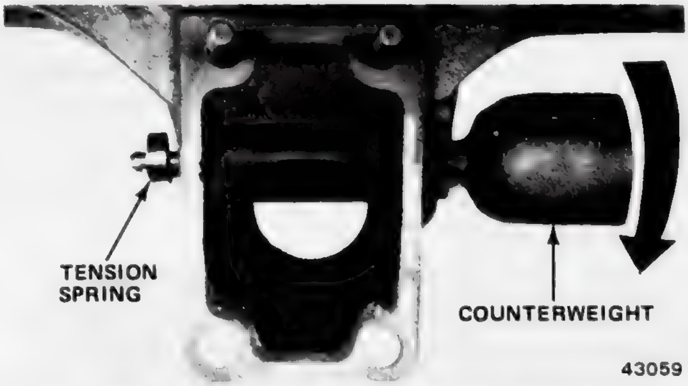

Fig. 1K-9 Heat Valve in Heat ON Position—Six-Cylinder

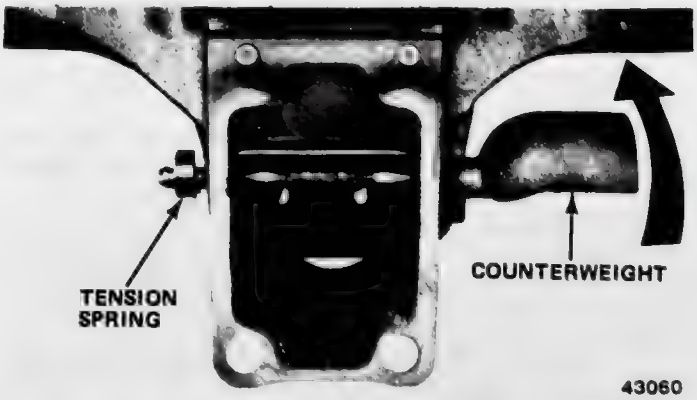

Fig. 1K-10 Heat Valve in Heat OFF Position—Six-Cylinder

Replacement

(1) Remove and separate intake and exhaust manifolds.

(2) Remove manifold heat valve assembly by cutting heat valve shaft on both sides of valve.

(3) Lift valve from manifold and drive out remaining shaft sections and bushings.

(4) Install replacement bushings using heat valve shaft as guide pin.

(5) Ream out replacement bushings with 5/16-inch drill bit to remove all burrs.

(6) Position heat valve as shown in figure 1K-10 and install shaft and counterweight assembly.

(7) Rotate counterweight until spring stop contacts bottom of manifold boss.

(8) Align hole in valve with screw threads in shaft and install, but do not tighten retaining screw.

(9) Close heat valve and install tension spring with hook end up and pointing away from manifold. Hook spring under support pin.

(10) Operate heat valve several times to allow shaftto center.

(11) Hold shaft and move valve as far as possible from counterweight. Tighten retaining screw.

(12) Check operation of valve.

(13) Install intake and exhaust manifolds.

Eight-Cylinder Engine

A thermostatically controlled heat valve mounted between the right exhaust manifold and exhaust pipe directs exhaust heat to the intake manifold for rapid fuel vaporization during engine warmup. When the counterweight is in the horizontal position, the valve is in the heat ON position, and directs exhaust heat through the intake manifold crossover passage (fig. 1K-11). The exhaust heat crosses through the intake manifold and discharges into the left exhaust manifold until the engine reaches operating temperature. At this time, the thermostatic spring loses its tension and the counterweight moves downward, opening the valve and allowing the exhaust heat to discharge through the right exhaust pipe.

The manifold heat valve must operate freely. Check and lubricate every 30,000 miles with American Motors Heat Valve Lubricant, or equivalent.

Replacement

(1) Disconnect and lower exhaust pipes.

(2) Replace manifold heat valve and gasket.

(3) Replace exhaust pipe gasket.

(4) Position exhaust pipes and connect to exhaust manifolds.

NOTE: *A gasket is not used between heat valve and manifold.*

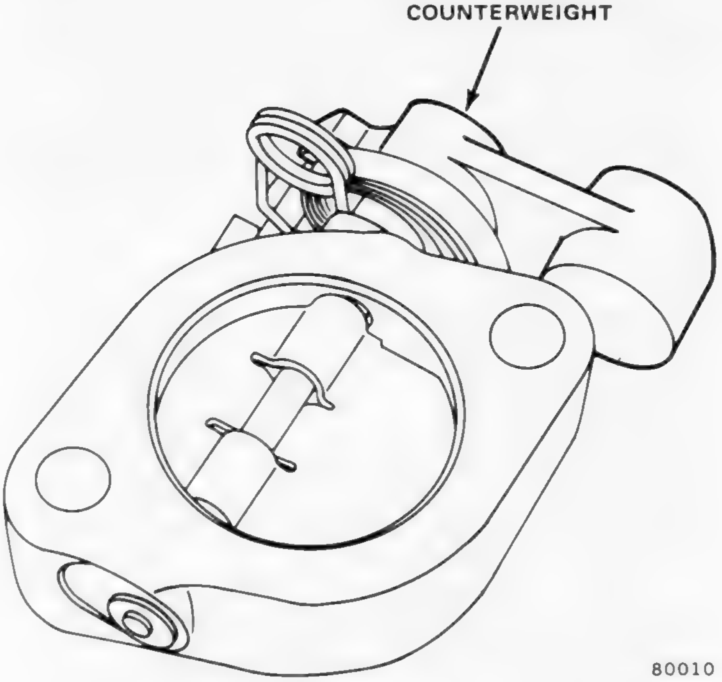

Fig. 1K-11 Exhaust Manifold Heat Valve in Heat ON Position—Eight-Cylinder

MUFFLERS

Replacement

Removal

NOTE: *Gremlin, Concord and AMX original equipment exhaust systems are manufactured with the rear pipe welded to the muffler. Service replacement mufflers and rear pipes are clamped together.*

(1) Remove front and rear muffler clamps.

(2) Support rear of car by side rails and allow axle to hang free.

NOTE: *Pacer only: support car by axle.*

(3) Remove tailpipe hanger clamp.

(4) Insert tool between tailpipe and muffler several places to loosen pipe from muffler.

(5) Disconnect hanger from rear of muffler.

(6) Heat rear pipe-to-muffler joint with oxyacetylene torch until cherry red.

(7) Place block of wood against front of muffler and drive muffler rearward to disengage.

(8) Drive muffler off tailpipe.

Installation

(1) Drive muffler onto tailpipe. Be sure nib on tailpipe aligns with slot of muffler.

(2) Drive rear pipe into muffler. Be sure pipe has

sufficient clearance with floor pan.

(3) Drive entire assembly forward to mate with front pipe or converter.

(4) Install clamps and hangers.

(5) Start engine and check for leaks and contact with body panels.

PIPES

Front Pipe Replacement

Removal

(1) Disconnect pipe at manifold.

(2) Disconnect rear end of pipe.

(a) If equipped with converter, heat front pipe-to-converter joint with oxyacetylene torch until cherry red. Twist front pipe back and forth to disengage.

(b) If not equipped with converter, heat front pipe-to-rear pipe joint with oxyacetylene torch until cherry red. Twist front pipe back and forth to disengage.

Installation

(1) Install rear of pipe into converter or rear pipe.

(2) Clean mating surface of manifold. Install pipe to manifold but do not tighten. Use replacement seal if required.

(3) Align pipe. Tighten clamp at rear. Tighten flange to manifold.

Rear Pipe or Tailpipe Replacement

Removal

To remove any pipe attached to the muffler, cut the pipe close to the muffler. Collapse the part remaining in the muffler and remove.

Installation

To install a rear pipe, disconnect the muffler hanger and lower the front of the muffler. Install the pipe. Install the muffler hanger before tightening clamps.

To install a tailpipe, support the car by side sills (support Pacer by the axle). Install tailpipe to muffler. Install clamp and hangers.

SPECIFICATIONS

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	In-Use Recheck Torque	Service Set-To Torque	In-Use Recheck Torque
Exhaust Manifold Nuts — Four-Cylinder	24	20-28	18	15-21
Exhaust and Intake Manifold Screws and Nuts — Six-Cylinder	31	24-38	23	18-28
Exhaust Manifold Screws — Eight-Cylinder	34	27-41	25	20-30
Exhaust Pipe-to-Manifold Nuts	27	20-34	20	15-25

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

80422

AIR GUARD SYSTEM

GENERAL

This system incorporates a belt driven air pump, diverter (bypass) valve, air injection manifold(s) and connecting hoses (fig. 1K-12, 1K-13 and 1K-14).

Air is discharged from the air pump to the diverter valve which directs it to the air distribution system or dumps it through a bypass port, depending on engine operating conditions. Air pressure in this system is maintained at approximately 5 psi (7.5 psi in California) by a relief valve incorporated in the diverter valve.

Air is routed through the air distribution system into the engine exhaust port area. The air mixes with hot

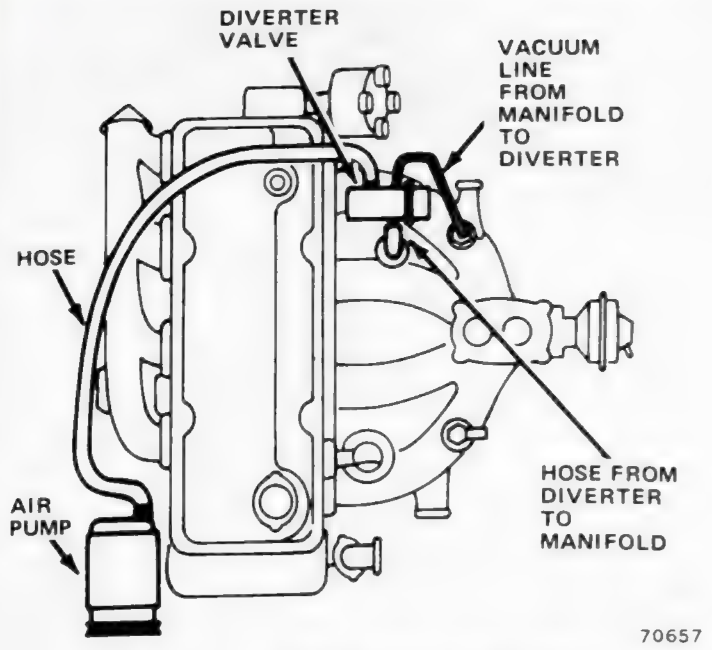

Fig. 1K-12 Air Guard System—Four-Cylinder

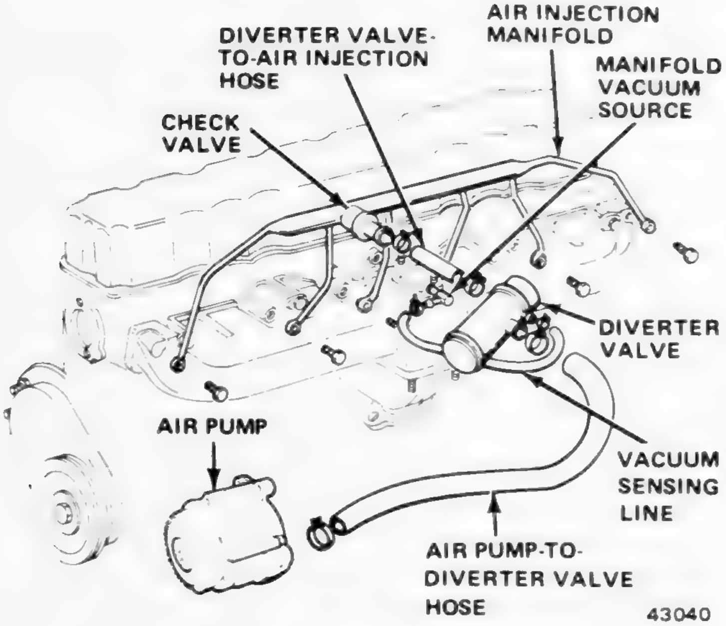

Fig. 1K-13 Air Guard System—Six-Cylinder

exhaust products and causes a further burning of the mixture, reducing hydrocarbon and carbon monoxide emissions to the atmosphere.

On four-cylinder engines, air flows from the diverter valve through the check valve attached to a fitting in the intake manifold adjacent to cylinder number 3. A distribution passage in the head carries air to drilled holes intersecting the exhaust valve ports.

On six- and eight-cylinder engines, air from the diverter valve is directed into the air injection manifold(s). At each exhaust port, a hollow screw carries air into the exhaust manifold(s). Cylinder number 7 on eight-cylinder engines is not included.

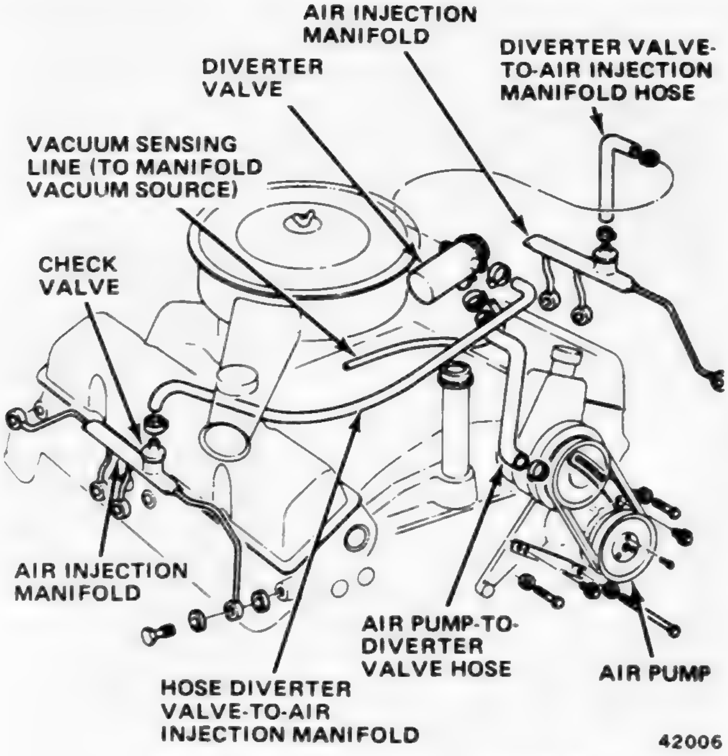

Fig. 1K-14 Air Guard System—Eight-Cylinder

A new item for 1978 is the vacuum delay valve on California six-cylinder engines. The delay valve, installed between the manifold vacuum source and the diverter valve, reduces the diverter dump mode operating time.

AIR PUMP

Components

The same air pump is used for all engines. The diameter of the pump pulley is determined by application. The major components of the air pump are enclosed in a die-cast aluminum housing. A filter fan assembly, rotor shaft and drive hub are visible on the pump exterior (fig. 1K-15).

The pump is designed for long life and is serviceable only by replacement. Do not remove the rear housing cover for any reason. The internal components of the pump are not serviceable.

The aluminum housing has cavities for air intake, compression, and exhaust and a bore for mounting the front bearing. The housing also includes cast metering areas that reduce the noise of intake and compression. Mounting bosses are located on the housing exterior.

The front bearing supports the rotor shaft. The bearing is secured in position by plastic injected around grooves in the housing and bearing outer race.

The rear cover supports the vane pivot pin, rear bearing inner race and exhaust tube. Dowel pins pressed into the housing correctly position the end cover which is fastened by four screws.

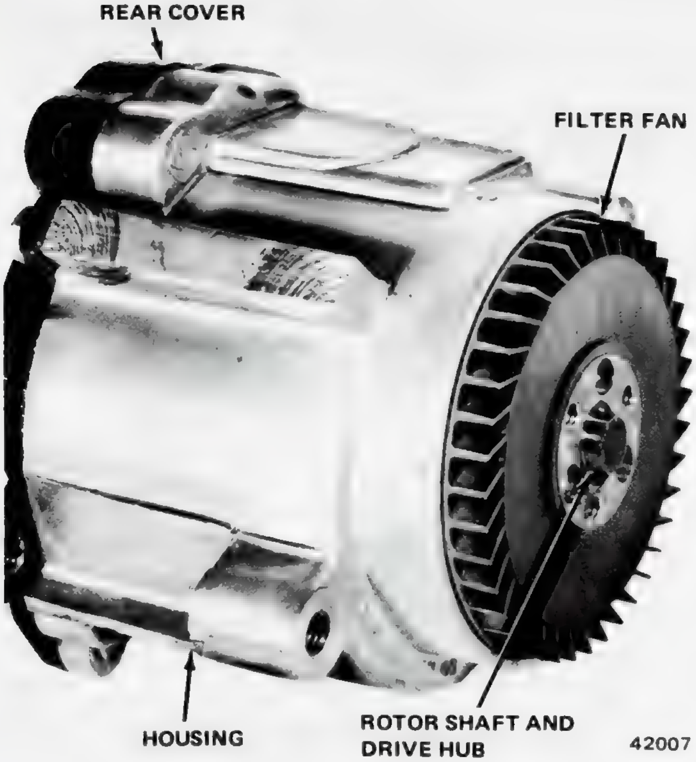

Fig. 1K-15 Air Pump

The rotor positions and drives the two vanes. A stamped steel liner supports the carbon shoes and shoe springs which seal the vanes and rotor. The two plastic vanes are molded to hubs which support bearings that rotate on the pivot pin. The pulley drive hub is pressed on the rotor shaft, and bolt holes in the hub provide for attachment of a pulley.

Operation

The pump vanes are located 180° apart and rotate around the pivot pin which is located on the centerline of the pump housing. The rotor which drives the vanes rotates off the centerline of the pump housing (fig. 1K-16). This creates changes in the distance between the outside of the rotor and the inner wall of the pump housings during rotor rotation. As the leading vane moves past the intake opening, it is moving from a small area to a large area. This creates a partial vacuum which draws air into the pump. As the vanes and rotor continue to rotate, the trailing vane passes the intake and traps the air between the vanes. The vanes and rotor move the air into a smaller area. This begins to compress the air. Compression continues until the leading vane passes the exhaust opening. There the compressed air passes out of the pump and on to the rest of the Air Guard System.

Air Pump Noise Diagnosis

The air pump is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. Allow for normal break-in wear before replaceing the pump for excessive noise.

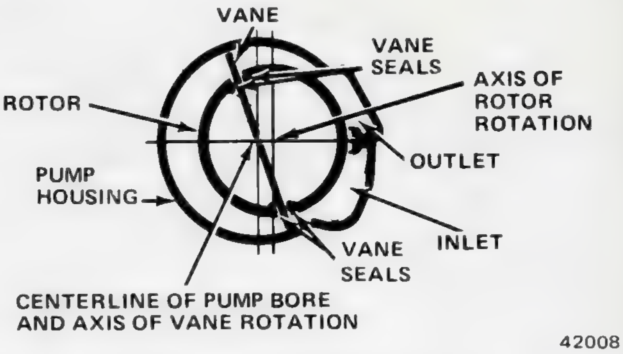

Fig. 1K-16 Air Pump Operation

A chirping or squeaking noise probably originates from vane rub in the housing bore and is noticeable at low speed intermittently. Vane chirping is often eliminated at increased pump speeds or with additional wear-in time. A chirping noise may also be caused by the drive belt slipping on a siezed pump.

Bearing noise, **a rolling sound noticeable at all speeds,** is easily distinguished from vane chirping. It does not necessarily indicate bearing failure. If bearing noise reaches an objectional level at certain speeds, the pump may have to be replaced.

Failure of a rear bearing is identified **by a continuous knocking noise** and replacement of the pump is required.

Service Precautions

Observe the following list of service precautions to prevent damage to the air pump.

- Do not attempt to prevent pulley from rotating by inserting tools into the centrifugal filter fan.
- Do not operate engine with pump belt removed or disconnected except for noise diagnosis.
- Do not attempt to lubricate.
- Do not clean centrifugal filter.
- Do not disassemble pump or remove rear cover.
- Do not exceed 20 foot-pounds (27 Nm) torque on mounting screws.
- Do not pry on aluminum housing to adjust belt tension. Adjust by hand pressure only.
- Do not clamp pump in vise.
- Do not permit liquids to enter pump when steam- or pressure-cleaning engine.

Service Procedures

Removal—Four-Cylinder

(1) Disconnect air pump output hose at back of air pump.

(2) Remove adjusting screw and remove drive belt from pump.

(3) Remove pivot screw.
(4) Remove pump.

Installation—Four-Cylinder

(1) Position pump in brackets.
(2) Install pivot screw, washers, engine ground strap and nut. Do not tighten nut.
(3) Install adjusting screw, tighten belt and tighten adjusting screw.

NOTE: *Adjust belt tension by hand only.*

(4) Tighten pivot screw.
(5) Install hose to pump.

Removal—Six-Cylinder

(1) Disconnect air pump output hose at back of air pump.
(2) Remove adjusting screw and remove drive belt.
(3) Remove front mounting bracket.
(4) Remove adjusting bracket from cylinder head.
(5) Slide pump from pivot stud.

Installation—Six-Cylinder

(1) Slide pump onto pivot stud.
(2) Install front mounting bracket.
(3) Install adusting bracket and install adjusting screw.
(4) Install drive belt and adjust to specified tension. Tighten pivot stud nut.

NOTE: *Adjust the belt tension by hand only.*

(5) Connect hose to pump.

Removal—Eight-Cylinder

(1) Disconnect air pump output hose at pump.
(2) Loosen mount bracket-to-pump attaching screws. Remove drive belt.
(3) Remove pivot screw and brace screws.
(4) Remove pump.

Installation—Eight-Cylinder

(1) Position pump at mounting location and install pivot and brace attaching screws. Do not tighten.
(2) Install drive belt and adjust to specified tension.

NOTE: *Adjust the belt tension by hand only.*

(3) Tighten mounting screws and adjusting strap screw to 20 foot-pounds (27 Nm) torque.

DIVERTER (BYPASS) VALVE

General

A diverter valve is used in all Air Guard applications. The valves for four-cylinder, six-cylinder and eight-cylinder engines differ visually only in the number of outlets. The four- and six-cylinder diverter valve has one outlet and the eight-cylinder diverter valve has two. A high flow diverter is used on some applications where greater air flow is required for emission control.

The valve momentarily diverts air pump output from reaching the exhaust manifold(s) during rapid deceleration. It also acts as a pressure release when air pump output is excessive. An internal silencer is incorporated in the diverter housing to muffle the airflow.

Operation

In a rapid deceleration condition, high intake manifold vacuum is applied to the diaphragm in the diverter. When the vacuum signal is 20 inches of mercury or more, the spring tension of the diaphragm is overcome. This moves the metering valve down against its upper seat and away from its lower seat, diverting air pump output pressure to atmosphere (fig. 1K-17). Air pump output is diverted only momentarily because of a bleed hole in the diaphragm. This hole allows vacuum to quickly equalize on both sides of the diaphragm and the diaphragm spring returns the metering valve to its normal position.

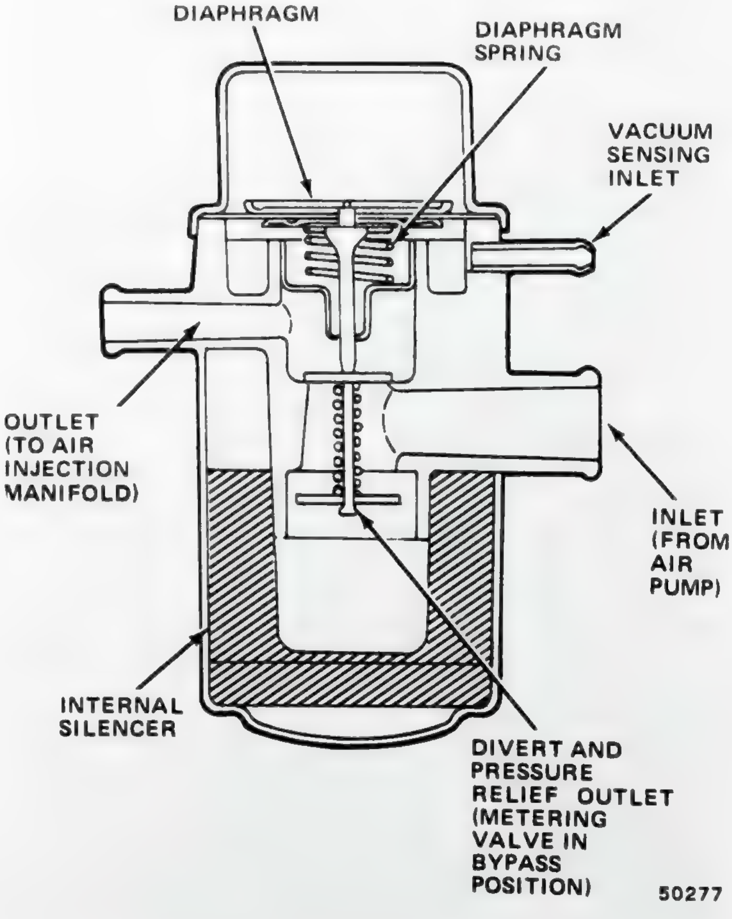

Fig. 1K-17 Diverter Valve—Typical

If the air pump develops excessive output pressure, this excessive pressure overcomes the diaphragm spring tension, pushing the metering valve down. Pump output pressure is diverted to atmosphere. When pump output pressure returns to normal, the metering valve moves up from the upper seat and against the lower seat, returning to its normal open position. Pump output pressure is directed to the exhaust manifold(s).

Diverter Test

(1) Start engine and run at idle.

(2) Check diverter vents. Little or no air should flow from vents.

(3) Accelerate engine to 2000 to 3000 rpm and rapidly close throttle. A strong flow of air should pass from the diverter vents for approximately 5 seconds. The high flow diverter used on some engines should vent for approximately 3 seconds. If air does not flow or if backfire occurs, make certain vacuum sensing line has vacuum and is not leaking.

NOTE: *The diverter valve diverts air pump output when a vacuum of 20 inches Hg or more is applied at vacuum sensing line. Diverter also operates when pump output exceeds 5 psi (7.5 psi in California).*

(4) Slowly accelerate engine. Between 2500 and 3500 rpm air should begin to flow from diverter vents.

Diverter Replacement

The diverter valve is not serviceable and must be replaced if defective. The valve is attached to a bracket or is suspended by the hoses between the air pump and air injection manifold depending on application. To remove, disconnect hoses, vacuum sensing line and bracket clamp, if used. To install, connect hoses, vacuum line and bracket clamp, if used.

AIR INJECTION MANIFOLDS

An external air injection manifold is not used on four-cylinder engines. Air from the pump is distributed by passages in the intake manifold and in the cylinder head.

The air injection manifold on six- and eight-cylinder engines distributes air from the pump to each of the injection screws.

A check valve, incorporating a stainless steel spring plunger and an asbestos seat, prevents the reverse flow of exhaust gases to the pump during pump or belt failure or diverter valve bypass operation. Reverse flow would damage the air pump and connecting hoses. On four-cylinder engines, the check valve is attached to the Air Guard inlet passage of the intake manifold. On six- and eight-cylinder engines, the check valve is integral with the air injection manifold.

The distribution tubes of the air injection manifold on six- and eight-cylinder engines are connected directly to the exhaust manifold(s). The hollow attaching screws conduct airflow into the manifold.

Check Valve Test

To check the air injection manifold check valve for proper operation, disconnect the air supply hose at the check valve. With the engine running above idle speed, listen and feel for exhaust leakage at the check valve. A slight leak is normal.

Air Injection Manifold Removal—Six-Cylinder

(1) Disconnect air delivery hose at check valve.

(2) Remove injection screws from each cylinder exhaust port.

NOTE: *Some resistance to removal may be encountered due to carbon build-up on the screws.*

(3) Remove air injection manifold.

Air Injection Manifold Installation—Six-Cylinder

(1) Assemble air injection manifold and screws to exhaust manifold. Tighten screws to 20 foot-pounds (27 Nm) torque.

(2) Connect air delivery hose.

Air Injection Manifold Removal—Eight-Cylinder

(1) Disconnect air delivery hose at check valve.

(2) Remove injection screws.

NOTE: *Some resistance to removal may be encountered due to carbon build-up on the screws.*

(3) Remove air injection manifold.

(4) Remove sealing gaskets from air injection manifold.

Air Injection Manifold Installation—Eight-Cylinder

(1) Install air injection manifold using replacement sealing gasket on either side of each opening.

(2) Install injection screws to exhaust manifold. Tighten screws to 38 foot-pounds (52 Nm) torque.

(3) Connect air delivery hose to check valve.

SPECIFICATIONS

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	Metric (N·m)		USA (ft.lbs.)	
	Service Set-To Torque	In-Use Recheck Torque	Service Set-To Torque	In-Use Recheck Torque
Air Pump Adjusting Screw				
Four-Cylinder	24	20-28	18	15-21
Six-Cylinder and Eight-Cylinder	27	20-30	20	15-22
Air Pump Pivot Screw				
Four-Cylinder	27	23-31	20	17-23
Six-Cylinder and Eight-Cylinder	27	20-30	20	15-22
Air Injection Manifold Screws				
Six-Cylinder	27	20-27	20	15-20
Eight-Cylinder	52	41-61	38	30-45

All Torque values given in newton-meters and foot-pounds with dry fits unless otherwise specified.

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CATALYTIC CONVERTER SYSTEM

GENERAL

Pellet-type catalytic converters are used on all 49-state, altitude and California applications. In addition, all six-and eight-cylinder California cars require a monolithic-type, warm-up converter. Six-cylinder engines use a single warm-up converter and eight-cylinder engines use one or two, depending on application. The warm-up converter is mounted between the exhaust manifold and the pellet-type catalytic converter.

Leaded fuel poisons the catalytic converter, although use of a few gallons of leaded fuel in an emergency does not seriously impair the converter.

Converter Types

The **warm-up converter** is of the monolithic substrate type. A mixture of platinum and palladium catalyzing agents is coated on an extruded material resembling a honeycomb. Two catalysts are mounted end-to-end in a stainless steel cylinder and are retained by wire mesh and mounting rings. The catalyst is not serviceable.

The **pellet-type converter** contains beads of alumina coated with platinum and palladium catalyzing agents. Thousands of pellets are contained in a stainless steel canister. A plug is provided in the converter to permit replacement of the pellets should they become poisoned.

OPERATION

Both warm-up and pellet-type converters operate on the same chemical principles. The major difference in the two types, other than construction, is that the warm-up converter reacts more rapidly to incoming gases. It is particularly effective in converting exhaust gases immediately after start-up.

All exhaust gases flow through the catalytic converter. A chemical change oxidizes carbon monoxide and hydrocarbons into water and carbon dioxide. The catalysts which produce this chemical change are platinum and palladium present as a fine coating on the substrate.

The temperature inside the converter during the chemical reaction is somewhat higher than the temperature of the exhaust gases as they leave the engine. Insulation in the pellet-type converter keeps the outside skin of the converter at about the same temperature as the muffler. Due to its mass, the converter stays hot much longer than the muffler.

The stainless steel catalytic converter body is designed to last the life of the car. Excessive heat can result in bulging or other distortion, but excessive heat is not the fault of the converter—the engine has a carburetor, air pump or ignition problem permitting unburned fuel to enter the converter. If a converter is heat-damaged, correct the carburetor, air pump, or ignition problem at the same time the converter is replaced, and check all other components of the exhaust system for heat damage.

CATALYST REPLACEMENT

Warm-Up Converter

The warm-up converter is an integral part of the front pipe of the exhaust system. The front pipe is removed by disconnecting at the manifold and at the pellet-type converter joint.

Pellet-Type Converter

The threaded plug used in previous years has been replaced with a pressed-in plug for 1978. A replacement kit consists of bridge, plug, washer and screw (fig. 1K-18).

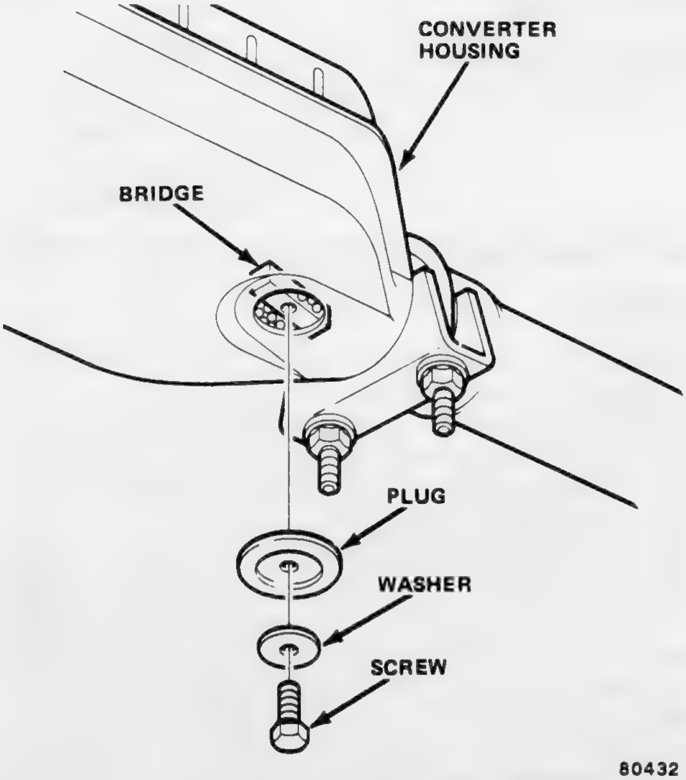


Fig. 1K-18 Fill Plug Replacement Parts

(1) Raise car.

(2) Place hose of Vacuum Pump Tool J-25077 on exhaust pipe and tighten clamp (fig. 1K-19).

(3) Connect shop air (80 psi minimum) to fitting on vacuum pump.

(4) Remove plug from bottom of converter.

(a) Drive small chisel between plug and converter housing. Do not damage housing.

(b) Continue driving chisel into plug to deform.

(c) Repeat steps (a) and (b) several places around edge of plug until deformed sufficiently to be removed with pliers. Do not pry plug from housing.

(5) Position Vibrator Tool J-25077 and adapter on converter and lock in place (fig. 1K-20).

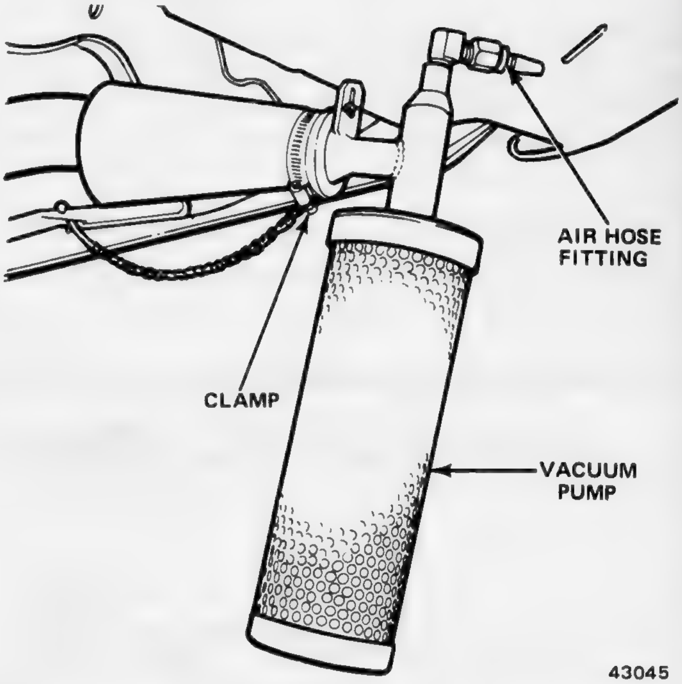


Fig. 1K-19 Vacuum Pump

(6) Remove shop air hose from vacuum pump.

(7) Connect shop air hose to fitting on vibrator. Catalyst pellets will fall into can for approximately 10 minutes.

(8) When converter is empty, disconnect shop air hose, remove can and discard pellets.

(9) Install refill can on vibrator.

(10) Connect shop air hose to vacuum pump and vibrator. Pellets will be drawn up and packed into place.

NOTE: *If any pellets come out of the tailpipe, the converter is defective and must be replaced.*

(11) When coverter is full, remove shop air hose from vibrator and remove vibrator from converter.

(12) Install plug on bottom of converter.

(a) Install screw into bridge and position bridge into plug opening.

(b) Use screw as handle to position bridge inside housing.

(c) Remove screw from bridge. Do not disturb position of bridge.

(d) Insert screw through washer and plug.

(e) Carefully thread screw into bridge and tighten.

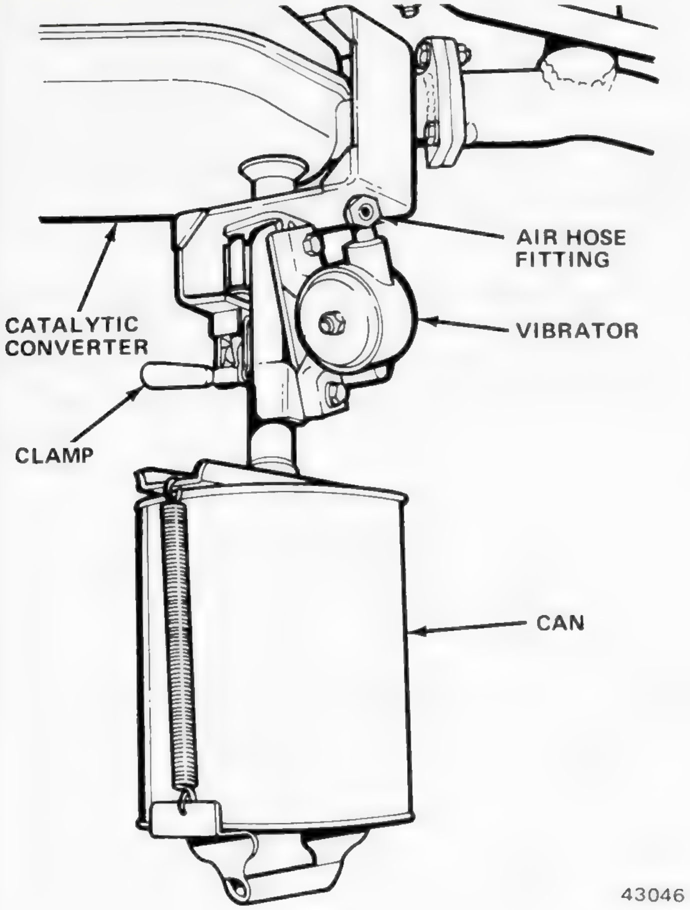


Fig. 1K-20 Vibrator Tool

(13) Disconnect shop air from vacuum pump and remove vacuum pump.

(14) Lower car.

Special Tools

J-25077
CATALYTIC CONVERTER
CATALYST CHANGER

NOTES

POWER PLANT INSTRUMENTATION

1L

SECTION INDEX

GENERAL INFORMATION

GENERAL

This chapter is divided into three sub-sections. The first sub-section, General Information, contains verbal descriptions of all instrumentation, operating principles, test procedures and replacement procedures. The second sub-section, Diagnosis and Repair Simplification (DARS) Charts, contains pictorial guides for diagnosing instrumentation malfunctions. The third sub-section, Circuits and Schematics, contains a separate fold-out for each car line. Each fold-out presents specifications, circuit board illustration, circuit board schematic and separate schematics for each indicator lamp and gauge circuit.

Power plant instrumentation includes all instrument panel gauges and indicator lamps used to monitor engine-related systems included in this volume. Refer to Volume 3 for speedometer, odometer, clock, illumination lamps, turn signal indicators and high beam indicator. Instrumentation covered in this chapter includes: ammeter, charging indicator lamp, constant voltage regulator (CVR), fuel gauge, oil pressure gauge, oil pressure indicator lamp, tachometer, temperature gauge, temperature indicator lamp and vacuum gauge (fig. 1L-1, 1L-2, 1L-3 and 1L-4). All these gauges and lamps are electrically operated, except the vacuum gauge which is mechanical. Unless otherwise stated, instrumentation is standard on all models.

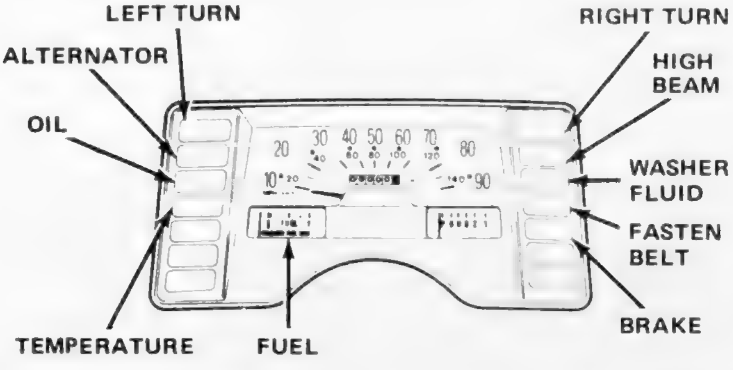


Fig. 1L-1 Pacer Instrumentation

OPERATION

Ammeter

The ammeter is part of the optional Rally Package on Pacer, Gremlin and Concord and is standard on AMX.

The ammeter is an instrument used to indicate current flow into or out of the battery. Whenever electrical loads in the car are greater than the alternator can supply, current flows from the battery and the ammeter indicates discharge (-). Whenever the electrical loads of the car are less than the alternator can supply, excess current is available to charge the battery, and the am-

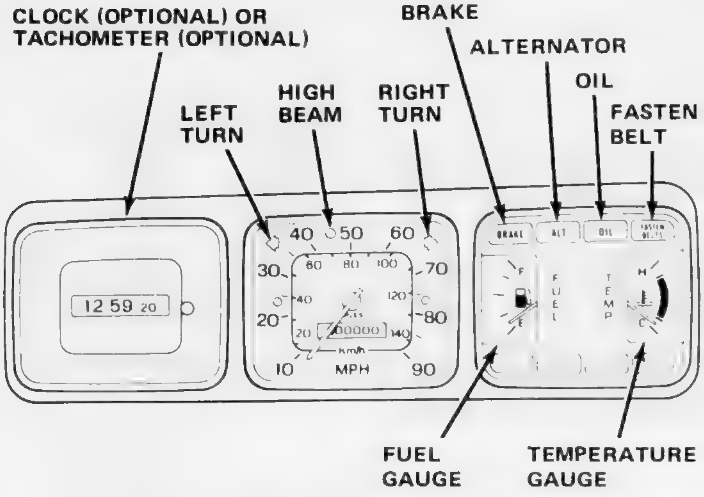


Fig. 1L-2 Gremlin, Concord and AMX Instrumentation

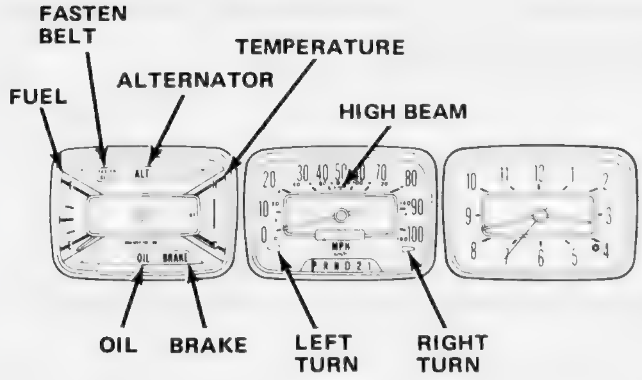
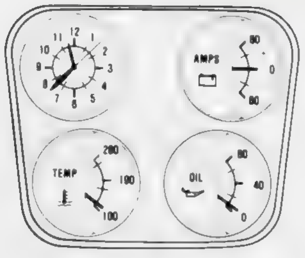


Fig. 1L-3 Matador Instrumentation

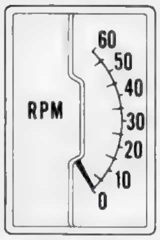
meter indicates charge (+). If the battery is fully charged, the voltage regulator reduces alternator output to meet only immediate vehicle electrical loads. When this happens, the ammeter indicates zero.

A conventional ammeter must be connected between the battery and the alternator in order to indicate current flow in and out of the battery. The disadvantage is that alternator output has to flow all the way into the car, through the ammeter, and all the way back to the battery. This requires passing through the dash connector twice. The reverse path is followed when battery voltage is needed to supply vehicle electrical needs. The ammeter system used in AMC cars eliminates this disadvantage.

The "ammeter" is actually a specially-calibrated voltmeter. It is connected to read voltage drop across a special resistance wire between the battery and the alternator. Whenever voltage is higher at the alternator end of the wire, the "ammeter" reads (+) and whenever voltage is higher at the battery end, the "ammeter" reads (-). When voltage is the same at both ends, the "ammeter" reads zero.



PACER CLUSTER



PACER TACHOMETER

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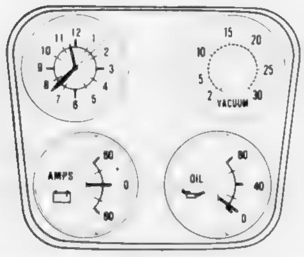
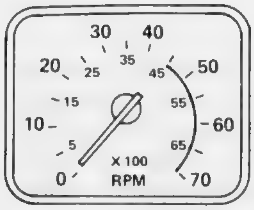


GREMLIN, CONCORD AND AMX CLUSTER



GREMLIN, CONCORD AND AMX TACHOMETER

80237

Fig. 1L-4 Rally Package Instrumentation

Charging Indicator Lamp

The charging indicator lamp illuminates whenever alternator output voltage does not equal battery voltage.

Constant Voltage Regulator (CVR)

Fuel and temperature gauges on Pacer and Matador are designed to operate on low voltage. The CVR provides approximately 5 volts for this purpose. Battery voltage is supplied to the CVR. The CVR contains a small heating coil and thermostatic points. With battery voltage applied to the CVR, the points vibrate open and closed at a rate which supplies an average of 5 volts to the gauges. The CVR is screwed to the circuit board on Pacers. It is plugged into the circuit board on Matadors.

Fuel Gauge

Fuel gauges in Gremlin, Concord and AMX are magnetic. Gauges in Pacer and Matador operate on regulated voltage provided by a constant voltage regulator (CVR). The fuel gauge system consists of the gauge, a variable-resistance sending unit in the fuel tank and appropriate wiring. Pacer and Matador also include the CVR.

Magnetic Gauge

Battery voltage is applied through two coils in the gauge. One coil is connected directly to ground, and the other coil is grounded through the sending unit. Variable resistance in the sending unit is controlled by the position of a float that rides on the top surface of the fuel. Magnetic fields are created around both coils in the gauge, and the needle is attracted to the coil having the greater current flow.

NOTE: *Three different sending units are used for Gremlin and are identified by the color of the ground wire. Four-cylinder with manual transmission is light-blue, four-cylinder with automatic transmission is red and six-cylinder is white. Float travel is different for each application because of different fuel tank capacities.*

CVR Gauge

The gauge needle is attached to a temperature-sensitive bimetal coil. A heating coil wrapped around the bimetal provides heat to operate the bimetal. Current flow through the heating coil is grounded through the variable resistance of sending unit in the fuel tank. The sending unit offers high resistance at low fuel level and very low resistance at high fuel level.

Oil Pressure Gauge

The oil pressure gauge is part of the optional Rally Package on Pacer, Gremlin and Concord and is standard on AMX.

NOTE: *When a car is equipped with the optional oil pressure gauge, the original warning lamp and sending unit are retained.*

The oil pressure gauge system consists of a magnetic type gauge, a variable-resistance sending unit and appropriate wiring. Battery voltage is applied through two coils in the gauge. One coil is connected directly to ground, and the other coil is connected to the sending unit. Variable resistance in the sending unit is controlled by the oil pressure applied to it. Magnetic fields are created around both coils in the gauge, and the needle is attracted to the coil having the greater current flow.

Oil Pressure Indicator Lamp

The oil pressure indicator lamp illuminates whenever engine oil pressure is dangerously low. The sending unit is an ON-OFF switch held in the OFF position by oil pressure. When pressure is below the calibration pressure of the switch, the switch closes, providing ground for the indicator lamp and it illuminates.

NOTE: *Cars equipped with electric choke use an oil pressure switch with two additional terminals to provide current flow to the choke heater coil.*

Tachometer

The tachometer is an optional instrument. It is also included in the optional Rally Package on Pacer, Gremlin and Concord and is standard on AMX.

The tachometer is wired to the negative side of the ignition coil primary circuit. Current flowing through the coil is turned on and off by the ignition system each time a spark plug fires. The tachometer senses these interruptions in current flow and converts pulses per second into revolutions per minute. The information is displayed by a needle on a dial.

Temperature Gauge

The temperature gauge is standard equipment on all cars except Pacer. A temperature gauge is included in the optional Rally Package on Pacer.

NOTE: *Pacers with the optional temperature gauge* do not *retain the function of the standard temperature indicator lamp.*

All temperature gauges except Matador are magnetic. The Matador gauge operates on regulated voltage provided by a constant voltage regulator (CVR). The temperature gauge system consists of the gauge, a variable-resistance sending unit and appropriate wiring. Matador also includes the CVR.

Magnetic Gauge

Battery voltage is applied through two coils in the gauge. One coil is connected directly to ground, and the other coil is grounded through the sending unit. Variable resistance in the sending unit is controlled by temperature applied to it. Magnetic fields are created around both coils in the gauge, and the needle is attracted to the coil having the greater current flow.

CVR Gauge

The gauge needle is attached to a temperature-sensitive bimetal coil. A heating coil wrapped around the bimetal provides heat to operate the bimetal. Current flow through the heating coil is grounded through the variable resistance of the sending unit in the engine. The sending unit offers high resistance at low engine temperature and very low resistance at high engine temperature.

Temperature Indicator Lamp

The temperature indicator lamp is included only on Pacer without Rally Package.

The temperature indicator lamp illuminates whenever engine coolant is dangerously hot. The sending unit is an ON-OFF switch, and is normally in the OFF position. Whenever coolant temperature is above the calibration temperature of the switch, the switch closes, providing ground for the indicator lamp and it illuminates.

Vacuum Gauge

The vacuum gauge is standard on AMX and is part of the optional Rally Package on Gremlin and Concord.

The vacuum gauge is a mechanical instrument connected by rubber hose to a fitting in the intake manifold.

INSTRUMENTATION DIAGNOSIS

General

Improper operation of electrical gauges is usually traced to faulty continuity of wiring (including printed circuits), improperly calibrated components or high resistance caused by loose or corroded connections.

A common diagnostic procedure is to bypass a suspected component, wire or connection with a jumper wire. If the system functions properly with the jumper installed, the problem usually is within the bypassed item.

Test Equipment

Several gauge tests require Universal Gauge Tester J-24538. This instrument provides variable resistance over a wide range of ohm readings. If the tester is not available, a suitable substitute can be made with an accurate ohmmeter and a spare fuel tank sending unit.

(1) Attach one lead of ohmmeter to sending unit terminal.

(2) Attach other ohmmeter lead to sending unit ground wire.

(3) Refer to Sending Unit Resistance Requirements chart for resistance values that apply to gauge being tested. Move float arm and mark appropriate resistance values on sending unit case.

(4) Disconnect ohmmeter. Fasten jumper wire to sending unit terminal. Tester is now calibrated and ready to use.

Printed Circuit Test

(1) Remove instrument cluster from car and remove all bulbs and gauges.

(2) Connect test lamp or ohmmeter lead to correct pin terminal for circuit to be tested. Trace each circuit from pin to bulb or gauge in that circuit.

NOTE: *Use an ohmmeter or Test Lamp J-21008. When using an ohmmeter, use low scale (0 to 10 ohms) and adjust meter to zero reading.*

(3) Check for continuity at each uncoated position in circuit. Test lamp should light or ohmmeter should read zero ohms at each position.

(4) Trace circuit leading away from bulb or gauge to terminal pin or ground screw.

(5) Check for continuity in circuit at each uncoated position. Test lamp should light or ohmmeter should read zero ohms.

(6) Connect test lamp or ohmmeter lead to ground pin terminal and other lead to cluster metal case. Test lamp should light or ohmmeter should read zero ohms.

(7) Replace printed circuit if lamp fails to light or ohmmeter indicates resistance on any test.

(8) Check for shorting between circuits. With lead connected to correct pin for circuit to be tested, move other lead to all other pin terminals in cluster. Lamp should not light or ohmmeter should indicate infinite resistance between circuits.

Ammeter Diagnosis

The accuracy of the ammeter may be determined by comparing readings against an ammeter of known accuracy.

(1) Turn ignition OFF.

(2) Disconnect main harness wire from junction block, located adjacent to starter solenoid.

(3) Connect known good ammeter between junction block and disconnected wire.

(4) Turn ignition switch to ON position. Do not start engine. Turn headlamps ON. Turn heater blower to HIGH speed.

(5) Compare reading of known good ammeter with reading of ammeter in car.

(6) Start engine and run at high idle. Turn headlamps and heater blower OFF. Compare reading of known good ammeter with reading of ammeter in car.

(7) If readings vary more than ±5%, replace ammeter.

Charging Indicator Diagnosis

Two charging systems are used in AMC cars—the built-in electronic voltage regulator system and the mechanical voltage regulator system. Before diagnosing a charging indicator lamp problem, determine which type of charging system is involved.

DARS charts are provided for three charging indicator lamp problems:

- Charging Indicator Lamp On, Engine Running
- Charging Indicator Lamp Off, Ignition On, Engine Not Running
- Charging Indicator Lamp On, Ignition Off

DARS charts 1, 2 and 3 are for electronic voltage regulators and 4, 5 and 6 are for mechanical regulators.

Fuel Gauge Diagnosis

Movement of the fuel in the tank may be caused by driving on long hills, driving on bumpy roads or by rapidly accelerating or braking. The fuel level indicator, moving up and down erratically by the motion of the fuel, may temporarily cause the fuel gauge to indicate incorrectly. Be sure to consider these conditions before suspecting a fault in the indicating system. Abnormal conditions are all variations of four basic malfunctions:

- Needle does not move.
- Needle moves but indiates a fuel level that does not correspond with actual fuel level.
- Needle moves to top of scale and remains there.
- Needle pulsates (CVR gauges only).

Refer to DARS chart 7 for a systematic method of finding the causes of these conditions in magnetic gauge systems. Refer to DARS chart 8 for CVR gauge systems. Charts 9 and 10 provide additional procedures needed only as directed in charts 7 and 8.

Oil Pressure Gauge Diagnosis

The magnetic oil pressure gauge may malfunction in several ways:

- Needle does not move.
- Needle moves but indicates an oil pressure that does not correspond with actual oil pressure.
- Needle moves to top of scale and remains there.

Refer to DARS chart 11 for a systematic method of finding the causes of these problems.

Calibration Test

If an oil pressure gauge is suspected of indicating pressure that does not correspond with actual oil pressure, perform a calibration test before performing electrical diagnosis procedures in DARS chart 11.

(1) Remove indicator lamp sending unit from T-fitting on engine. Do not disturb gauge sending unit.

(2) Connect direct-reading oil gauge to T-fitting.

(3) Start engine. Compare reading of in-car gauge with test gauge. Make observation at idle and at higher engine speeds. If readings of both gauges are approximately equal, in-car gauge is acceptable. If gauge is outside specifications, perform gauge test as outlined in DARS chart 11.

(4) After performing test, install indicator lamp sending unit and check for leaks.

Oil Pressure Indicator Lamp Diagnosis

Refer to DARS chart 12.

Tachometer Diagnosis

Electronic testing of the tachometer requires a square wave generator. Test values are given is Specifications. An acceptable test may be performed by comparing the vehicle tachometer with a test tachometer of known accuracy. Tachometers are not adjustable. Replace if defective.

Temperature Gauge Diagnosis

Before performing temperature gauge diagnosis, be sure the cooling system is performing properly. Overheating may be caused by low coolant level, restrictions, loose or broken drive belt, defective water pump, incorrect ignition timing. Undercooling may be caused by a stuck thermostat. Be sure to consider these conditions before suspecting an actual abnormal condition in the indicating system. Abnormal conditions are all variations of four basic malfunctions:

- Needle does not move.
- Needle moves but indicates a temperature that does not correspond with actual coolant temperature.
- Needle moves to top of scale and remains there.
- Needle pulsates (CVR gauges only).

Refer to DARS chart 13 for a systematic method of finding the causes of these conditions in magnetic gauge systems. Refer to DARS chart 14 for CVR gauge systems. Charts 9 and 10 provide additional procedures needed only as directed in charts 13 and 14.

Temperature Indicator Lamp Diagnosis

Refer to DARS charts 15 and 16.

Vacuum Gauge Diagnosis

The vacuum gauge is a non-adjustable mechanical gauge. Accuracy may be checked by connecting a vacuum gauge of known accuracy into the existing gauge hose with a T-fitting.

INSTRUMENT CLUSTER REPLACEMENT

Pacer

Removal

(1) Disconnect battery negative cable.

(2) Remove instrument cluster bezel with straight, firm pull.

(3) Remove radio control knobs and nuts.

(4) Remove radio overlay retaining screws.

(5) Remove headlamp switch overlay retaining screws.

(6) Pull headlamp switch rearward and disconnect speedometer cable.

(7) Remove instrument cluster retaining screws.

(8) Disconnect instrument panel wire harness connectors.

(9) Remove steering tube cover (column shift automatic only).

(10) Disconnect gear selector dial cable from steering column if equipped and remove cluster assembly.

Installation

(1) Connect gear selector dial cable to steering column, if equipped.

(2) Install steering tube cover, if removed.

(3) Connect speedometer cable.

(4) Connect instrument panel wire harness connectors to cluster and install cluster assembly.

(5) Install cluster retaining screws.

(6) Install headlamp switch overlay and retaining screws.

(7) Install radio overlay and retaining screws.

(8) Install radio control knobs and nuts.

(9) Install instrument cluster bezel.

(10) Connect battery negative cable.

(11) Reset clock, if equipped.

Gremlin, Concord and AMX

Removal

(1) Disconnect battery negative cable.

(2) Protect steering column with shop cloth.

(3) Remove bezel retaining screws:

(a) Six at top edge
(b) One at left end
(c) Two above radio
(d) Two behind glove compartment door

(4) Tip bezel outward at top and disconnect tabs along lower edge.

(5) Unplug glove compartment lamp connectors, if equipped.

(6) Disconnnect speedometer cable.

(7) Reach into opening above bezel and push down on three illumination lamp housings. Pull out on top of bezel until lamp housings are free.

(8) Disconnect headlamp switch connector, wiper switch connector and illumination lamp.

(9) Twist and remove cluster illumination lamp sockets.

(10) Unplug cluster connectors.

Installation

(1) Connect cluster wiring connectors.

(2) Install illumination lamp sockets.

(3) Connect headlamp and wiper switch connectors and install lamp.

(4) Align tabs at bottom of bezel with opening and tip bezel upward. It may be necessary to press down on illumination housings for clearance. Do not push bezel into final position.

(5) Connect speedometer cable.

(6) Connect glove compartment lamp wires, if removed.

(7) Push top of bezel to installed position.

(8) Install retaining screws.

(9) Remove protective cloth.

(10) Connect battery and reset clock, if equipped.

Matador

Removal

(1) Disconnect battery negative cable.

(2) Remove radio control knobs and attaching nuts.

(3) Remove right mirror remote control from instrument panel, if equipped.

(4) Remove bezel attaching screws and remove bezel.

(5) Cover steering column with cloth to prevent scratching column.

(6) If equipped with clock, remove clock housing attaching screws, pull assembly away from cluster, and disconnect bulbs and electrical leads. Remove assembly.

(7) If not equipped with clock, remove clock opening cover.

(8) Using clock access opening, disconnect speedometer cable and move cable away from instrument cluster.

(9) Disconnect gear selector dial cable from steering column.

(10) Remove cluster mounting screws and disconnect electrical connections.

(11) Remove cluster.

Installation

(1) Position cluster and connect electrical components.

(2) Install cluster mounting screws.

(3) Connect gear selector dial cable.

(4) Connect speedometer cable.

(5) Connect clock elctrical connector and install bulbs and clock, or cover.

(6) Install instrument cluster bezel.

(7) Install right mirror remote control, if removed.

(8) Install radio attaching nuts and control knobs.

(9) Connect battery negative cable.

(10) Reset clock, if equipped.

Rally Package

Removal

(1) Disconnect battery negative cable.

(2) Remove screws attaching Rally Package cluster to lower instrument panel.

(3) Tag cluster wires for use during installation.

(4) Disconnect wiring from rear of cluster.

Installation

(1) Connect cluster wiring.

(2) Install cluster-to-lower instrument panel attaching screws.

(3) Connect battery negative cable.

(4) Reset clock.

GAUGE REPLACEMENT

Ammeter

(1) Remove Rally Package cluster.

(2) Remove housing-to-gauge assembly screws. Remove housing.

(3) Remove front plate.

(4) Remove ammeter, nuts and washers.

(5) Install ammeter, nuts and washers.

(6) Install front plate.

(7) Install housing.

(8) Install cluster to car.

Fuel Gauge

Pacer

(1) Remove instrument cluster.

(2) Remove two screws attaching speedometer to cluster and remove speedometer.

(3) Remove fuel gauge nuts and remove gauge.

(4) Position gauge and install nuts.

NOTE: *Be sure nuts fasten securely to printed circuit.*

(5) Install speedometer.

(6) Install cluster.

Gremlin, Concord and AMX

(1) Remove cluster bezel from car.

(2) Remove clock or tachometer screws, if equipped. It is not necessary to remove clock adjusting knob.

(3) Disconnect clock feed wire from circuit board, if equipped.

(4) Remove cluster housing and circuit board-to-bezel screws.

(5) Remove cluster housing and circuit board assembly from bezel. If equipped with clock, move aside as required.

(6) Unplug gauge from circuit board. Do not damage face plate by prying.

(7) Install gauge to pins on circuit board.

(8) Position housing on bezel. Move clock aside, as required.

(9) Install housing-to-bezel screws.

NOTE: *Clock ground wire terminal must be in contact with foil on circuit board, underneath clock mounting boss.*

(10) Connect clock feed wire to circuit board, if removed.

(11) Install clock or tachometer screws.

(12) Install cluster bezel to car.

Matador

(1) Remove instrument cluster.

(2) Remove printed circuit board attaching screws.

(3) Remove instrument cluster mask and bulb indicator lens.

(4) Remove gauge, nuts and washer.

(5) Install gauge, nuts and washers.

(6) Install cluster lens and mask.

(7) Install circuit board.

(8) Install cluster.

Oil Pressure Gauge

(1) Remove Rally Package cluster.

(2) Remove housing-to-gauge assembly screws. Remove housing.

(3) Remove front plate.

(4) Remove oil pressure gauge, nuts and washers.

(5) Install oil pressure gauge, nuts and washers.

(6) Install front plate.

(7) Install housing.

(8) Install cluster to car.

Tachometer

Pacer

(1) Disconnect battery negative cable.

(2) Remove radio control knobs and nuts, if euipped.

(3) Remove cluster bezel with a straight, firm pull.

(4) Remove radio overlay.

(5) Install replacement tachometer.

(6) Connect tachometer and cigar lighter wiring.

(7) Install radio overlay.

(8) Install cluster bezel.

(9) Install radio control knobs and nuts, if removed.

(10) Connect battery negative cable.

(11) Reset clock.

Gremlin, Concord, AMX

(1) Remove cluster bezel from car.

(2) Remove tachometer screws.

(3) Remove gauge from housing.

(4) Install gauge.

(5) Install tachometer screws.

(6) Install cluster bezel to car.

Temperature Gauge

Gremlin, Concord and AMX

(1) Remove cluster bezel from car.

(2) Remove clock or tachometer screws, if equipped. It is not necessary to remove clock adjusting knob.

(3) Disconnect clock feed wire from circuit board, if equipped.

(4) Remove cluster housing and circuit board-to-bezel screws.

(5) Remove cluster housing and circuit board assembly from bezel. If equipped with clock, move aside as required.

(6) Unplug gauge from circuit board. Do not damage face plate by prying.

(7) Install gauge to pins on circuit board.

(8) Position housing on bezel. Move clock aside, as required.

(9) Install housing-to-bezel screws.

NOTE: *Clock ground wire terminal must be in contact with foil on circuit board, underneath clock mounting boss.*

(10) Connect clock feed wire to circuit board, if removed.

(11) Install clock or tachometer screws.

(12) Install cluster bezel to car.

Matador

(1) Remove cluster.

(2) Remove printed circuit board attaching screws.

(3) Remove instrument cluster mask and bulb indicator lens.

(4) Remove gauge.

(5) Install gauge.

(6) Install cluster lens and mask.

(7) Install circuit board.

(8) Install cluster.

Rally Package

(1) Remove Rally Package cluster.

(2) Remove housing-to-gauge assembly screws. Remove housing.

(3) Remove front plate.

(4) Remove temperature gauge, nuts and washers.

(5) Install temperature gauge, nuts and washers.

(6) Install front plate.

(7) Install housing.

(8) Install cluster to car.

Vacuum Gauge

(1) Remove Rally Package cluster.

(2) Remove housing-to-gauge assembly screws. Remove housing.

(3) Remove front plate.

(4) Remove vacuum gauge, nuts and washers.

(5) Install vacuum gauge, nuts and washers.

(6) Install front plate.

(7) Install housing.

(8) Install cluster to car.

INDICATOR LAMP REPLACEMENT

Pacer

(1) Remove instrument cluster bezel with a straight, firm pull.

(2) Use fingers, padded needlenose pliers or 1/8-inch hose slipped over bulb and pull out of clip.

NOTE: *It is not necessary to remove bulb clip from cluster.*

(3) Install replacement bulb.

(4) Install instrument cluster bezel.

Gremlin, Concord and AMX

Lamp replacement requires cluster removal. Refer to procedures in Instrument Cluster Replacement.

Matador

Without Air Conditioning

Lamp replacement does not require removal of components. Twist socket and remove from cluster. Replace bulb.

With Air Conditioning

(1) Disconnect battery negative cable.
(2) Remove instrument cluster bezel.
(3) Remove clock attaching screws and move clock to obtain access to bulb.
(4) Replace bulb.
(5) Install clock attaching screws.
(6) Install instrument cluster bezel.
(7) Connect battery negative cable.
(8) Reset clock.

PRINTED CIRCUIT REPLACEMENT

Pacer

Removal

(1) Remove instrument cluster.
(2) Remove speedometer-to-cluster screws.
(3) Remove CVR unit.
(4) Remove all bulbs and bulb clips from cluster. Twist counterclockwise to remove.
(5) Remove fuel gauge attaching nuts.
(6) Remove noise suppressor if equipped with radio, or connector strip if not equipped with radio.
(7) Remove printed circuit.

Installation

(1) Install printed circuit.
(2) Install fuel gauge attaching nuts and tighten securely.
(3) Install bulbs.
(4) Install radio noise suppressor or connector strip.
(5) Install CVR unit.
(6) Install speedometer screws.
(7) Install instrument cluster.

Gremlin, Concord and AMX

Removal

(1) Remove cluster bezel assembly from car.
(2) Remove clock or tachometer screws, if equipped. It is not necessary to remove clock adjusting knob.
(3) Disconnect clock feed wire from circuit board, if equipped.
(4) Remove cluster housing and circuit board-to-bezel screws.
(5) Remove cluster housing and circuit board assembly from bezel. If equipped with clock, move aside as required.
(6) Unplug fuel and temperature gauges from circuit board. Do not damage face plate.
(7) Remove lamp sockets from circuit board.
(8) Slide circuit board to disengage from locking tabs on housing.

NOTE: *Circuit board cannot be slid with gauges or lamp sockets installed.*

Installation

(1) Slide circuit board into position on housing and lock behind tabs.
(2) Install lamp sockets.
(3) Install fuel and temperature gauges to pins on circuit board.
(4) Position housing on bezel. Move clock aside, as required.
(5) Install housing-to-bezel screws.

NOTE: *Clock ground wire terminal must be in contact with foil on circuit board, underneath clock mounting boss.*

(6) Connect clock feed wire to circuit board, if removed.
(7) Install clock or tachometer scresw.
(8) Install cluster bezel assembly to car.

Matador

Removal

(1) Remove instrument cluster.
(2) Remove all bulbs. Twist counterclockwise to remove.

(3) Remove radio noise suppressor and constant voltage regulator (CVR).

(4) Remove circuit board attaching screws.

(5) Remove mask and lens.

(6) Remove gauges.

(7) Remove printed circuit board.

Installation

(1) Install gauges.

(2) Install lens.

(3) Install mask.

(4) Install printed circuit board and attaching screws.

(5) Install radio noise suppressor and CVR.

(6) Install bulbs.

(7) Install instrument cluster.

CONSTANT VOLTAGE REGULATOR (CVR) REPLACEMENT

Pacer

(1) Remove instrument cluster.

(2) Remove attaching screws and remove CVR.

(3) Install CVR. Be sure terminal pins are plugged securely into printed circuit. Install screws.

(4) Install instrument cluster.

Matador

(1) Disconnect battery negative cable.

(2) On non-air conditioned models, reach behind cluster and unplug CVR.

(3) On air conditioned models, remove cluster for access to CVR.

(4) Plug CVR into printed circuit. Be sure terminals are seated securely.

(5) Install cluster, if removed.

(6) Connect battery cable.

(7) Reset clock, if equipped.

DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHARTS

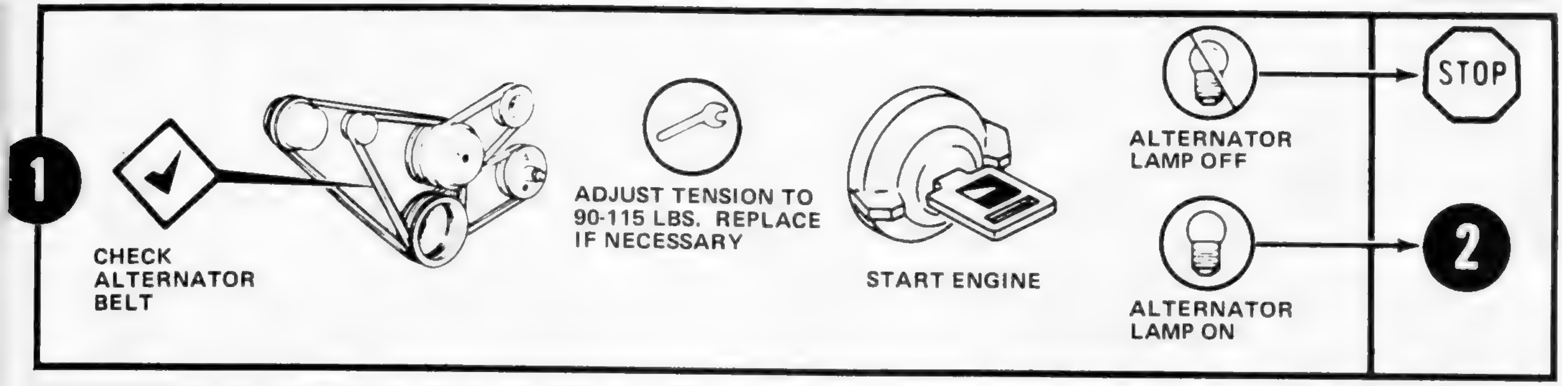
CHARGING INDICATOR LAMP—ELECTRONIC REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

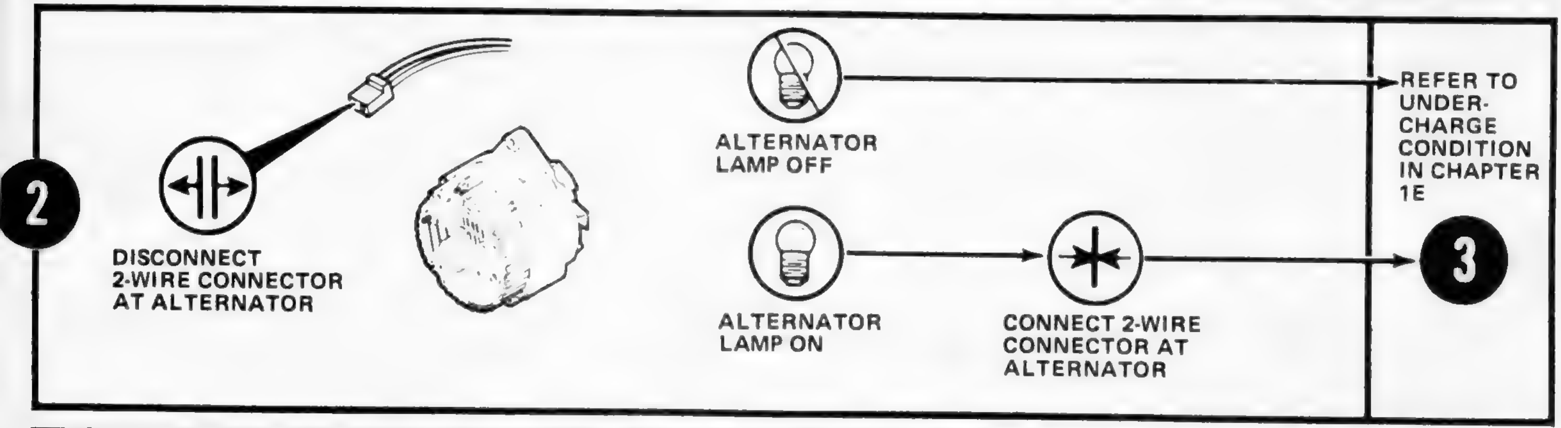
Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

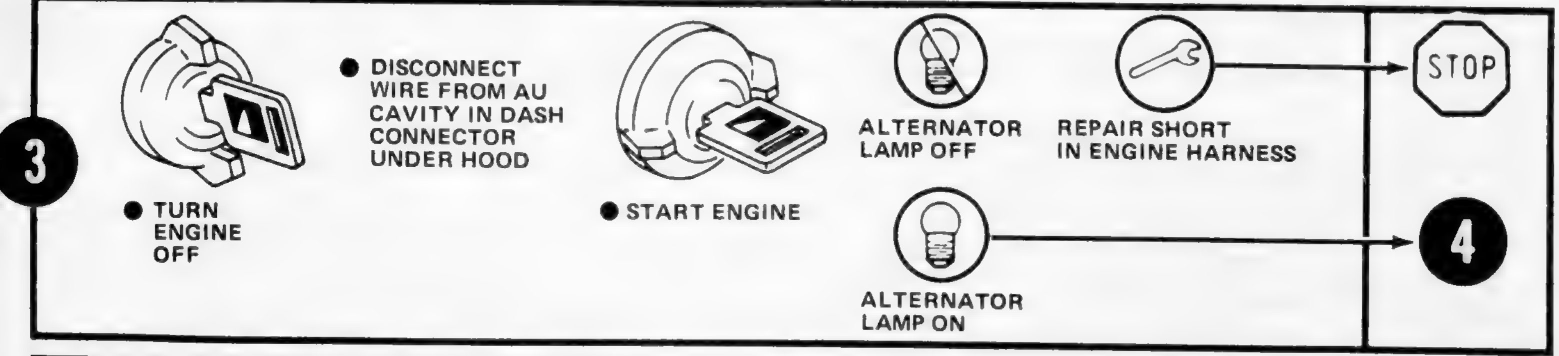
PROBLEM: ALTERNATOR LAMP ON, ENGINE RUNNING

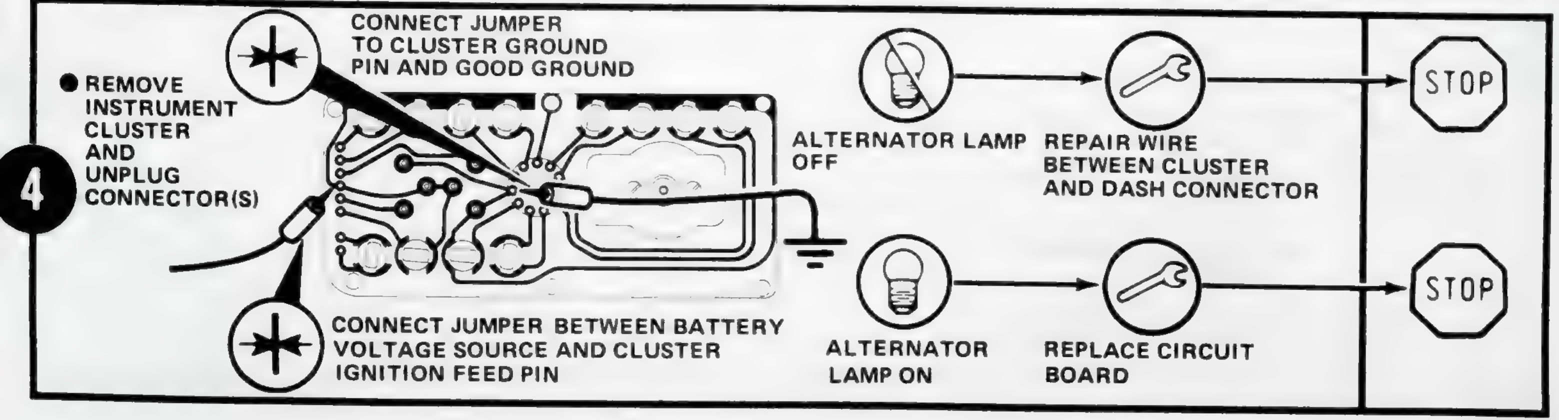
Chart 1

STEP **SEQUENCE** **RESULT**









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CHARGING INDICATOR LAMP—ELECTRONIC REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: ALTERNATOR LAMP OFF, IGNITION ON, ENGINE NOT RUNNING

Chart 2

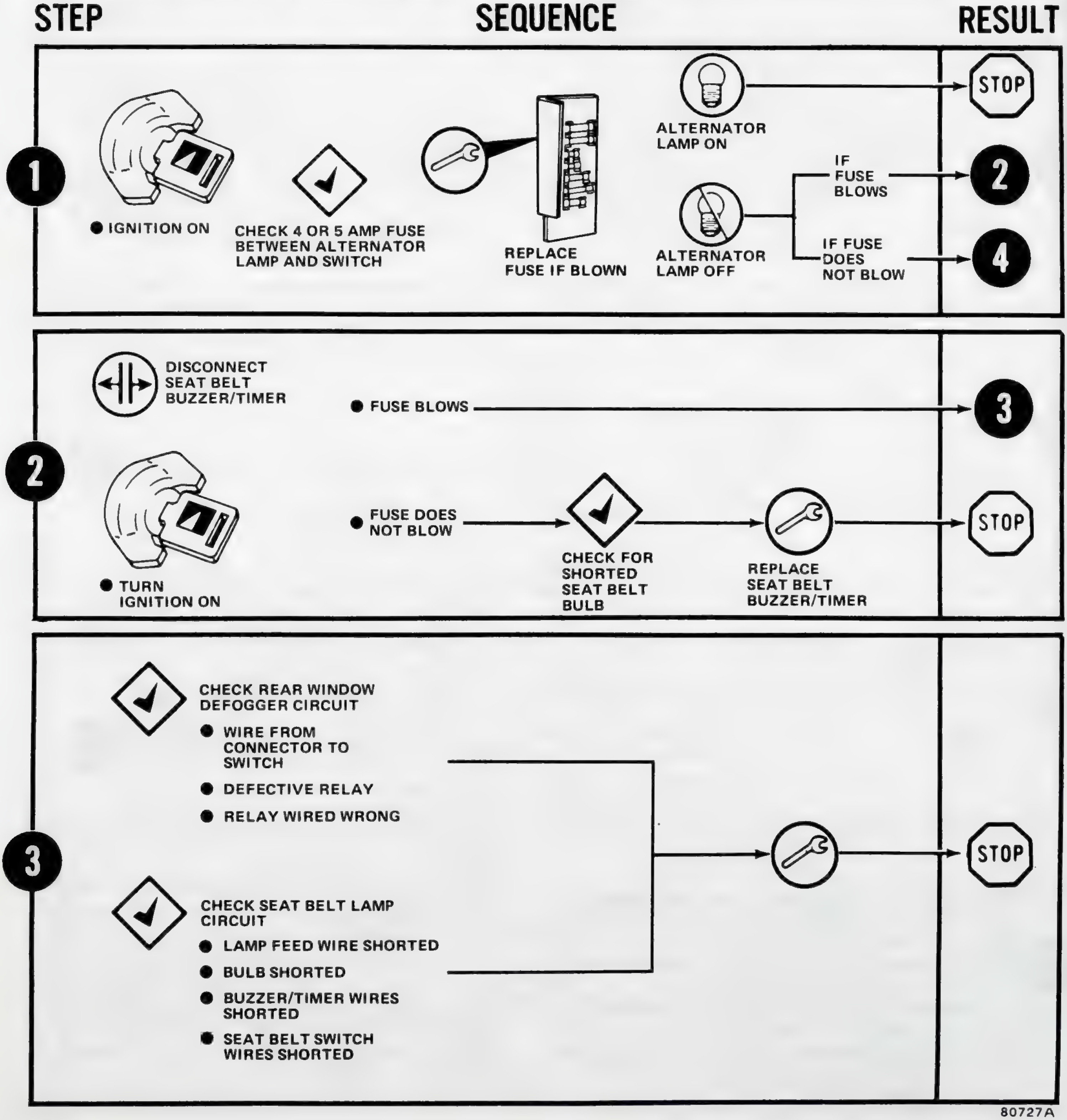

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Chart 2

STEP **SEQUENCE** **RESULT**

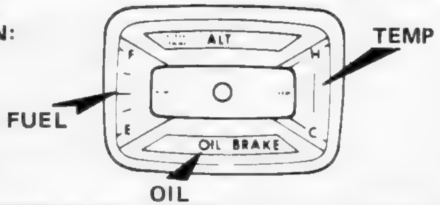
4

✓ CHECK THE FOLLOWING FOR PROPER OPERATION:

OIL PRESSURE LIGHT

FUEL GAUGE

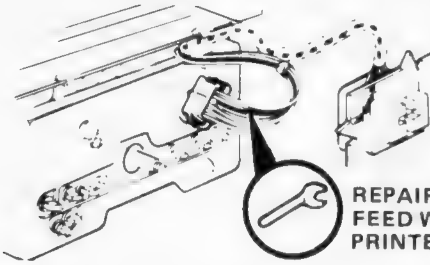
TEMPERATURE GAUGE



GAUGES INOPERATIVE → 5

GAUGES OPERATE PROPERLY → 6

5

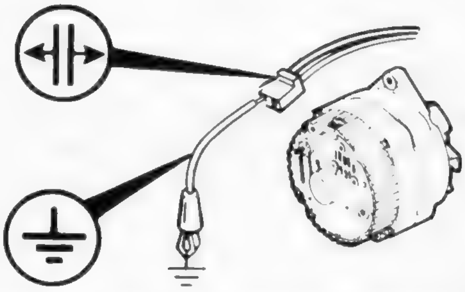


REPAIR IGNITION FEED WIRE OR PRINTED CIRCUIT → STOP

6

DISCONNECT NO.1 AND NO. 2 WIRES

GROUND NO. 1 TERMINAL WIRE



ALTERNATOR LIGHT ON → 7

ALTERNATOR LIGHT OFF → 8

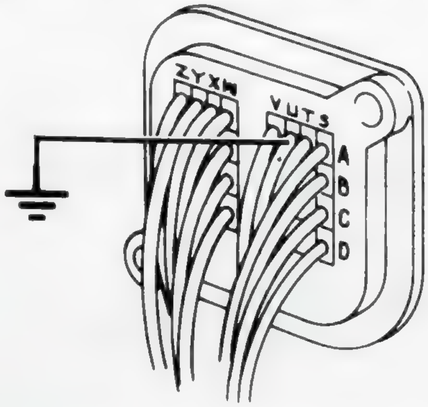
7

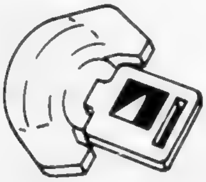
REPAIR ALTERNATOR

→ STOP

8

INSERT PAPER CLIP IN AU TERMINAL OF DASH CONNECTOR FROM UNDER INSTRUMENT PANEL AND GROUND CLIP





TURN IGNITION SWITCH ON

ALTERNATOR LIGHT ON → 9

ALTERNATOR LIGHT OFF → 10

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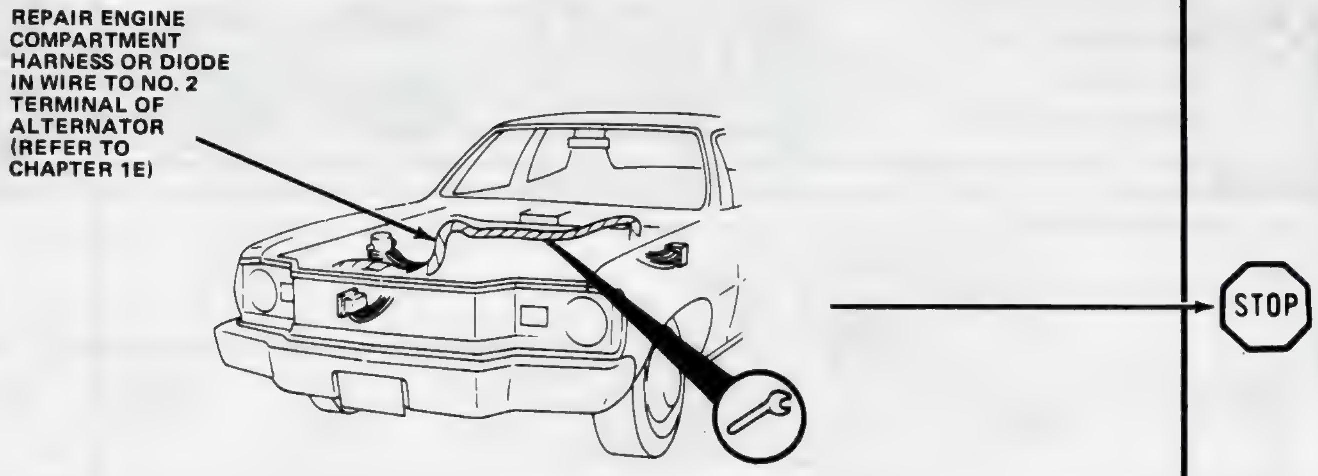
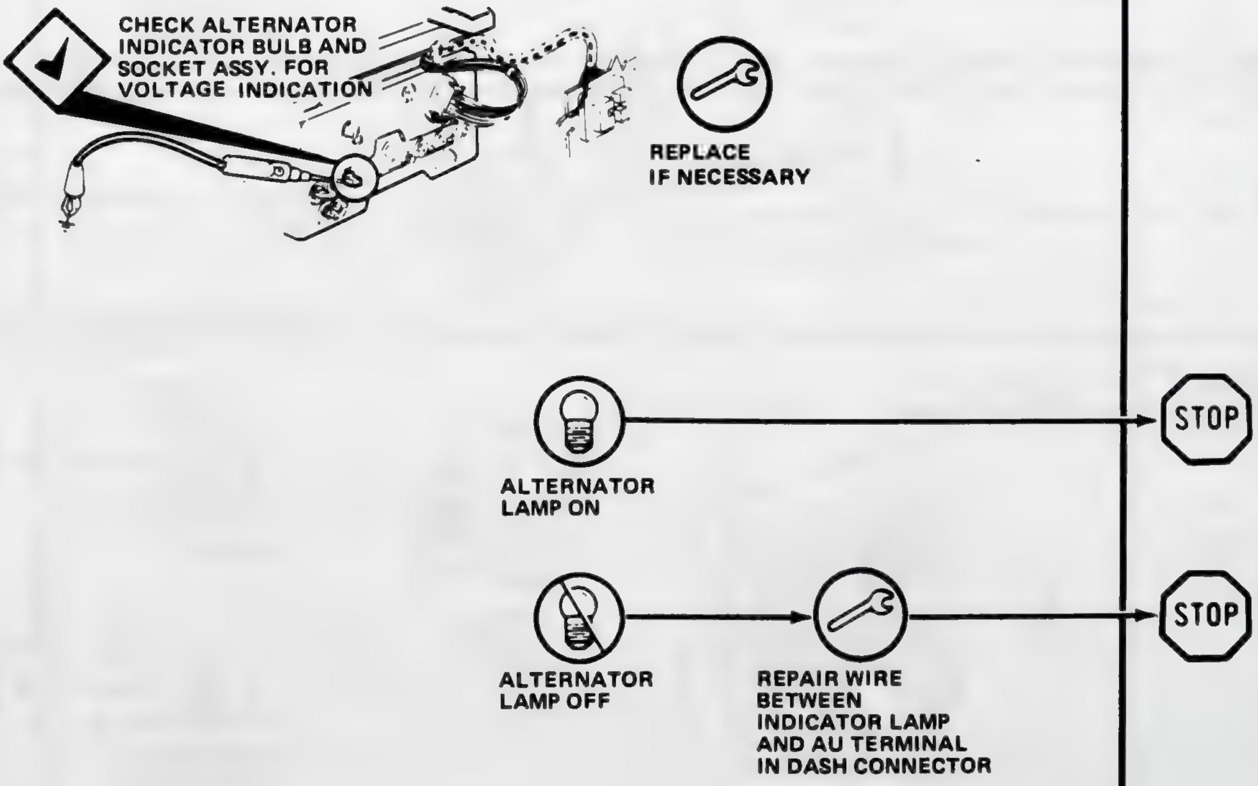
Chart 2

STEP **SEQUENCE** **RESULT**

9



10



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CHARGING INDICATOR LAMP—ELECTRONIC REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

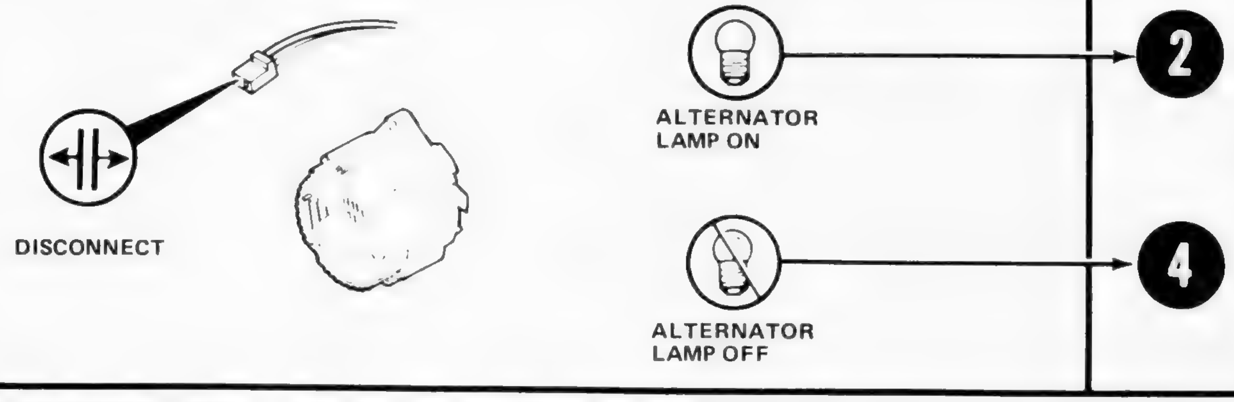
Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: ALTERNATOR LAMP ON, IGNITION OFF

Chart 3

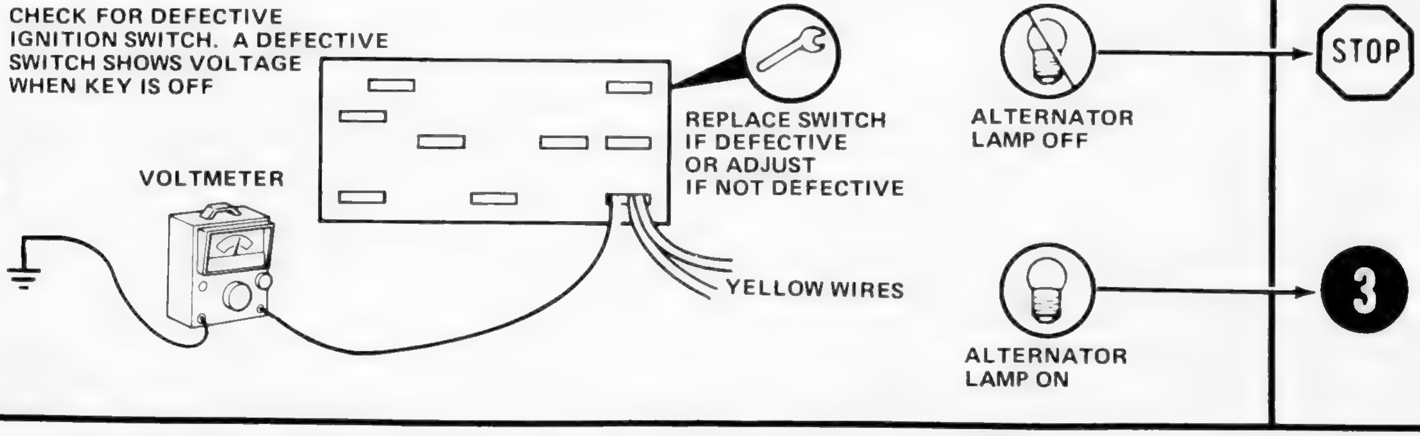
STEP **SEQUENCE** **RESULT**

1



2

CHECK FOR DEFECTIVE IGNITION SWITCH. A DEFECTIVE SWITCH SHOWS VOLTAGE WHEN KEY IS OFF



REPLACE SWITCH IF DEFECTIVE OR ADJUST IF NOT DEFECTIVE

3

- LOCATE AND REPAIR UNINTENTIONAL IGNITION FEED TO INDICATOR LAMP FEED WIRE → STOP

4

REPLACE RECTIFIER BRIDGE

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CHARGING INDICATOR LAMP—MECHANICAL REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: ALTERNATOR LAMP ON, ENGINE RUNNING

Chart 4

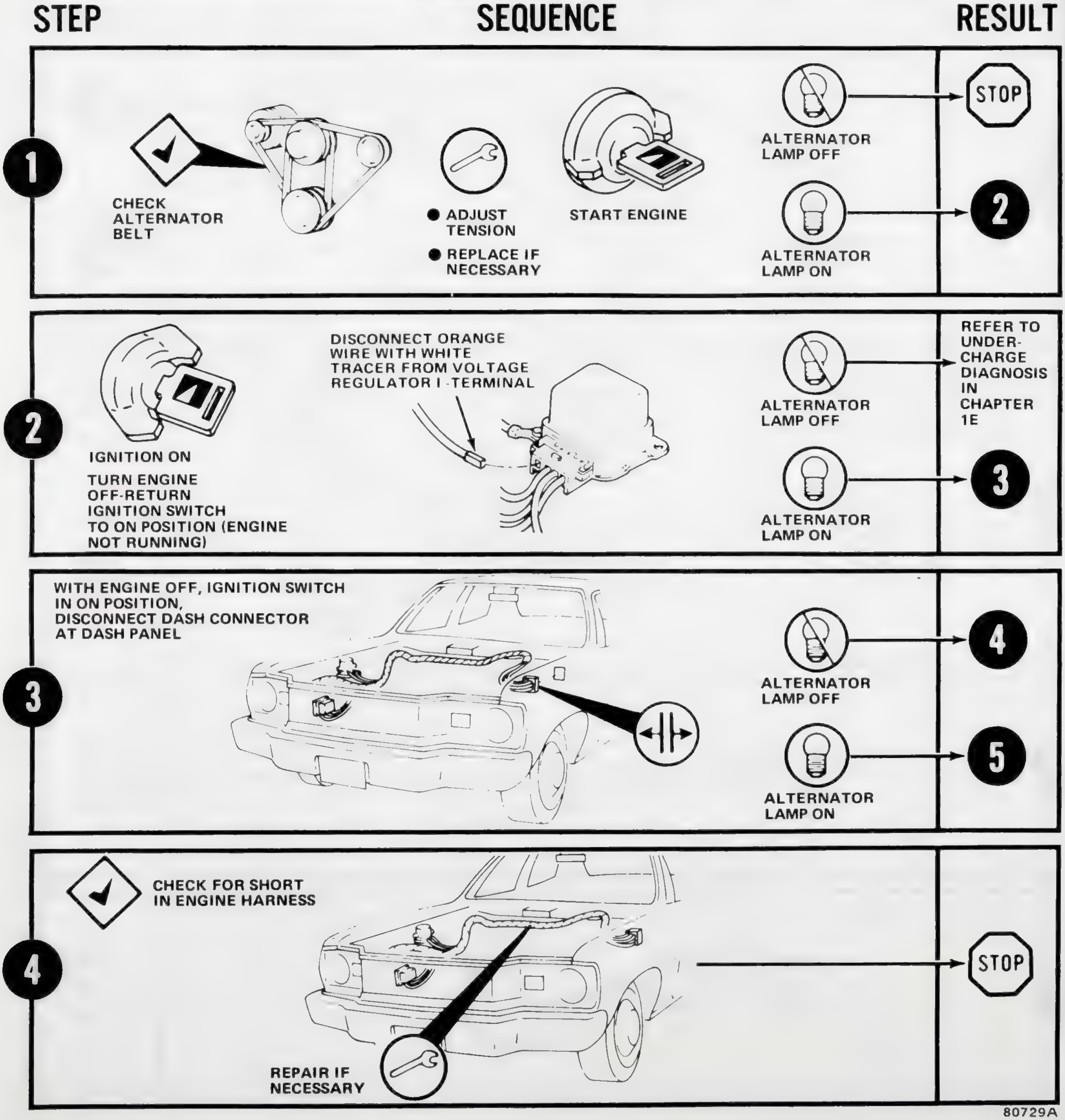
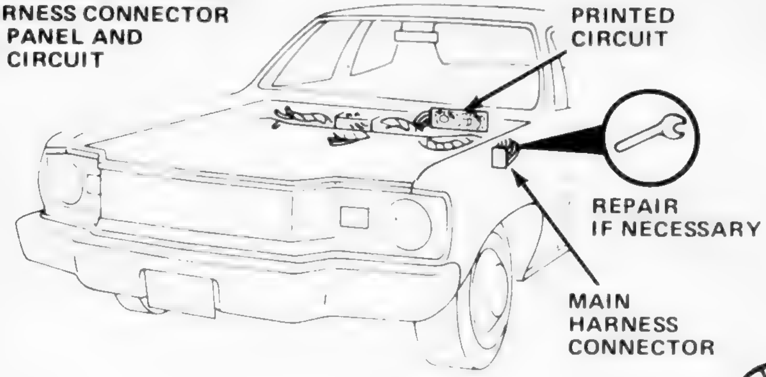


Chart 4

STEP **SEQUENCE** **RESULT**

5

CHECK FOR SHORT BETWEEN MAIN HARNESS CONNECTOR AT DASH PANEL AND PRINTED CIRCUIT

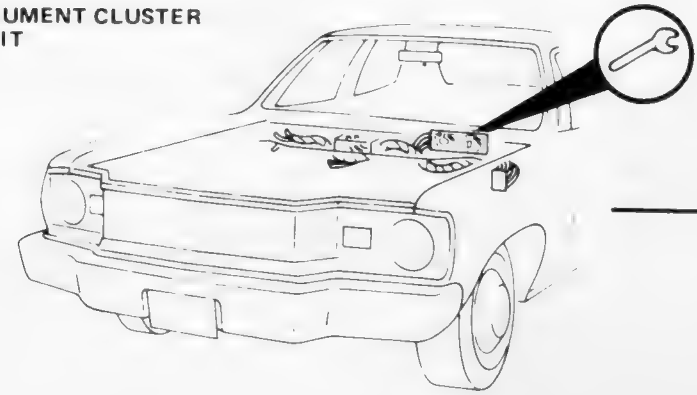


ALTERNATOR LAMP OFF → STOP

ALTERNATOR LAMP ON → 6

6

REPLACE INSTRUMENT CLUSTER PRINTED CIRCUIT



→ STOP

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CHARGING INDICATOR LAMP—MECHANICAL REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: ALTERNATOR LAMP OFF, IGNITION ON, ENGINE NOT RUNNING

Chart 5

STEP | **SEQUENCE** | **RESULT**

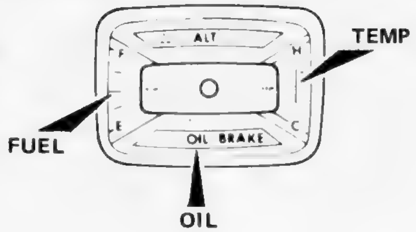
1

✓ CHECK THE FOLLOWING FOR PROPER OPERATION:

OIL PRESSURE LIGHT

FUEL GAUGE

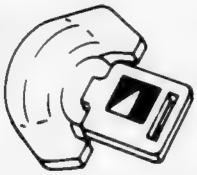
TEMPERATURE GAUGE



GAUGES INOPERATIVE → 2

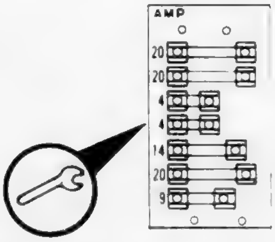
OK GAUGES OPERATE PROPERLY → 3

2



IGNITION ON, ENGINE NOT RUNNING

✓ CHECK 4 OR 5 AMP GAUGE FUSE



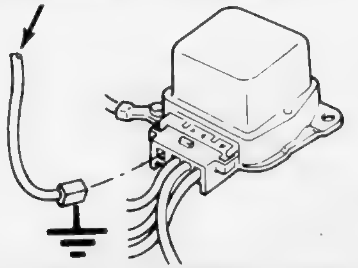
CHECK FOR CAUSE AND REPLACE FUSE IF BLOWN

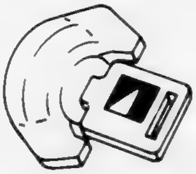
REPLACE FUSE → STOP

● FUSE OK → 4

3

DISCONNECT ORANGE WIRE WITH WHITE TRACER FROM VOLTAGE REGULATOR I-TERMINAL, AND CONNECT TO GROUND



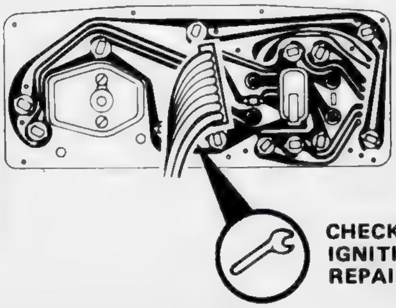


TURN IGNITION SWITCH ON

ALTERNATOR LAMP ON → REPLACE REGULATOR → STOP

ALTERNATOR LAMP OFF → 5

4



CHECK INSTRUMENT CLUSTER IGNITION FEED WIRING REPAIR IF OPEN

ALTERNATOR LAMP ON → STOP

ALTERNATOR LAMP OFF → 8

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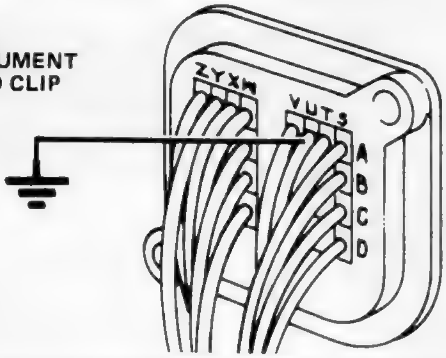
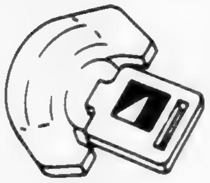
Chart 5

STEP **SEQUENCE** **RESULT**

5

INSERT PAPER CLIP IN AU TERMINAL OF DASH CONNECTOR FROM UNDER INSTRUMENT PANEL AND GROUND CLIP





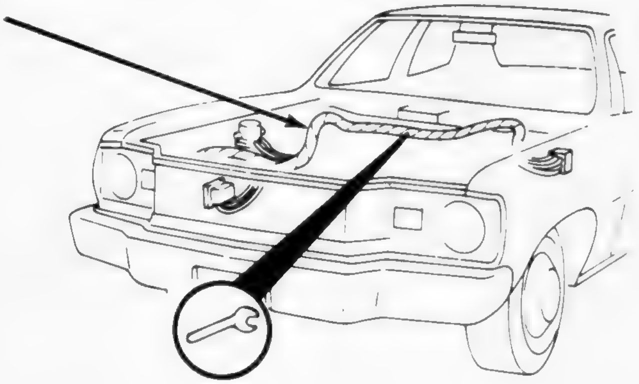
TURN IGNITION SWITCH ON

ALTERNATOR LAMP ON → 6

ALTERNATOR LAMP OFF → 7

6

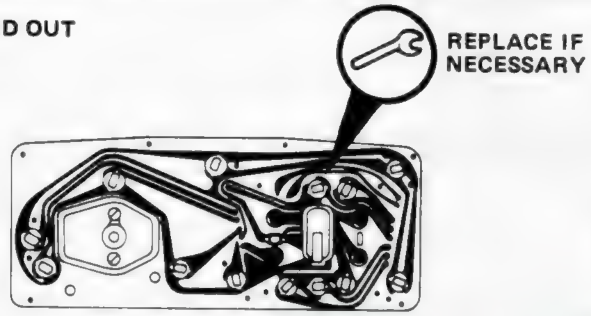
REPAIR ENGINE COMPARTMENT HARNESS, DASH CONNECTOR OR REPLACE DIODE IN I-TERMINAL WIRE



→ STOP

7

CHECK FOR BURNED OUT BULB



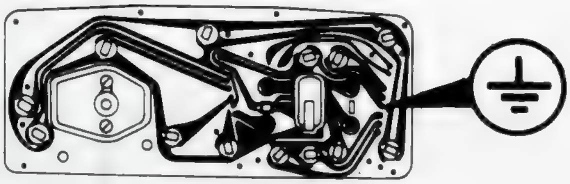
REPLACE IF NECESSARY

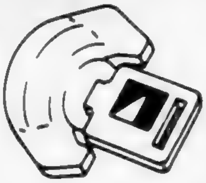
ALTERNATOR LAMP ON → STOP

ALTERNATOR LAMP OFF → 8

8

APPLY GROUND TO LAMP-TO-REGULATOR TERMINAL ON INSTRUMENT PRINTED CIRCUIT





TURN IGNITION SWITCH ON

ALTERNATOR LAMP ON → 9

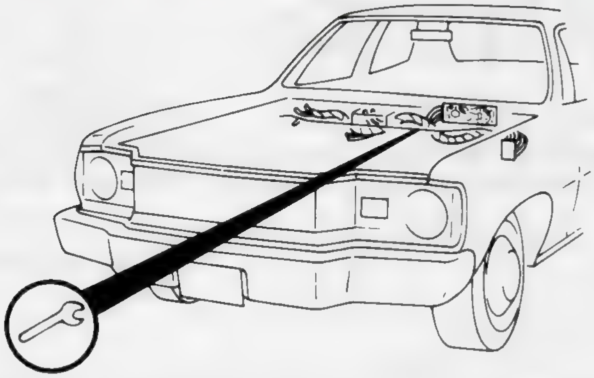
ALTERNATOR LAMP OFF → 10

80730B

Chart 5

STEP **SEQUENCE** **RESULT**

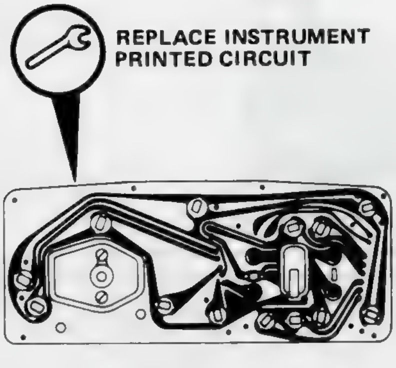
9



REPAIR
OPEN CIRCUIT
BETWEEN
INDICATOR LAMP AND REGULATOR

→ STOP

10



REPLACE INSTRUMENT
PRINTED CIRCUIT

→ STOP

80730C

CHARGING INDICATOR LAMP—MECHANICAL REGULATOR—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

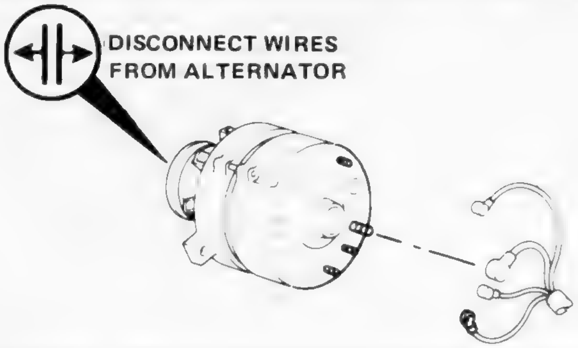
PROBLEM: ALTERNATOR LAMP ON, IGNITION OFF

Chart 6

STEP **SEQUENCE** **RESULT**

1

DISCONNECT WIRES FROM ALTERNATOR

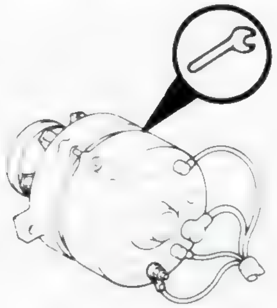


ALTERNATOR LAMP OFF → **2**

ALTERNATOR LAMP ON → **3**

2

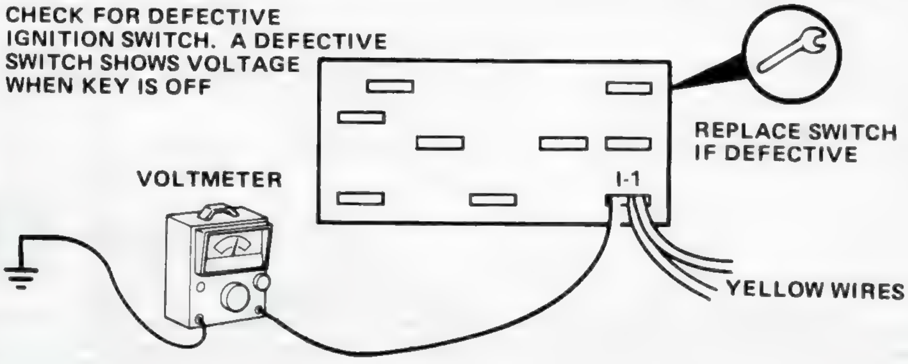
REPLACE DEFECTIVE POSITIVE DIODE IN ALTERNATOR AND DEFECTIVE DIODE IN IGNITION FEED WIRE TO ALTERNATOR



→ STOP

3

CHECK FOR DEFECTIVE IGNITION SWITCH. A DEFECTIVE SWITCH SHOWS VOLTAGE WHEN KEY IS OFF



REPLACE SWITCH IF DEFECTIVE

ALTERNATOR LAMP OFF → STOP

ALTERNATOR LAMP ON → **4**

4

- LOCATE AND REPAIR UNINTENTIONAL IGNITION FEED TO INDICATOR LAMP FEED WIRE → STOP

FUEL GAUGE—CVR DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

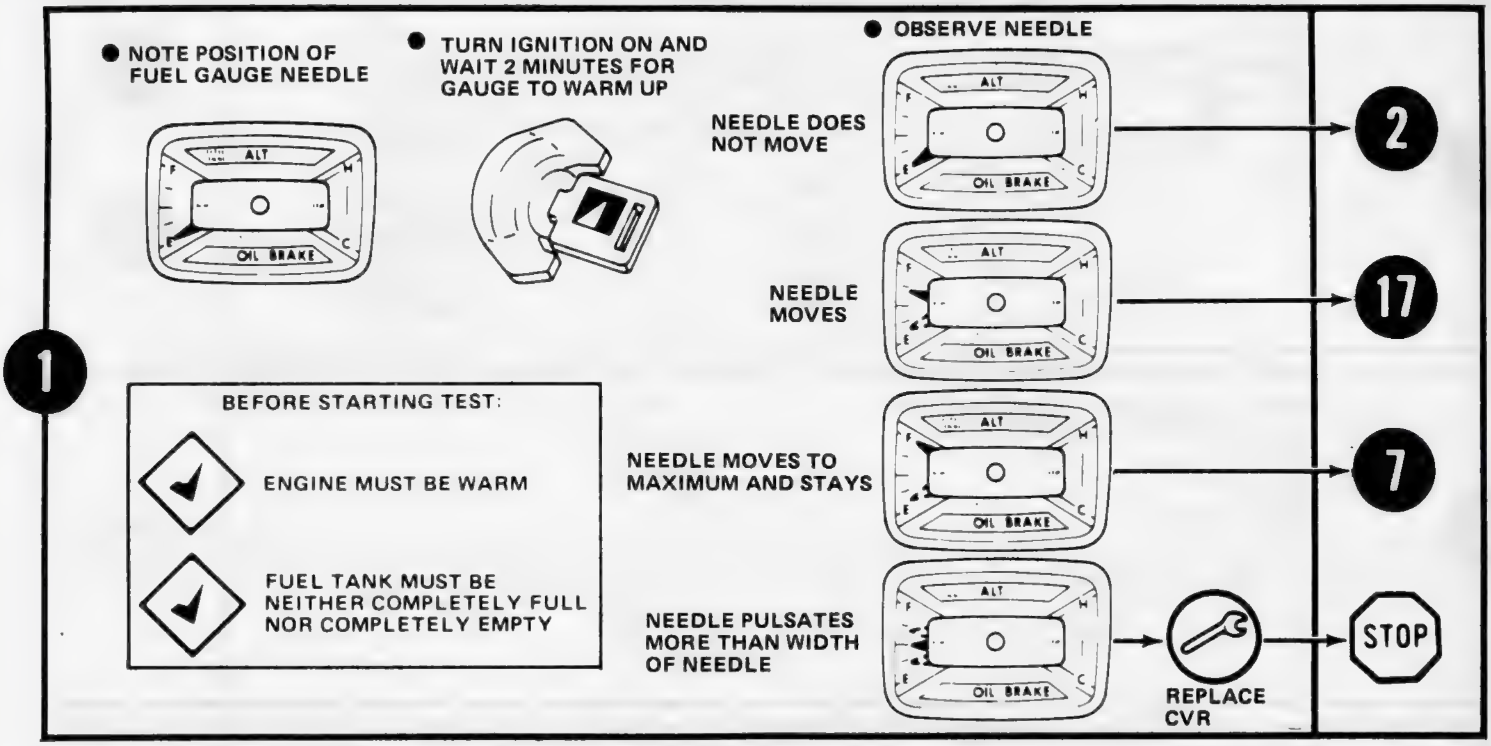
Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

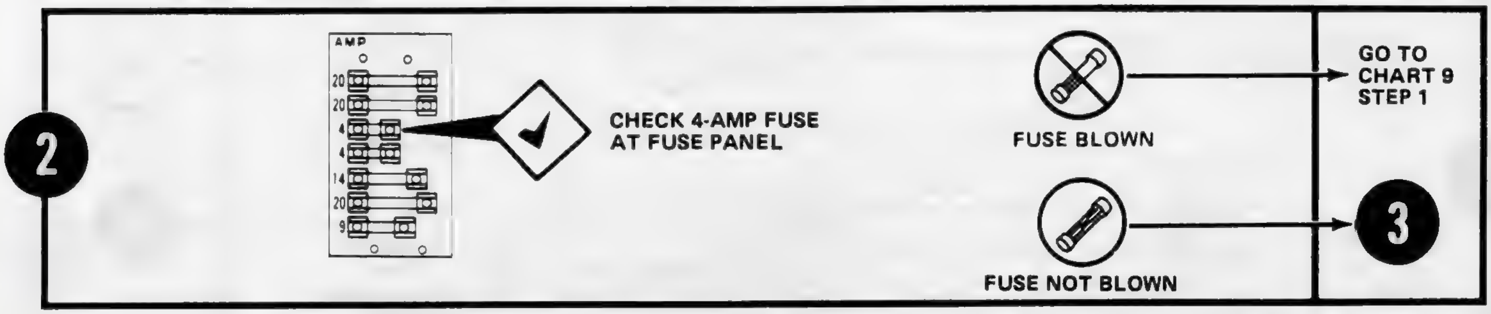
PROBLEM: FUEL GAUGE NOT FUNCTIONING PROPERLY

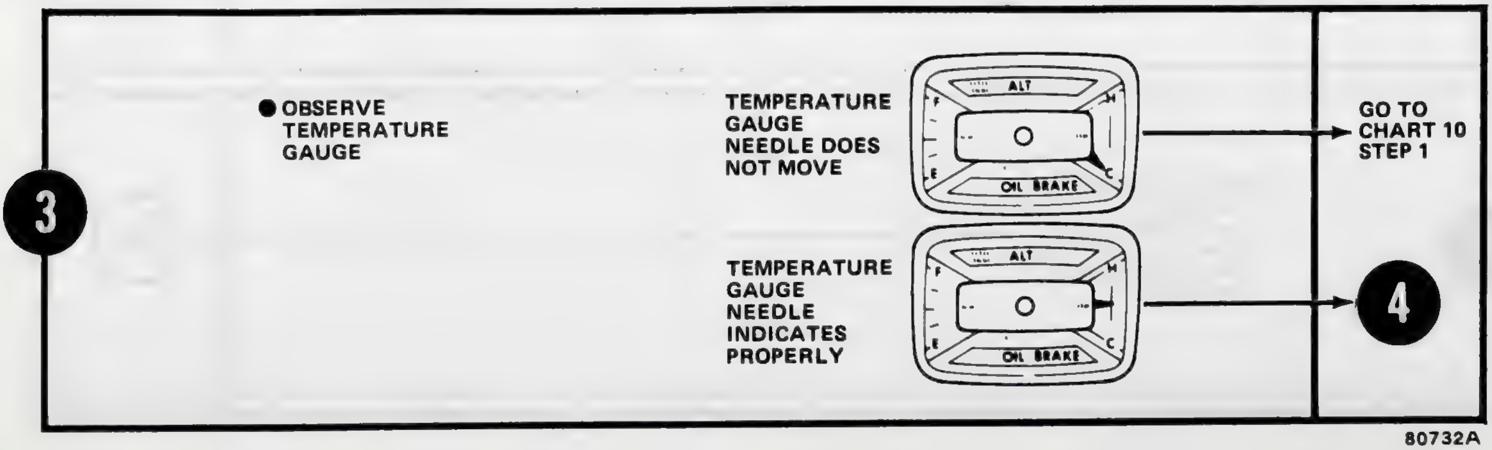
CVR TYPE

Chart 7

STEP **SEQUENCE** **RESULT**







80732A

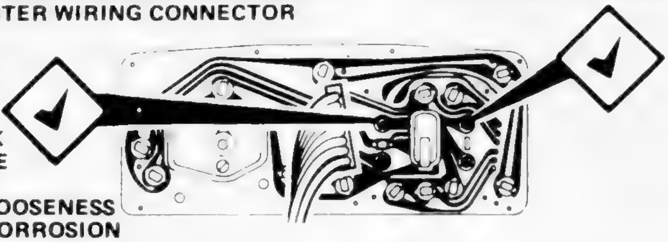
Chart 7

STEP | **SEQUENCE** | **RESULT**

4

- REMOVE CLUSTER
- DO NOT DISCONNECT INSTRUMENT CLUSTER WIRING CONNECTOR

CHECK FOR PRESENCE OF VOLTAGE AT GAUGE INPUT

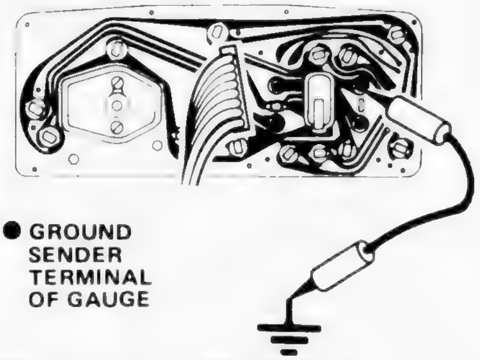


- CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION

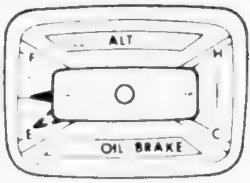
NOT OK — VOLTAGE NOT PRESENT → REPLACE CIRCUIT BOARD → STOP

OK — VOLTAGE PRESENT → 5

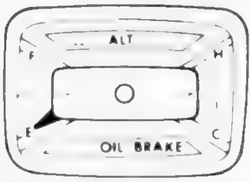
5



- GROUND SENDER TERMINAL OF GAUGE

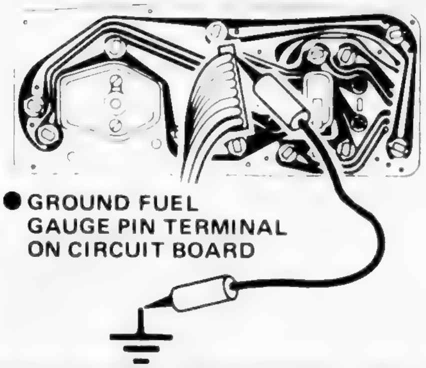


NEEDLE MOVES → 6

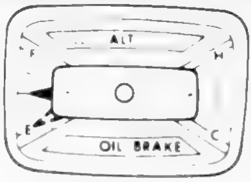


NEEDLE DOES NOT MOVE → REPLACE GAUGE → STOP

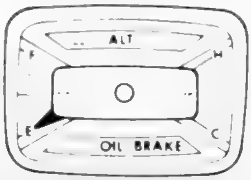
6



- GROUND FUEL GAUGE PIN TERMINAL ON CIRCUIT BOARD



NEEDLE MOVES → REPAIR OPEN CIRCUIT IN SENDER WIRE → STOP

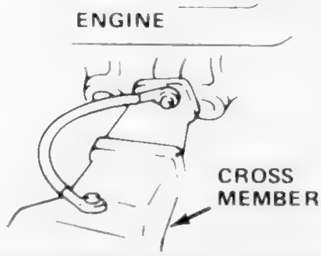


NEEDLE DOES NOT MOVE → REPLACE CIRCUIT BOARD → STOP

7

✓ CHECK BODY-TO-ENGINE GROUND STRAP

- BROKEN
- MISSING
- CORRODED
- SCREWS LOOSE, MISSING

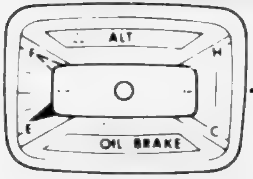


GROUND NOT OK → 8

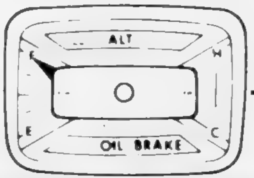
GROUND OK → 9

8

REPAIR GROUND



NEEDLE DROPS FROM MAXIMUM → STOP



NEEDLE REMAINS AT MAXIMUM → 9

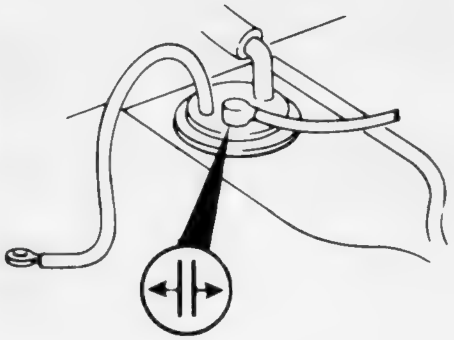
80732B

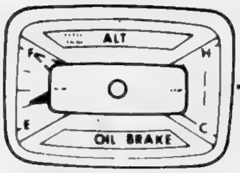
Chart 7

STEP **SEQUENCE** **RESULT**

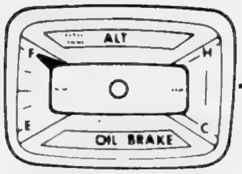
9

DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT



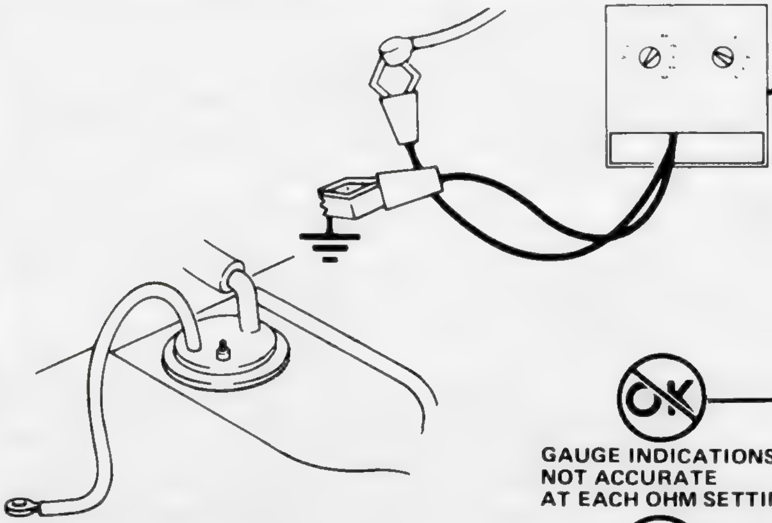


NEEDLE DROPS FROM MAXIMUM → **10**



NEEDLE REMAINS AT MAXIMUM → **14**

10



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.

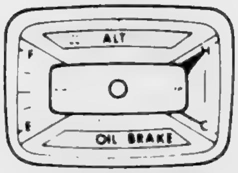
~~OK~~ GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → **11**

OK GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → **12**

11

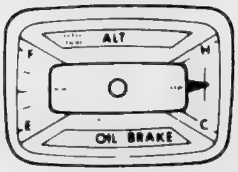
- OBSERVE TEMPERATURE GAUGE

TEMPERATURE GAUGE NEEDLE IS AT MAXIMUM



REPAIR CLUSTER GROUND OR REPLACE CVR → **STOP**

TEMPERATURE GAUGE NEEDLE INDICATES NORMALLY



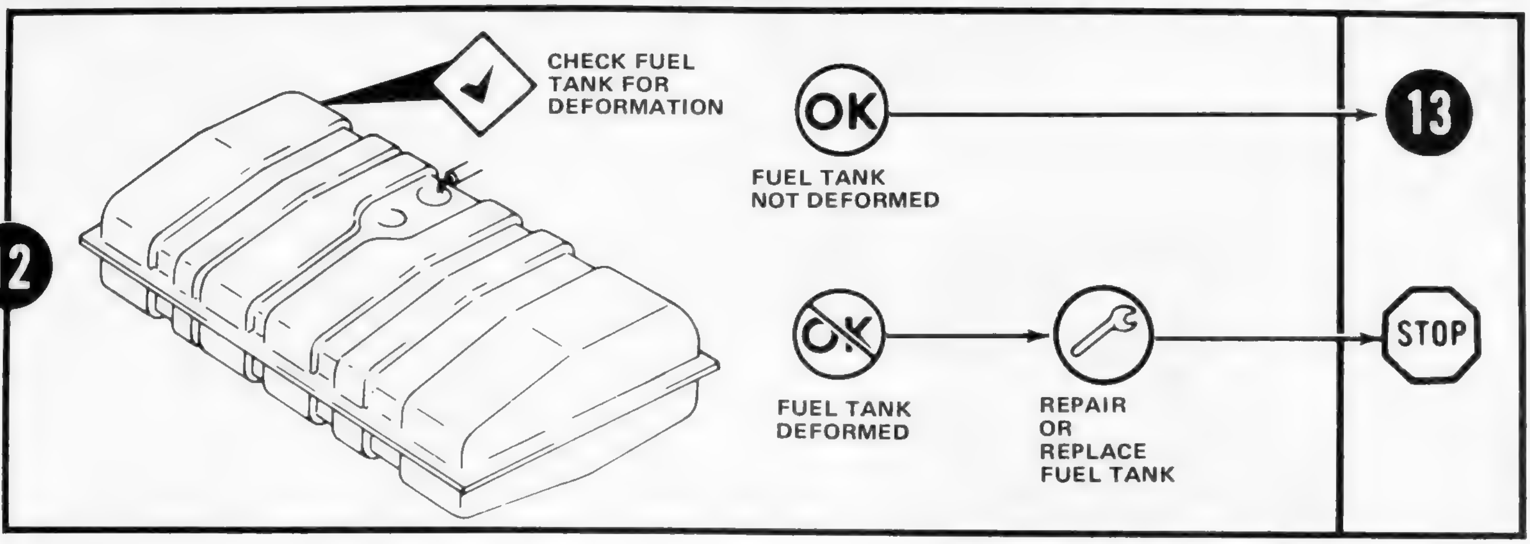
REPLACE FUEL GAUGE → **STOP**

80732C

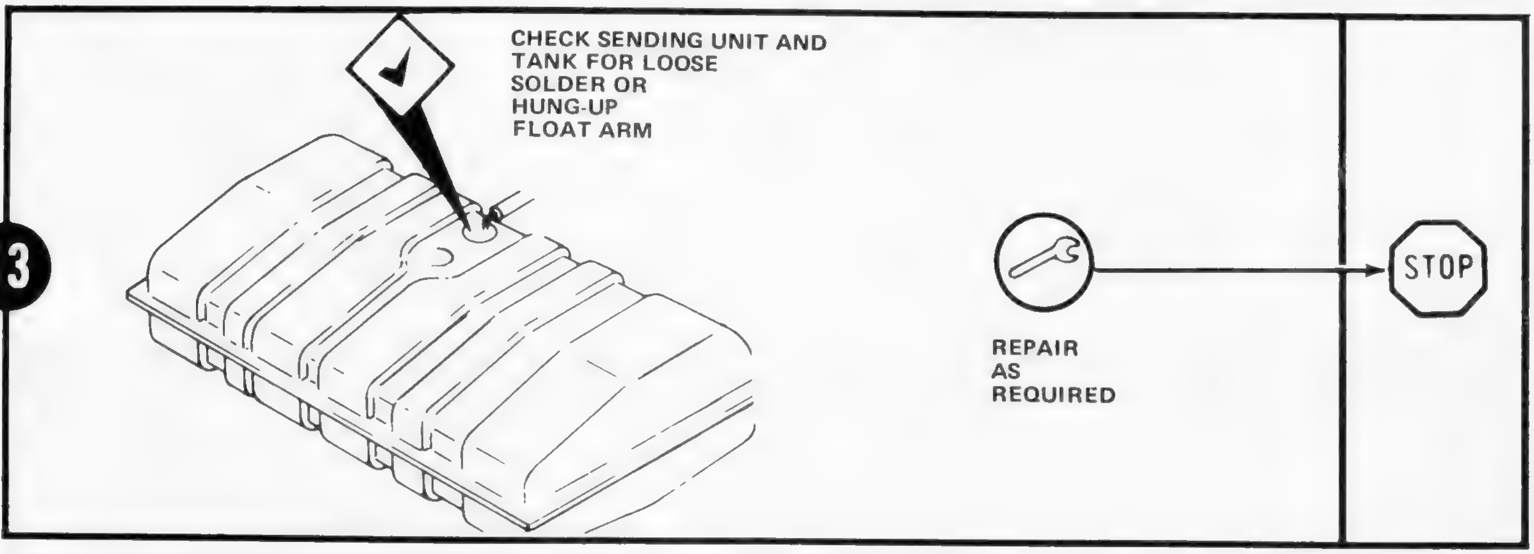
Chart 7

STEP **SEQUENCE** **RESULT**

12



13



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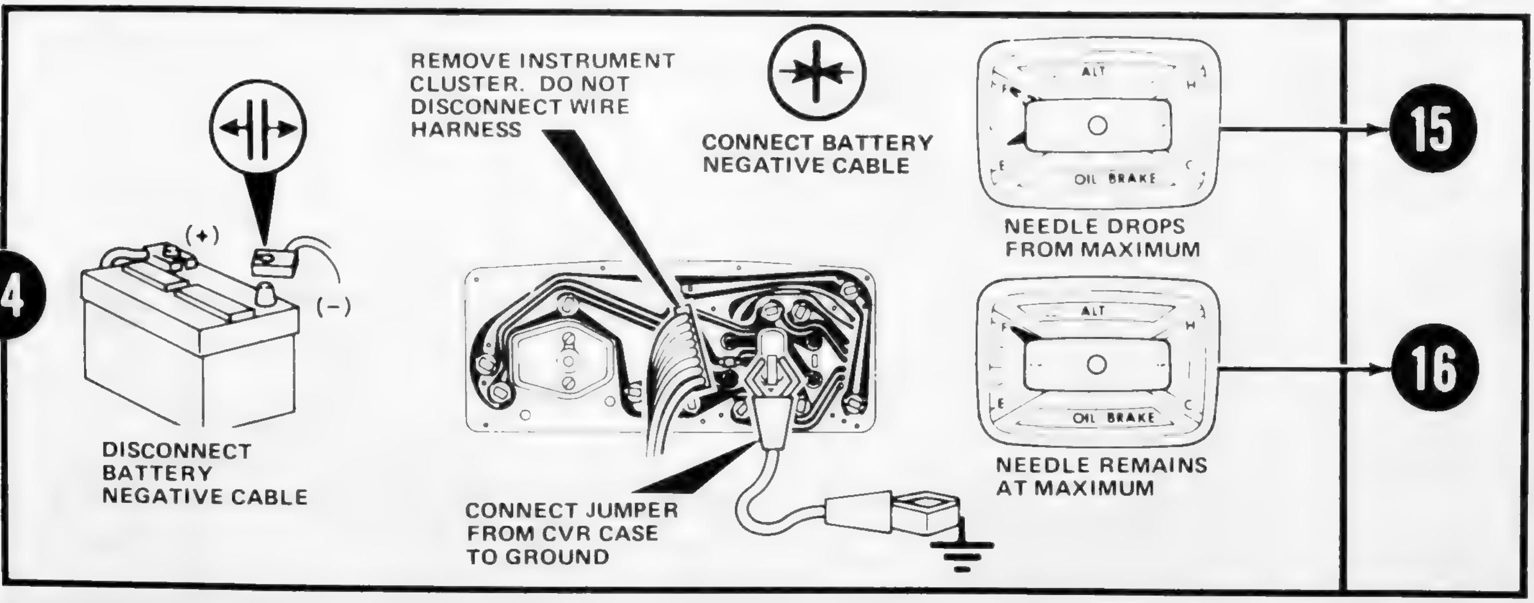


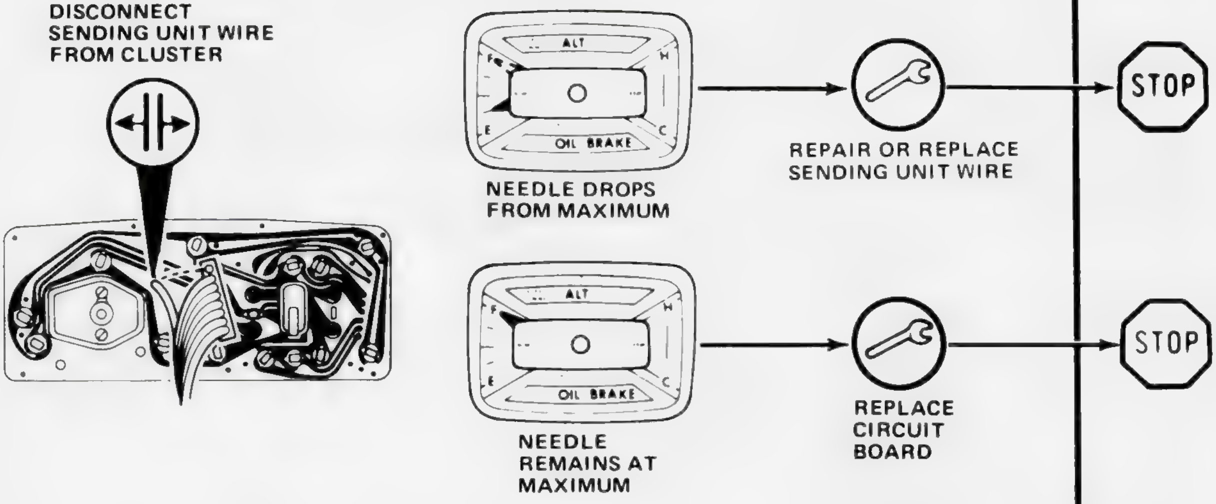
15

80732D

Chart 7

STEP **SEQUENCE** **RESULT**

16



DISCONNECT SENDING UNIT WIRE FROM CLUSTER

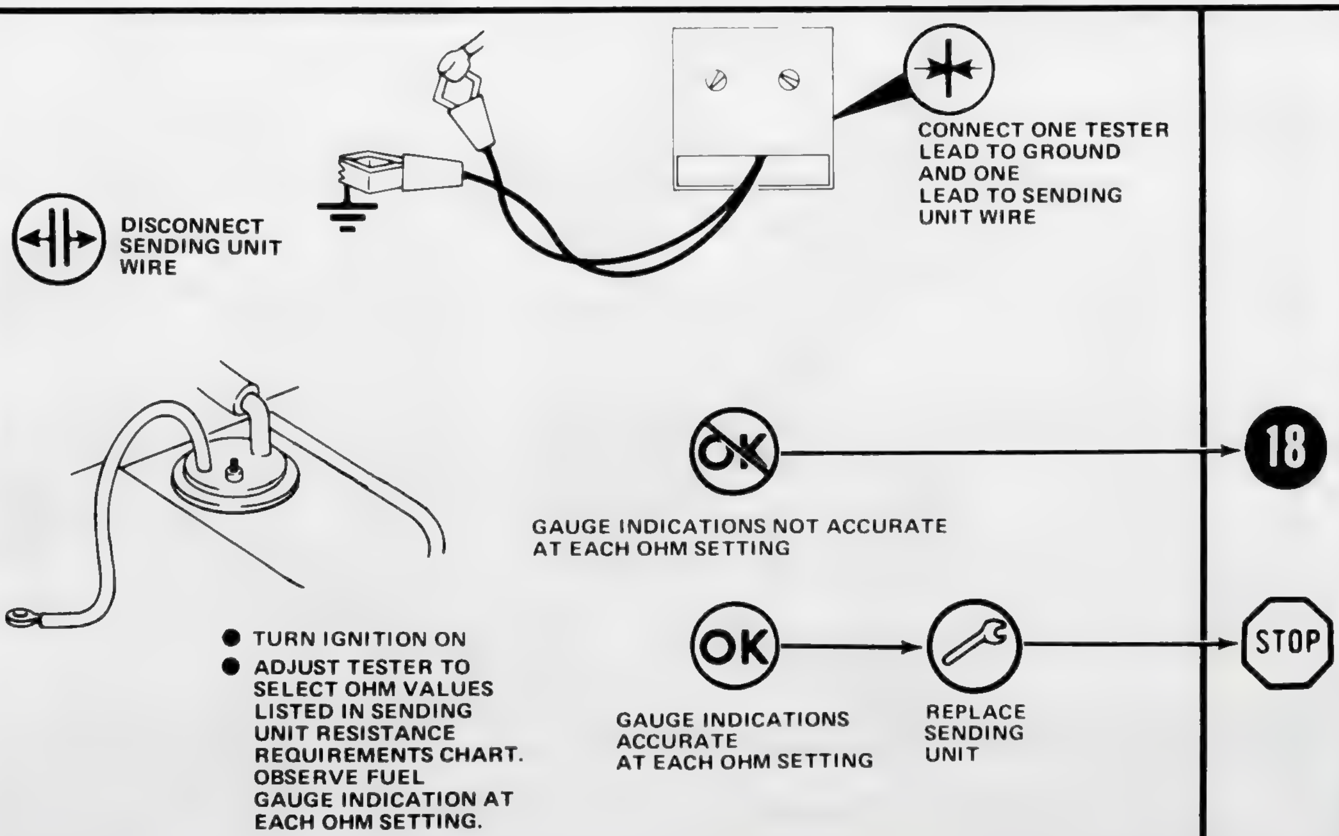
NEEDLE DROPS FROM MAXIMUM

REPAIR OR REPLACE SENDING UNIT WIRE

NEEDLE REMAINS AT MAXIMUM

REPLACE CIRCUIT BOARD

17



DISCONNECT SENDING UNIT WIRE

CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

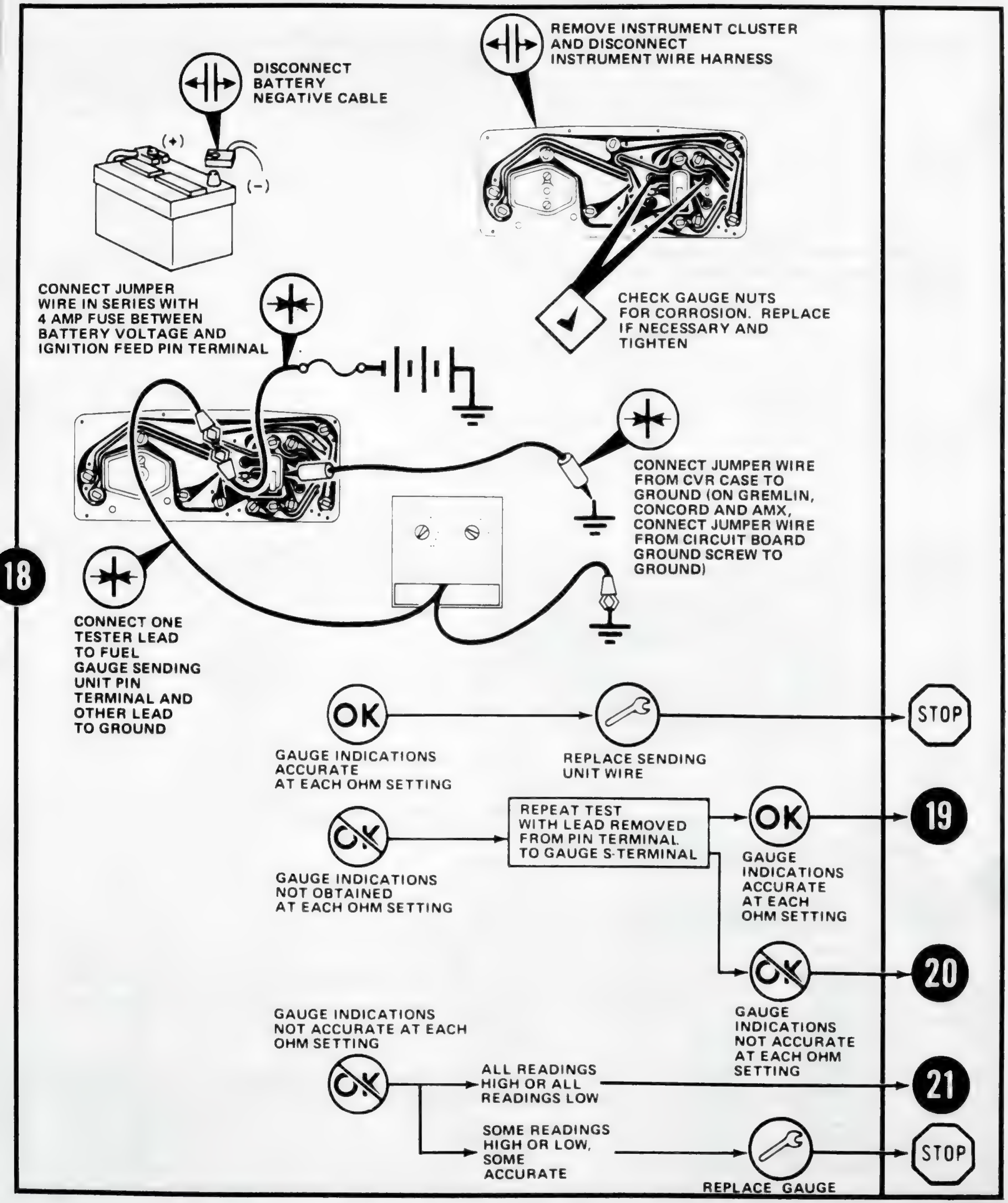
GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

REPLACE SENDING UNIT

80732E

Chart 7

STEP **SEQUENCE** **RESULT**



18

DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRE HARNESS

CHECK GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES WITH 4 AMP FUSE BETWEEN BATTERY VOLTAGE AND IGNITION FEED PIN TERMINAL

CONNECT JUMPER WIRE FROM CVR CASE TO GROUND (ON GREMLIN, CONCORD AND AMX, CONNECT JUMPER WIRE FROM CIRCUIT BOARD GROUND SCREW TO GROUND)

CONNECT ONE TESTER LEAD TO FUEL GAUGE SENDING UNIT PIN TERMINAL AND OTHER LEAD TO GROUND

OK — GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT WIRE → STOP

NOT OK — GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING → REPEAT TEST WITH LEAD REMOVED FROM PIN TERMINAL TO GAUGE S-TERMINAL

- OK — GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → 19
- NOT OK — GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 20

NOT OK — GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

- ALL READINGS HIGH OR ALL READINGS LOW → 21
- SOME READINGS HIGH OR LOW, SOME ACCURATE → REPLACE GAUGE → STOP

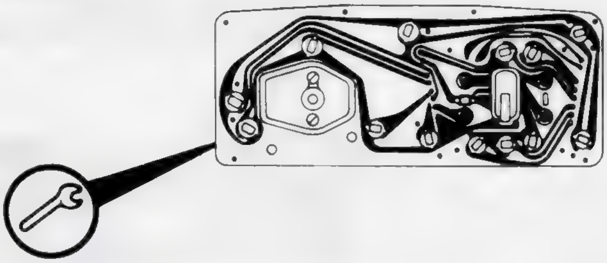
80732F

Chart 7

STEP **SEQUENCE** **RESULT**

19

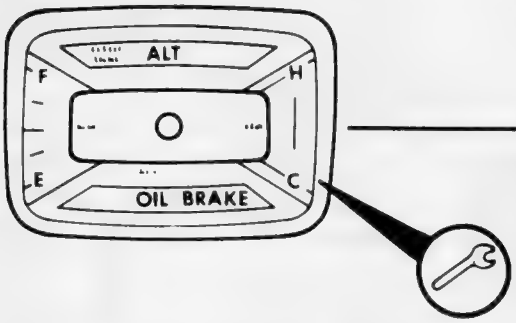
REPLACE
CIRCUIT
BOARD



STOP

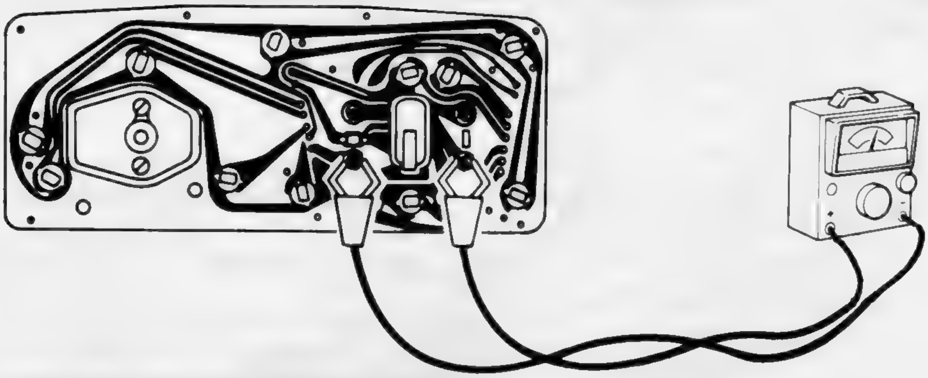
20

REPLACE
GAUGE



STOP

21



CONNECT OHMMETER LEADS TO GAUGE
INPUT TERMINAL AND GAUGE SENDER TERMINAL

- COMPARE OHMMETER READING WITH VALUES LISTED IN GAUGE RESISTANCE VALUES CHART

OK → GAUGE RESISTANCE CORRECT → REPLACE CVR → STOP

~~OK~~ → GAUGE RESISTANCE INCORRECT → REPLACE GAUGE → STOP

80732G

FUEL GAUGE—MAGNETIC DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Informaton for details on how to use this DARS chart.

PROBLEM: FUEL GAUGE NOT FUNCTIONING PROPERLY

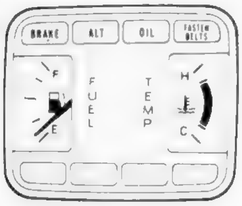
MAGNETIC TYPE

Chart 8

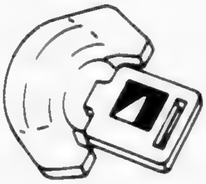
STEP **SEQUENCE** **RESULT**

1

- NOTE POSITION OF FUEL GAUGE NEEDLE

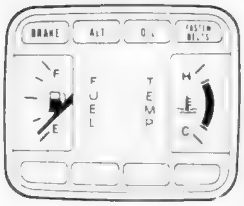


- TURN IGNITION ON



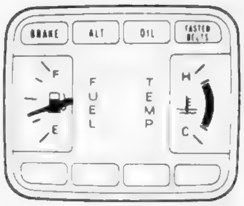
- OBSERVE NEEDLE

NEEDLE DOES NOT MOVE



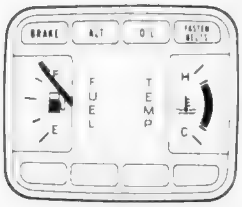
→ 2

NEEDLE MOVES



→ 14

NEEDLE MOVES TO MAXIMUM AND STAYS



→ 7

BEFORE STARTING TEST:

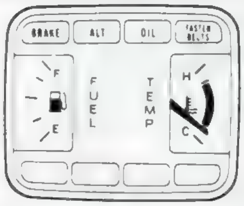
✓ ENGINE MUST BE WARM

✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY

2

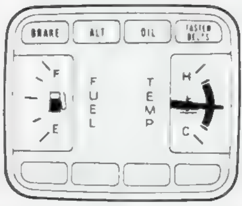
- OBSERVE TEMPERATURE GAUGE

TEMPERATURE GAUGE NEEDLE DOES NOT MOVE



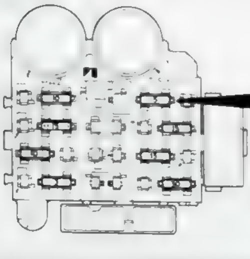
→ 3

TEMPERATURE GAUGE NEEDLE INDICATES PROPERLY



→ 4

3



✓ CHECK 5-AMP FUSE AT FUSE PANEL

FUSE BLOWN → GO TO CHART 9 STEP 1

FUSE NOT BLOWN → GO TO CHART 10 STEP 1

80733A

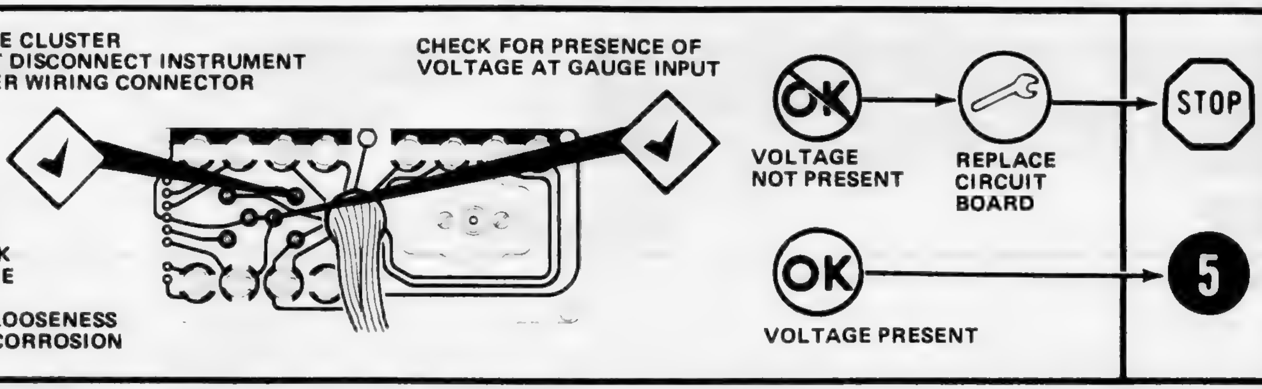
Chart 8

STEP **SEQUENCE** **RESULT**

4

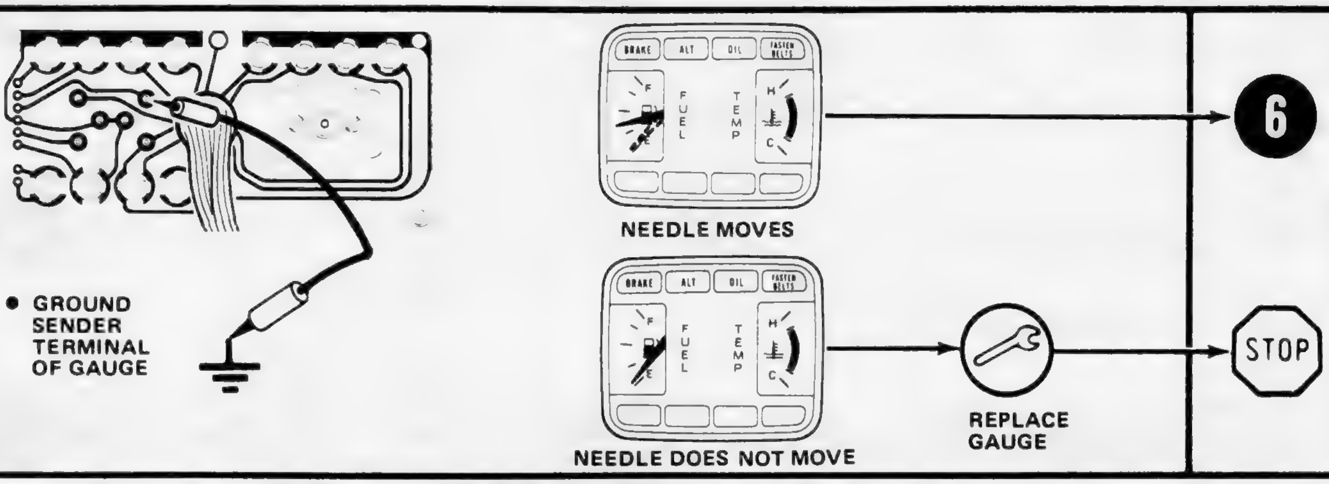
- REMOVE CLUSTER
- DO NOT DISCONNECT INSTRUMENT CLUSTER WIRING CONNECTOR
- CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION

CHECK FOR PRESENCE OF VOLTAGE AT GAUGE INPUT



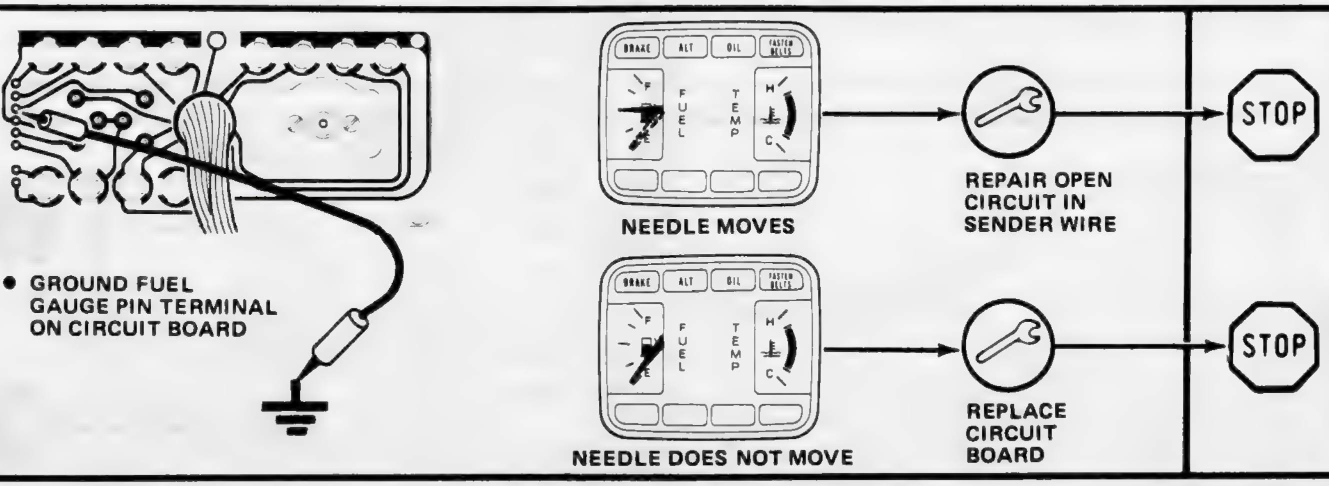
5

- GROUND SENDER TERMINAL OF GAUGE



6

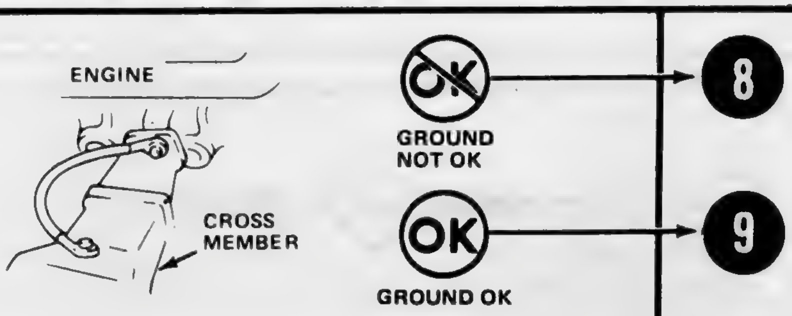
- GROUND FUEL GAUGE PIN TERMINAL ON CIRCUIT BOARD



7

CHECK BODY-TO-ENGINE GROUND STRAP

- BROKEN
- MISSING
- CORRODED
- SCREWS LOOSE, MISSING



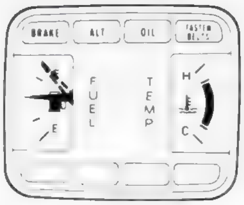
80733B

Chart 8

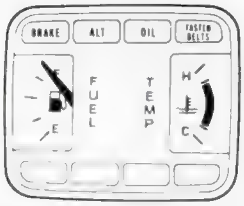
STEP **SEQUENCE** **RESULT**

8

REPAIR GROUND



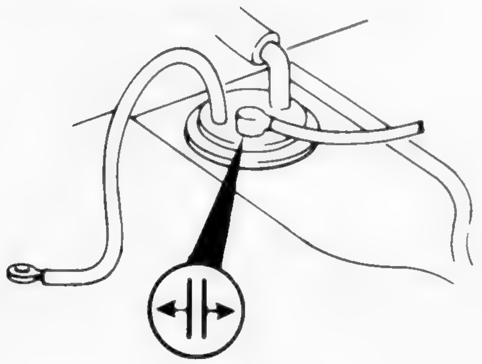
NEEDLE DROPS FROM MAXIMUM → STOP

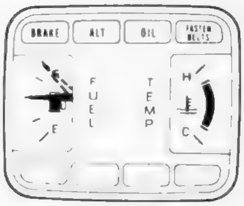


NEEDLE REMAINS AT MAXIMUM → 9

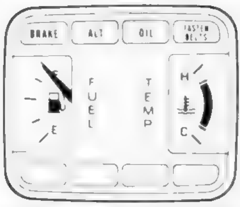
9

DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT



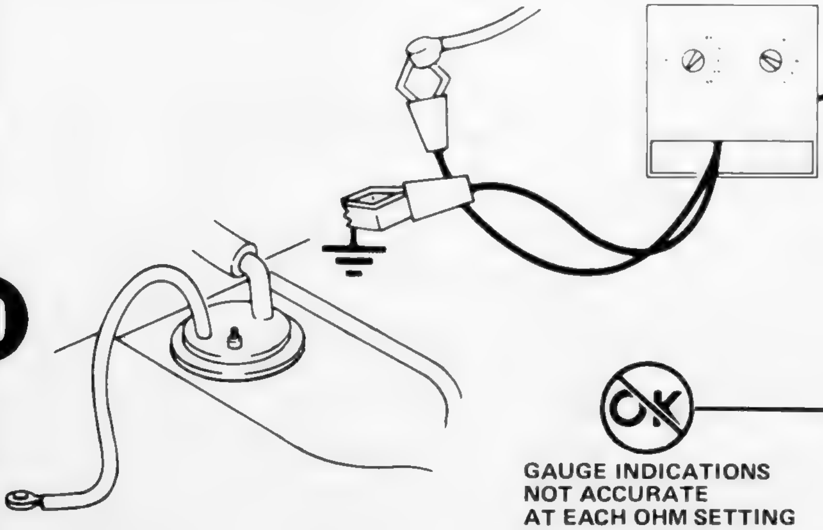


NEEDLE DROPS FROM MAXIMUM → 10



NEEDLE REMAINS AT MAXIMUM → 13

10



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.

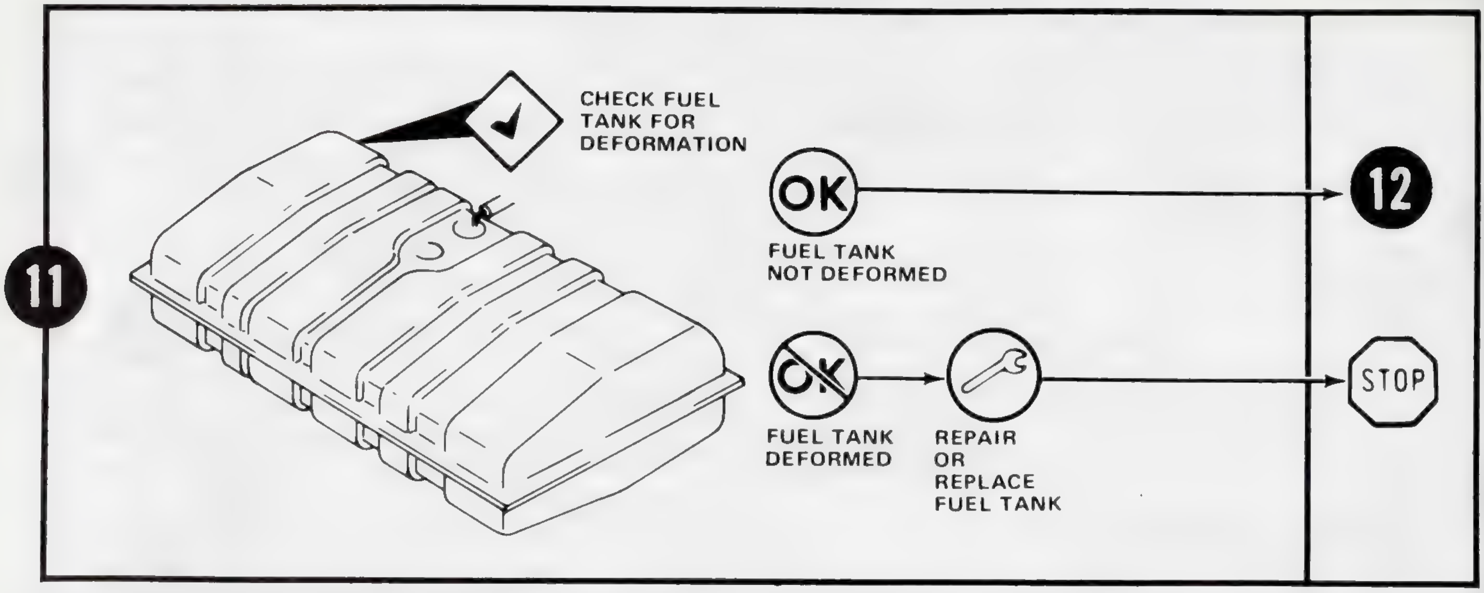
GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → REPLACE FUEL GAUGE → STOP

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → 11

80733C

Chart 8

STEP **SEQUENCE** **RESULT**

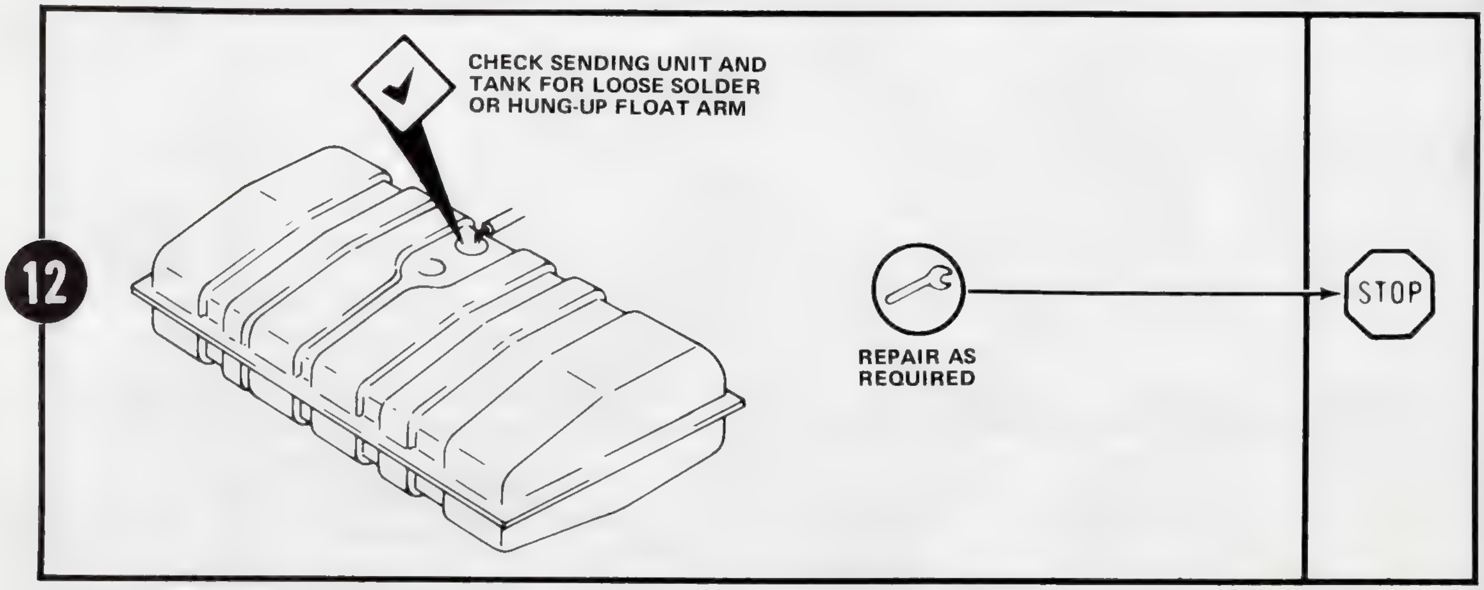


CHECK FUEL TANK FOR DEFORMATION

FUEL TANK NOT DEFORMED

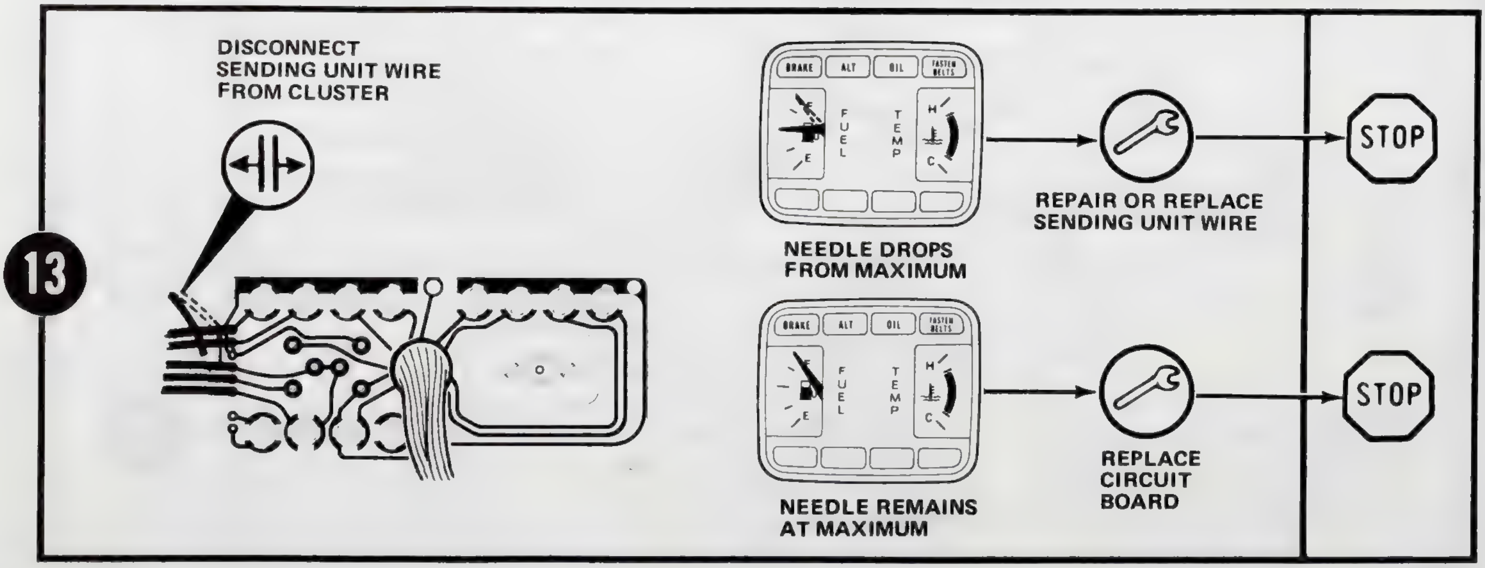
FUEL TANK DEFORMED

REPAIR OR REPLACE FUEL TANK



CHECK SENDING UNIT AND TANK FOR LOOSE SOLDER OR HUNG-UP FLOAT ARM

REPAIR AS REQUIRED



DISCONNECT SENDING UNIT WIRE FROM CLUSTER

NEEDLE DROPS FROM MAXIMUM

REPAIR OR REPLACE SENDING UNIT WIRE

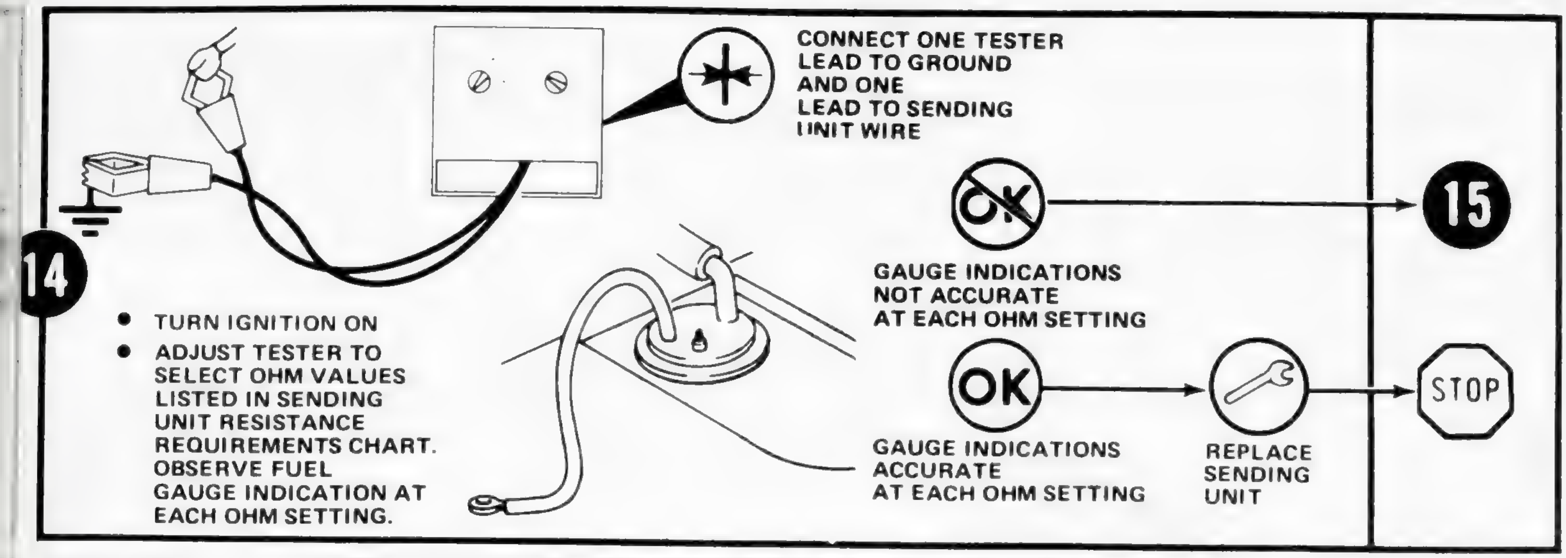
NEEDLE REMAINS AT MAXIMUM

REPLACE CIRCUIT BOARD

80733D

Chart 8

STEP **SEQUENCE** **RESULT**



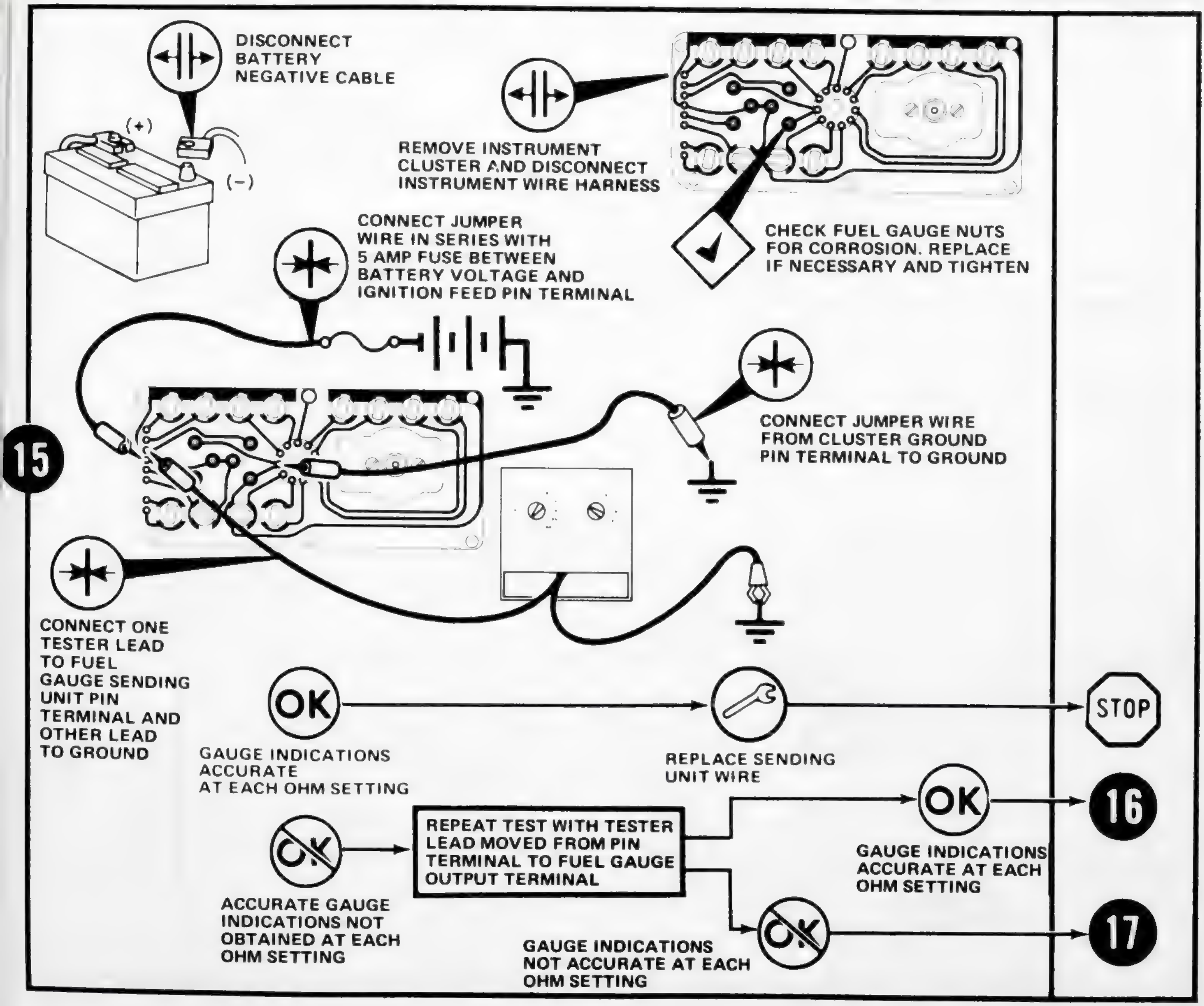
CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- TURN IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE FUEL GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

REPLACE SENDING UNIT



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRE HARNESS

CHECK FUEL GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES WITH 5 AMP FUSE BETWEEN BATTERY VOLTAGE AND IGNITION FEED PIN TERMINAL

CONNECT JUMPER WIRE FROM CLUSTER GROUND PIN TERMINAL TO GROUND

CONNECT ONE TESTER LEAD TO FUEL GAUGE SENDING UNIT PIN TERMINAL AND OTHER LEAD TO GROUND

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

REPLACE SENDING UNIT WIRE

ACCURATE GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING

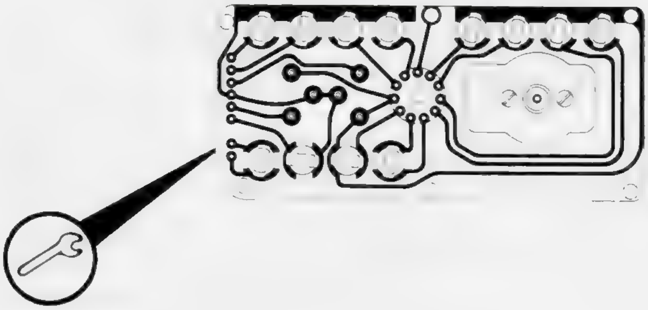
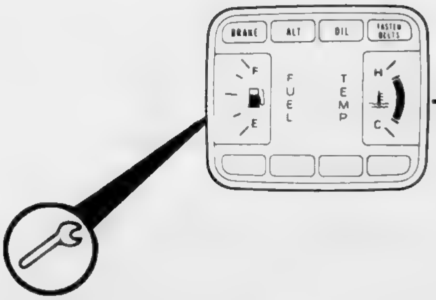
REPEAT TEST WITH TESTER LEAD MOVED FROM PIN TERMINAL TO FUEL GAUGE OUTPUT TERMINAL

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

80733E

Chart 8

STEP	SEQUENCE	RESULT
16	REPLACE CIRCUIT BOARD 	STOP
17	REPLACE GAUGE 	STOP

80733F

FUSE BLOWN—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

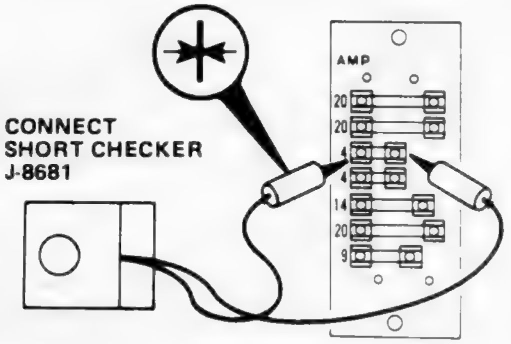
PROBLEM: GAUGE FUSE BLOWN

Chart 9

STEP **SEQUENCE** **RESULT**

1

CONNECT SHORT CHECKER J-8681

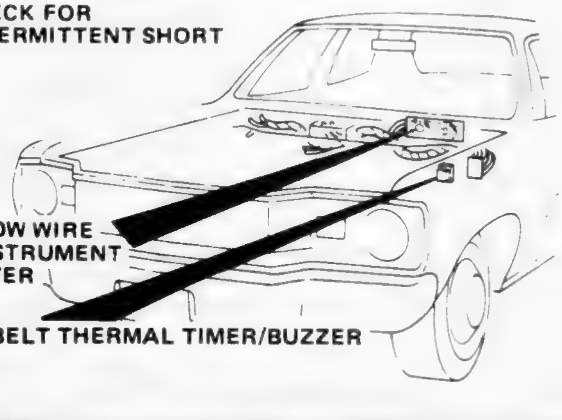


OK — SHORT NOT INDICATED → **2**

SHORT INDICATED → **3**

2

CHECK FOR INTERMITTENT SHORT



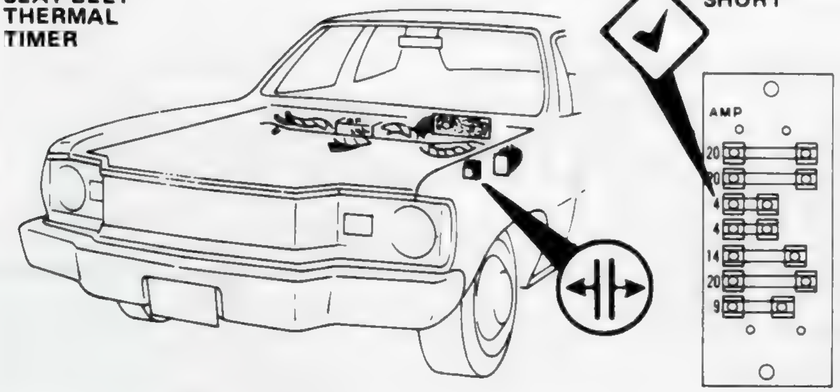
- YELLOW WIRE TO INSTRUMENT CLUSTER
- SEATBELT THERMAL TIMER/BUZZER

REPAIR AS NECESSARY → STOP

3

DISCONNECT SEAT BELT THERMAL TIMER

CHECK FOR SHORT



SHORT INDICATED → **4**

OK — SHORT NOT INDICATED → REPLACE THERMAL TIMER → STOP

80734A

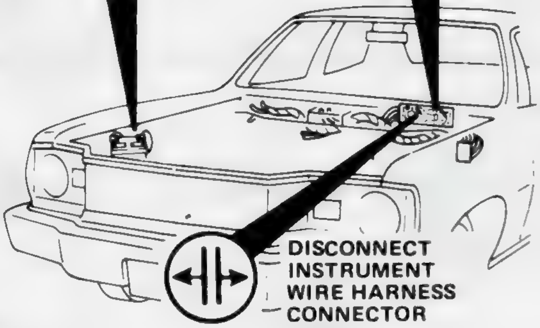
Chart 9

STEP **SEQUENCE** **RESULT**

4

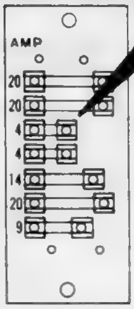
DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER



DISCONNECT INSTRUMENT WIRE HARNESS CONNECTOR FROM PRINTED CIRCUIT

CHECK FOR SHORT



CONNECT BATTERY NEGATIVE CABLE

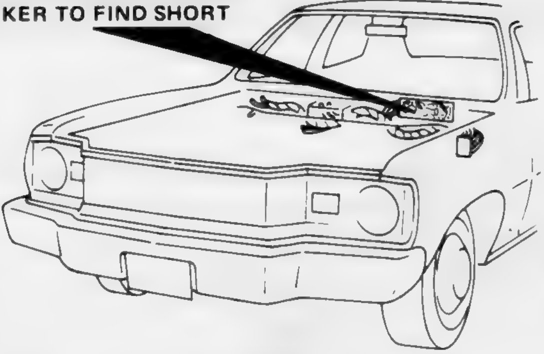
SHORT INDICATED → 5

OK

SHORT NOT INDICATED → 6

5

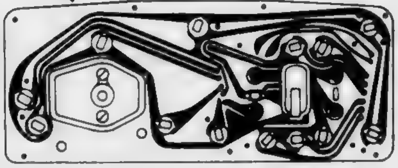
CHECK WIRING WITH SHORT CHECKER TO FIND SHORT



REPLACE SHORTED WIRE HARNESS → STOP

6

CHECK CIRCUIT BOARD AND GAUGES



REPAIR AS REQUIRED → STOP

- SHORTED BULBS (OIL, BRAKE, TEMPERATURE)
- CIRCUIT BOARD
- BURNED OR DEFECTIVE GAUGE CAUSED BY CIRCUIT BOARD LOSING GROUND
- CVR SHORTED TO GROUND

80734B

FUEL GAUGE AND TEMPERATURE GAUGE BOTH MALFUNCTION—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

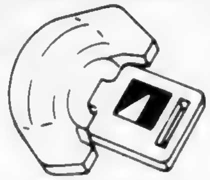
Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: NEITHER TEMPERATURE GAUGE NOR FUEL GAUGE OPERATES

Chart 10

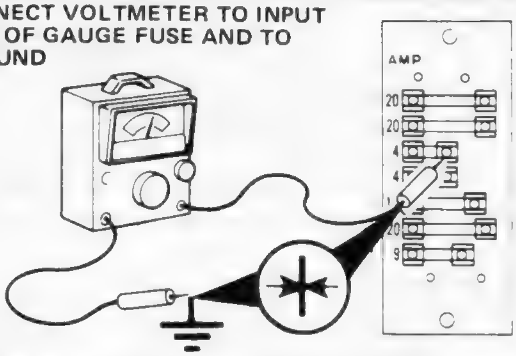
STEP **SEQUENCE** **RESULT**

1



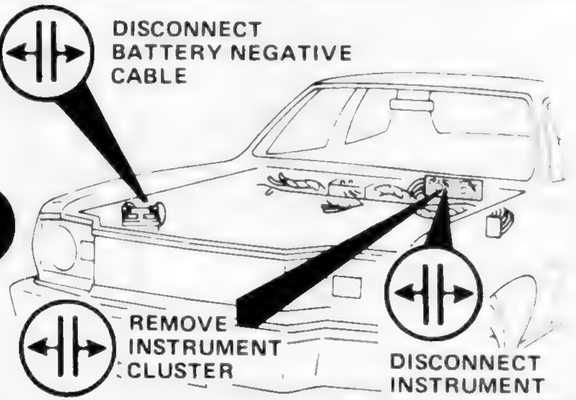
TURN IGNITION ON

CONNECT VOLTMETER TO INPUT SIDE OF GAUGE FUSE AND TO GROUND



- WRITE DOWN VOLTMETER INDICATION → **2**

2

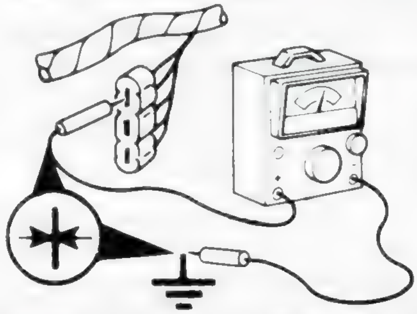


DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER

DISCONNECT INSTRUMENT WIRE HARNESS CONNECTOR

CONNECT VOLTMETER TO IGNITION FEED WIRE FEMALE CONNECTOR IN INSTRUMENT WIRE HARNESS CONNECTOR AND TO GOOD GROUND

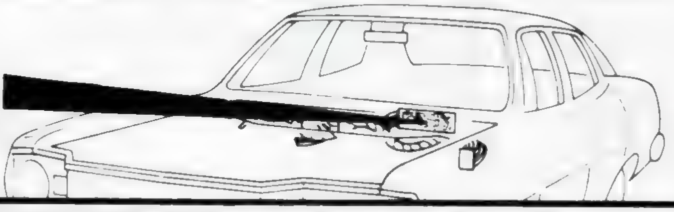


CONNECT BATTERY NEGATIVE CABLE

- VOLTMETER INDICATION DIFFERNT FROM STEP → **3**
- VOLTMETER INDICATION SAME AS STEP 1
  - PACER MATADOR → **4**
  - GREMLIN CONCORD AMX → **7**

3

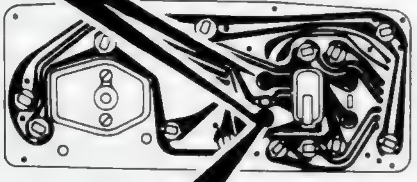
REPAIR OR REPLACE INSTRUMENT PANEL WIRE HARNESS



→ STOP

4

CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION



REPLACE, TIGHTEN OR CLEAN AS REQUIRED

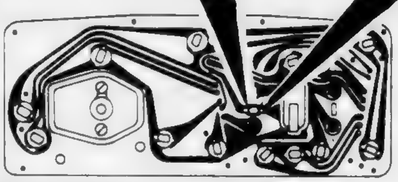
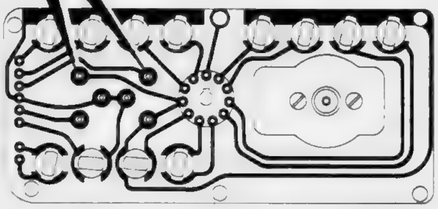
CONNECT JUMPER WIRES AND VOLTMETER

- JUMPER WIRE BETWEEN CVR CASE AND GROUND
- JUMPER WIRE IN SERIES WITH A 4-AMP FUSE BETWEEN BATTERY VOLTAGE SOURCE AND IGNITION FEED PIN TERMINAL ON CLUSTER
- VOLTMETER LEAD TO CVR INPUT TERMINAL
- VOLTMETER LEAD TO GROUND

- VOLTMETER INDICATION SAME AS STEP 1 → **5**
- VOLTMETER INDICATION DIFFERENT FROM STEP 1 → **6**

80735A

Chart 10

STEP	SEQUENCE	RESULT
5	● MOVE VOLTMETER PROBE TO GAUGE INPUT. NEEDLE SHOULD FLUCTUATE NO FLUCTUATION (STEADY VOLTAGE) → REPLACE CVR CVR FLUCTUATION → REPLACE GAUGES AND CHECK FOR PRINTED CIRCUIT GROUND	STOP STOP
6	CHECK RADIO NOISE SUPPRESSOR OR CONNECTOR STRIP FOR PROPER ATTACHMENT  USING SAME TEST SET-UP AS STEP 4, MOVE VOLTMETER PROBE FROM CVR TERMINAL TO RADIO NOISE SUPPRESSOR OR CONNECTOR STRIP OUTPUT TERMINAL VOLTMETER INDICATION SAME AS STEP 1 → VOLTMETER INDICATION DIFFERENT FROM STEP 1 →	8 9
7	CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION  CONNECT JUMPER WIRES AND VOLTMETER ● JUMPER WIRE BETWEEN GROUND PIN AND GROUND ● JUMPER WIRE IN SERIES WITH A 4-AMP FUSE BETWEEN BATTERY VOLTAGE SOURCE AND IGNITION FEED PIN TERMINAL ON CLUSTER ● VOLTMETER LEAD TO FUEL GAUGE INPUT TERMINAL ● VOLTMETER LEAD TO GROUND ● VOLTMETER INDICATION SAME AS STEP 1 → ● VOLTMETER INDICATION DIFFERENT FROM STEP 1 →	STOP 8
8	REPLACE CIRCUIT BOARD →	STOP
9	REPLACE RADIO NOISE SUPPRESSOR OR CONNECTOR STRIP →	STOP

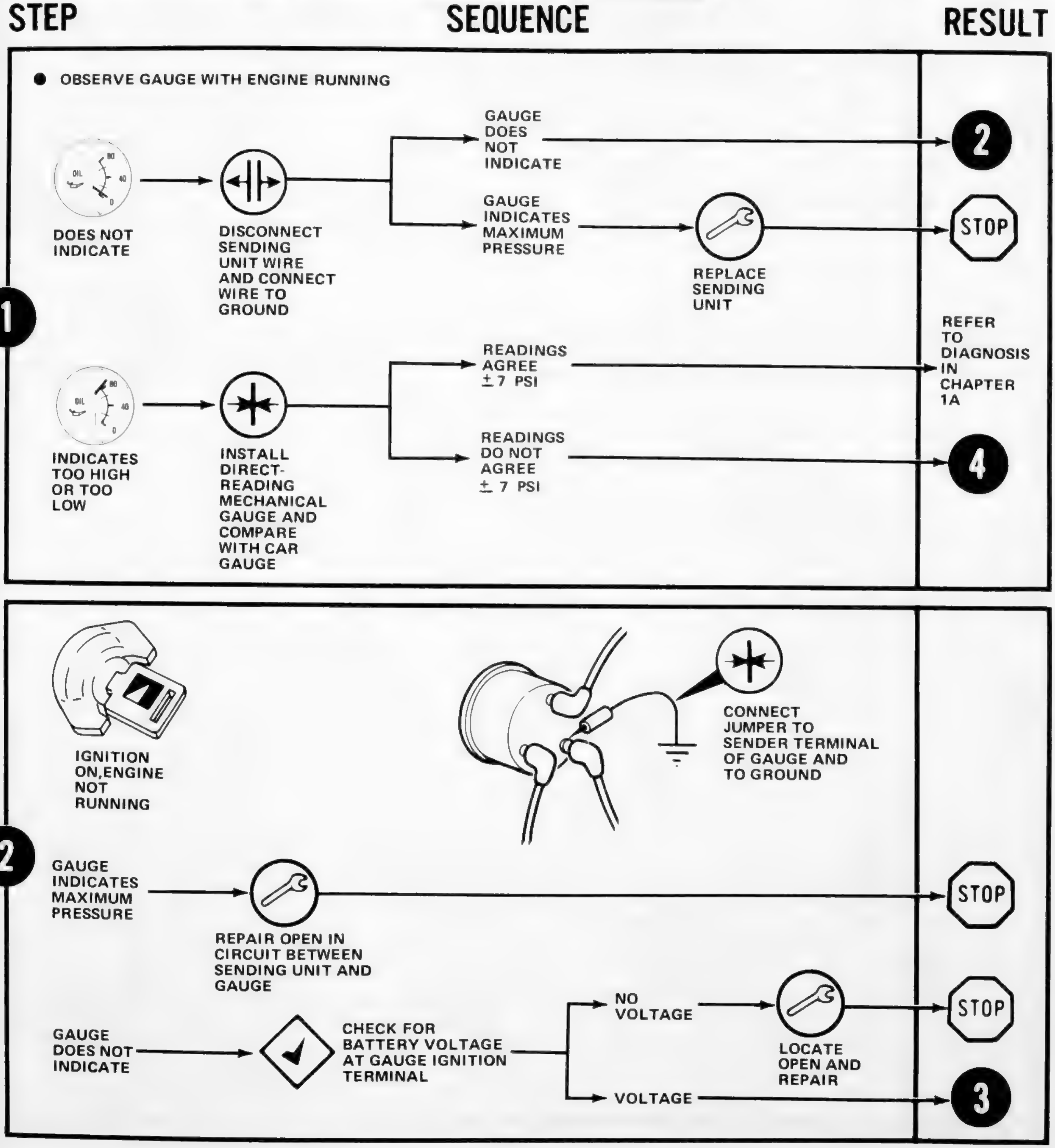
80735B

OIL PRESSURE GAUGE—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: OIL PRESSURE GAUGE DOES NOT INDICATE CORRECTLY

Chart 11

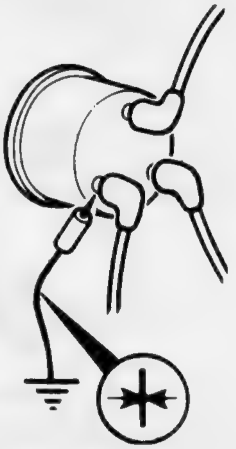


80736A

Chart 11

STEP **SEQUENCE** **RESULT**

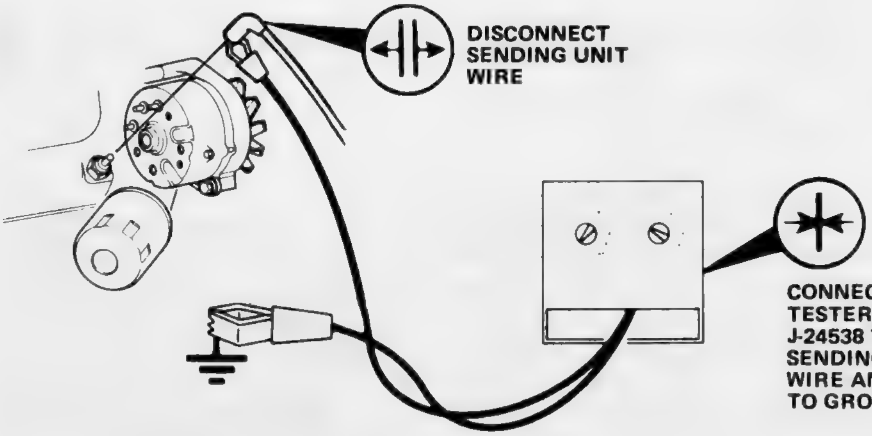
3



CONNECT JUMPER WIRE BETWEEN GAUGE GROUND TERMINAL AND KNOWN GOOD GROUND

- GAUGE NOW INDICATES → REPAIR GROUND WIRE → STOP
- GAUGE DOES NOT INDICATE → REPLACE GAUGE → STOP

4



DISCONNECT SENDING UNIT WIRE

CONNECT TESTER J-24538 TO SENDING UNIT WIRE AND TO GROUND

TURN IGNITION ON

- SELECT RESISTANCE VALUES LISTED IN SENDING UNIT RESISTANCE CHART

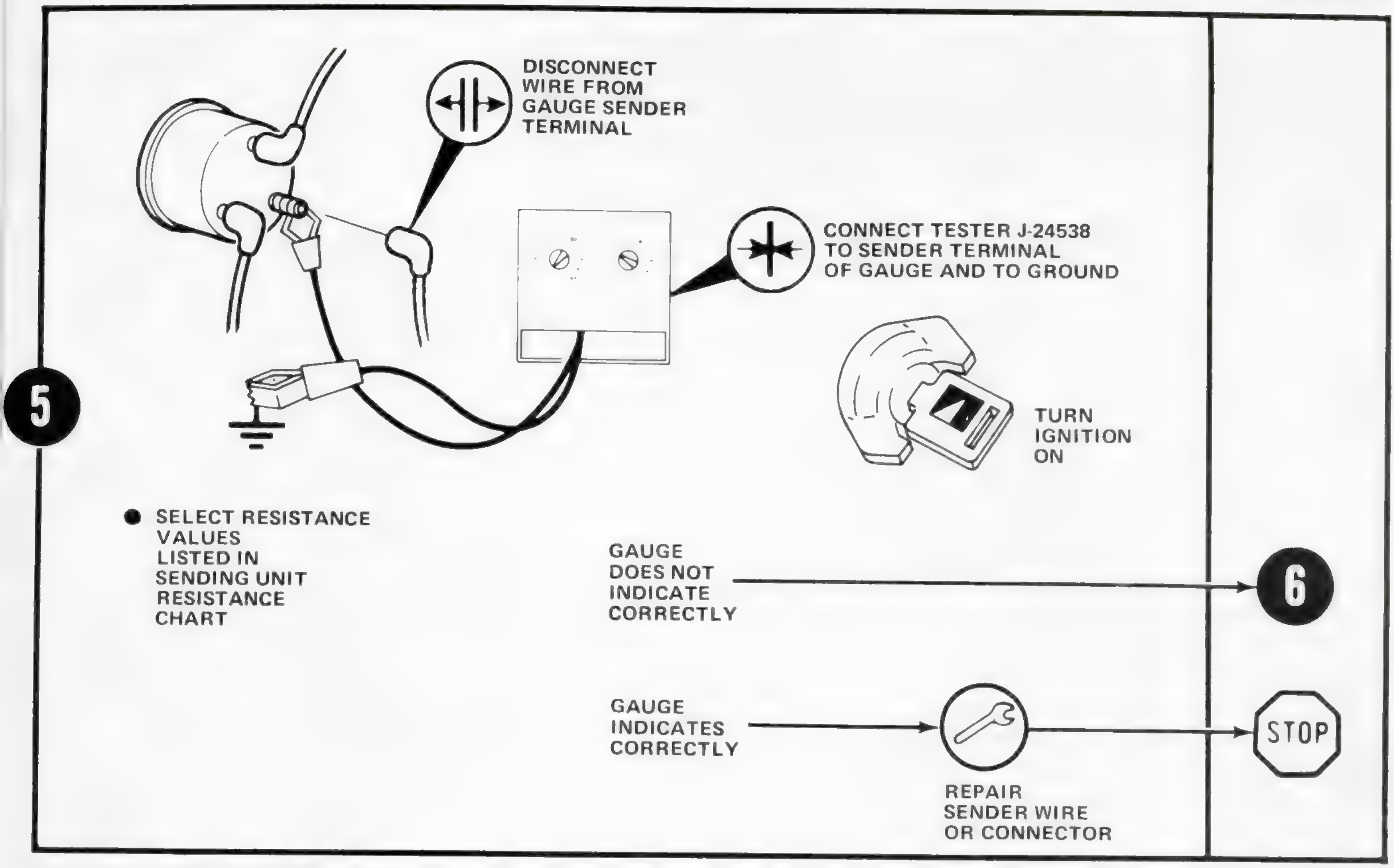
GAUGE DOES NOT INDICATE CORRECTLY → 5

GAUGE INDICATES CORRECTLY → REPLACE SENDING UNIT → STOP

80736B

Chart 11

STEP **SEQUENCE** **RESULT**



5

DISCONNECT WIRE FROM GAUGE SENDER TERMINAL

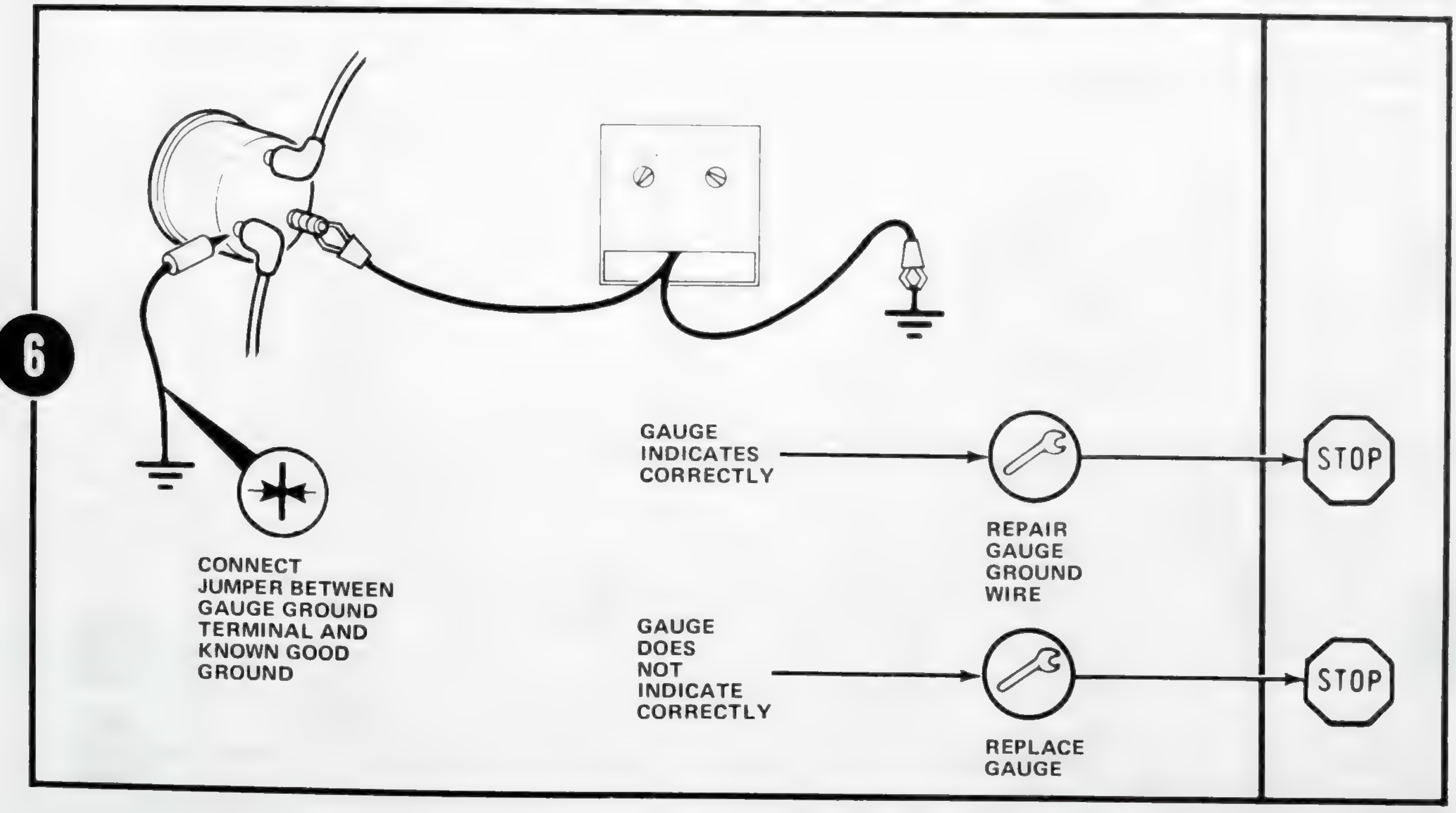
CONNECT TESTER J-24538 TO SENDER TERMINAL OF GAUGE AND TO GROUND

TURN IGNITION ON

- SELECT RESISTANCE VALUES LISTED IN SENDING UNIT RESISTANCE CHART

GAUGE DOES NOT INDICATE CORRECTLY → 6

GAUGE INDICATES CORRECTLY → REPAIR SENDER WIRE OR CONNECTOR → STOP



6

CONNECT JUMPER BETWEEN GAUGE GROUND TERMINAL AND KNOWN GOOD GROUND

GAUGE INDICATES CORRECTLY → REPAIR GAUGE GROUND WIRE → STOP

GAUGE DOES NOT INDICATE CORRECTLY → REPLACE GAUGE → STOP

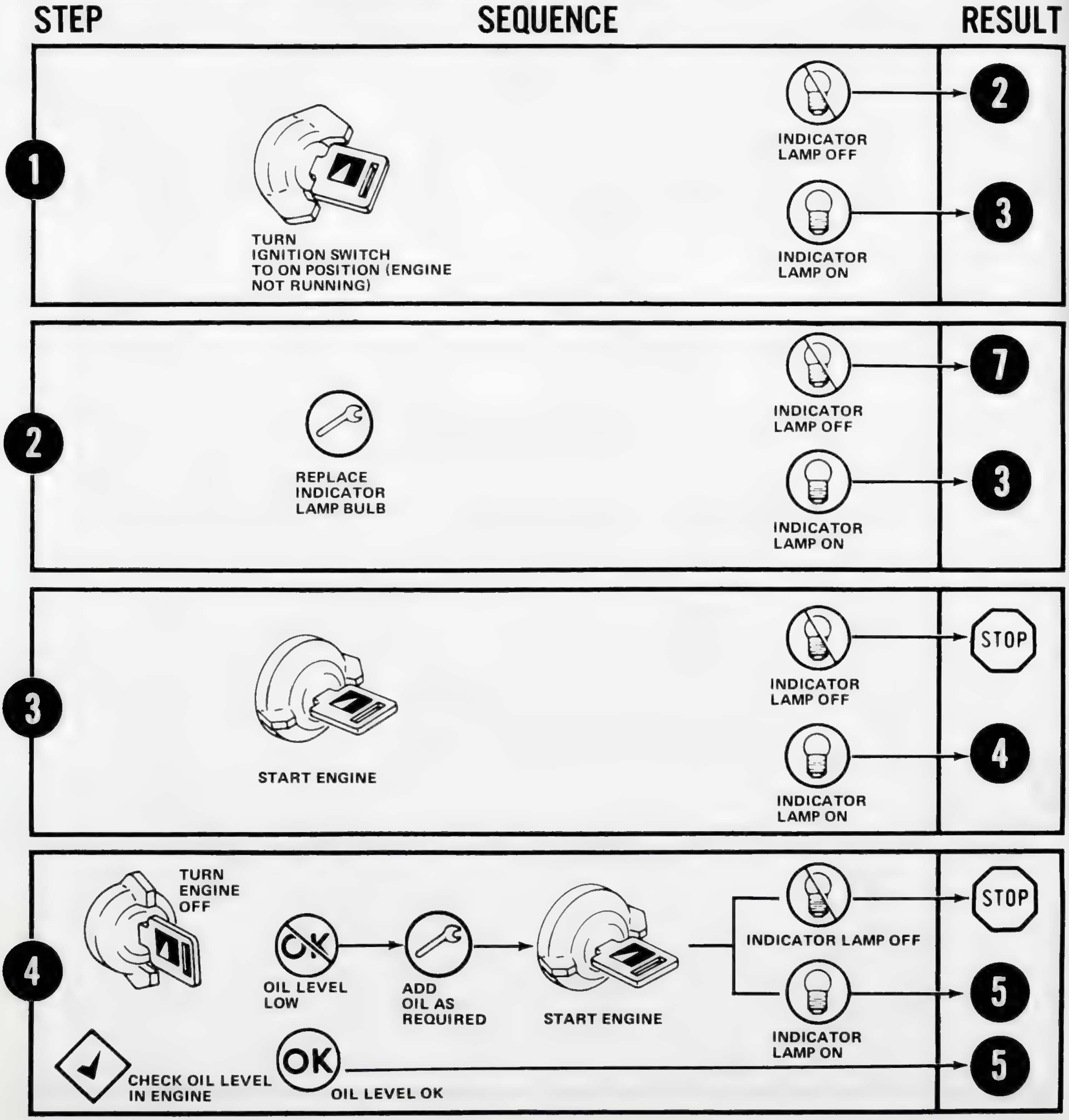
80736C

OIL PRESSURE LAMP—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: OIL PRESSURE INDICATOR LAMP NOT FUNCTIONING PROPERLY

Chart 12

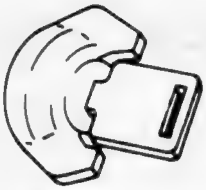


80737A

Chart 12

STEP **SEQUENCE** **RESULT**

5

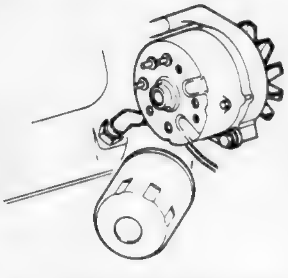


WITH ENGINE RUNNING, DISCONNECT SENDING UNIT WIRE AT SENDING UNIT

INDICATOR LAMP ON → REPAIR SHORT TO GROUND IN CIRCUIT BETWEEN BULB AND SENDING UNIT → STOP

INDICATOR LAMP OFF (NORMAL) → 6

6

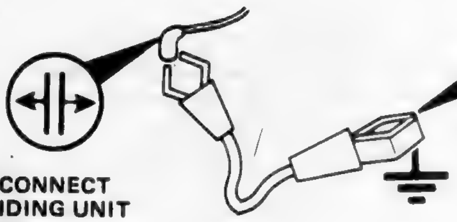


REMOVE SENDING UNIT. INSTALL DIRECT-READING GAUGE. VERIFY ACTUAL OIL PRESSURE AT ALL ENGINE SPEEDS.

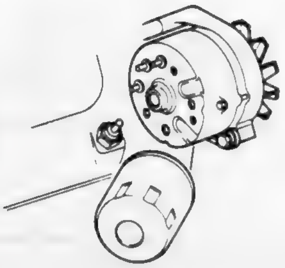
OIL PRESSURE OK → INSTALL REPLACEMENT SENDING UNIT → STOP

OIL PRESSURE LOW → LOCATE AND REPAIR CAUSE OF LOW OIL PRESSURE → STOP

7



DISCONNECT SENDING UNIT LEAD



CONNECT JUMPER BETWEEN SENDING UNIT WIRE AND GROUND

INDICATOR LAMP ON → REPLACE SENDING UNIT → STOP

INDICATOR LAMP OFF → LOCATE AND REPAIR OPEN IN CIRCUIT BETWEEN IGNITION SWITCH AND INDICATOR LAMP SENDING UNIT → STOP

80737B

TEMPERATURE GAUGE— CVR DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: TEMPERATURE GAUGE NOT FUNCTIONING PROPERLY

CVR TYPE **Chart 13**

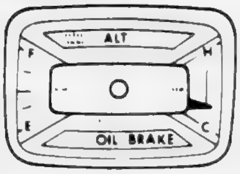
STEP **SEQUENCE** **RESULT**

1

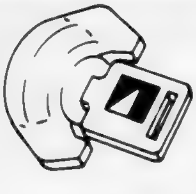
BEFORE STARTING TEST:

- ✓ ENGINE MUST BE WARM
- ✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY

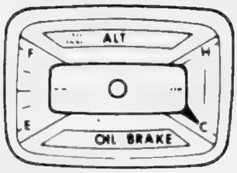
- NOTE POSITION OF TEMPERATURE GAUGE NEEDLE



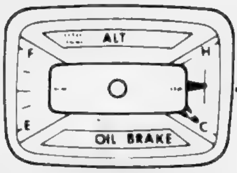
- TURN IGNITION ON AND WAIT 2 MINUTES FOR GAUGE TO WARM UP



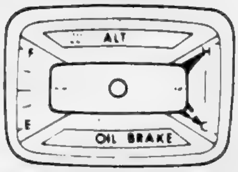
- OBSERVE NEEDLE



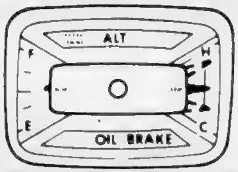
NEEDLE DOES NOT MOVE → 2



NEEDLE MOVES → 15



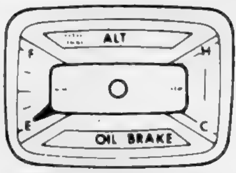
NEEDLE MOVES TO MAXIMUM AND STAYS → 7



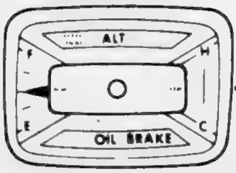
NEEDLE PULSATES MORE THAN WIDTH OF NEEDLE → REPLACE CVR → STOP

2

- OBSERVE FUEL GAUGE

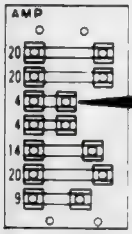


FUEL GAUGE NEEDLE DOES NOT MOVE → 3



FUEL GAUGE NEEDLE INDICATES PROPERLY → 4

3



✓ CHECK 4-AMP FUSE AT FUSE PANEL

FUSE BLOWN → GO TO CHART 9 STEP 1

FUSE NOT BLOWN → GO TO CHART 10 STEP 1

80738A

Chart 13

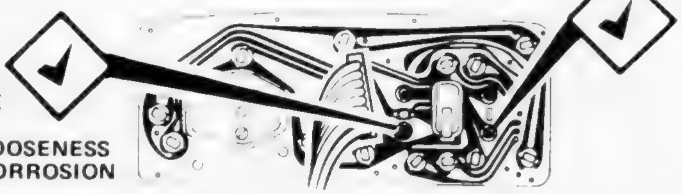
STEP **SEQUENCE** **RESULT**

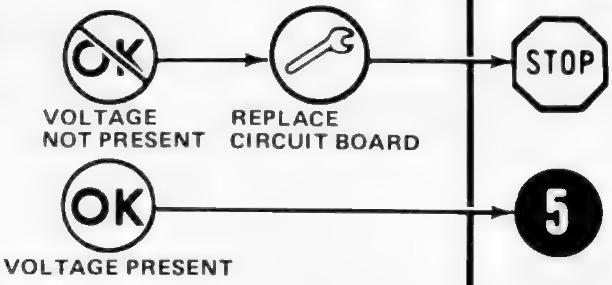
4

- REMOVE CLUSTER
- DO NOT DISCONNECT INSTRUMENT CLUSTER WIRING CONNECTOR

- CHECK GAUGE NUTS FOR LOOSENESS AND CORROSION

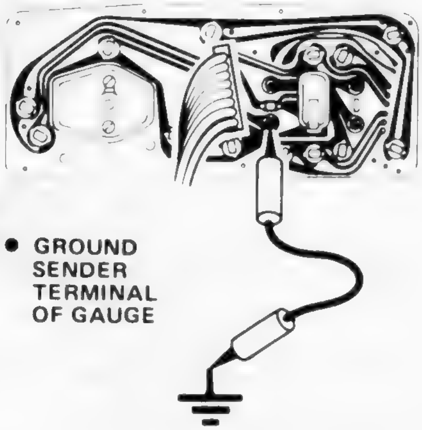
CHECK FOR PRESENCE OF VOLTAGE AT GAUGE INPUT

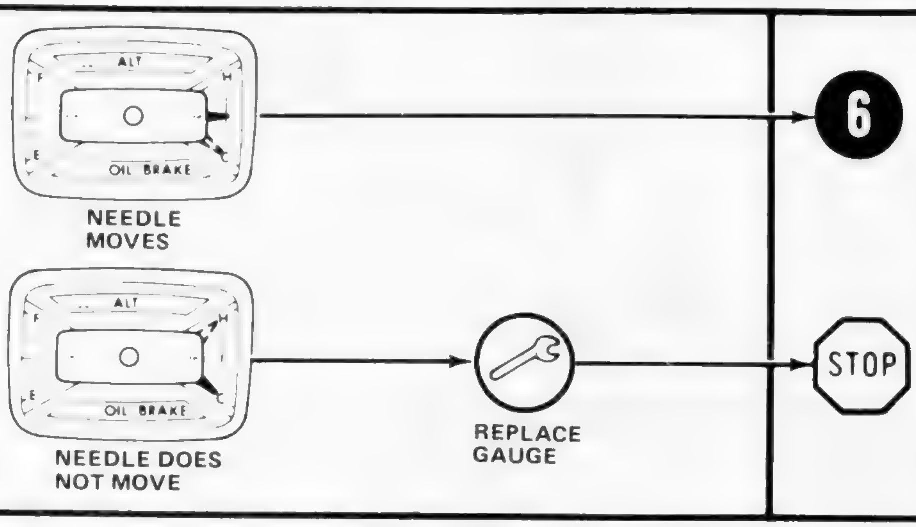




5

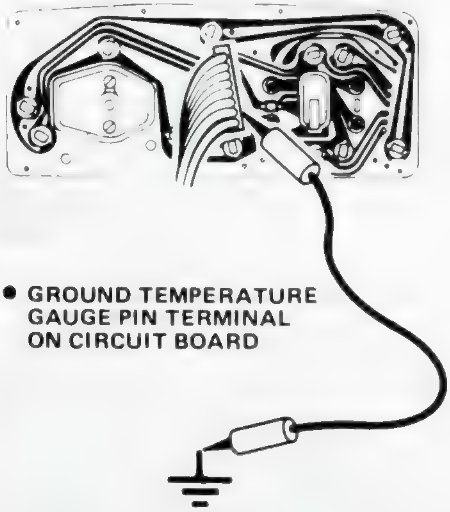
- GROUND SENDER TERMINAL OF GAUGE

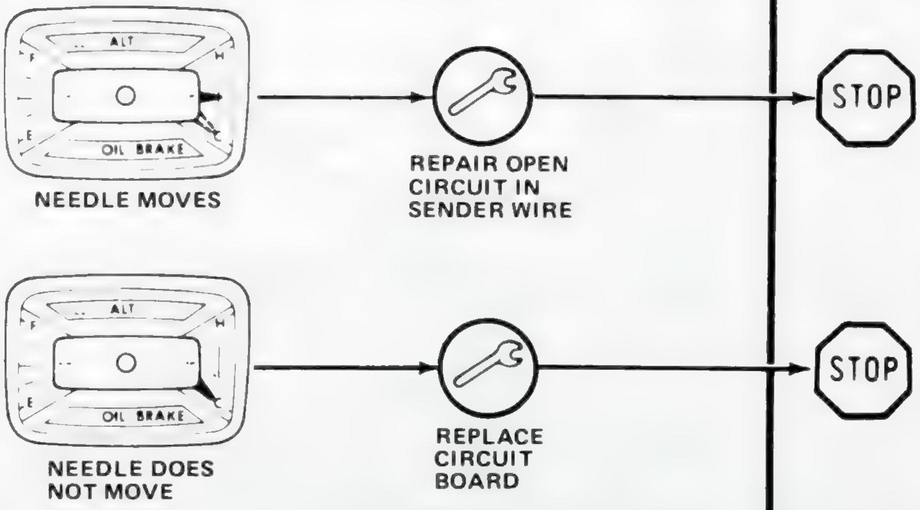




6

- GROUND TEMPERATURE GAUGE PIN TERMINAL ON CIRCUIT BOARD

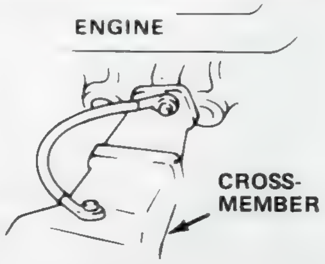


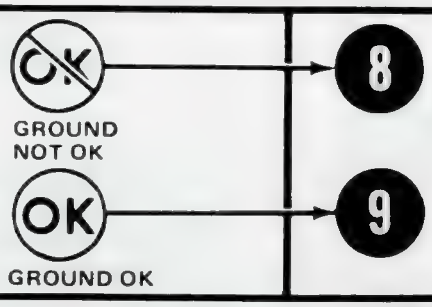


7

CHECK BODY-TO-ENGINE GROUND STRAP

- BROKEN
- MISSING
- CORRODED
- SCREWS LOOSE, MISSING

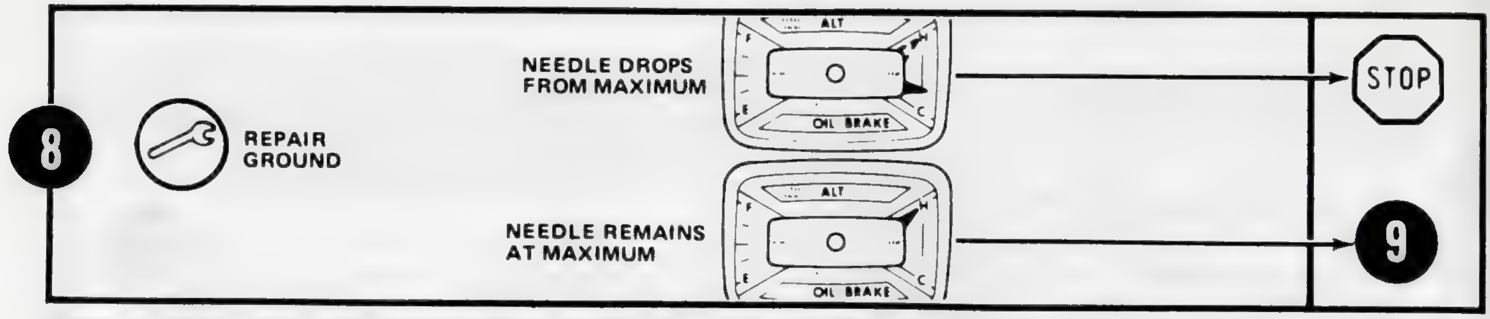




80738B

Chart 13

STEP **SEQUENCE** **RESULT**

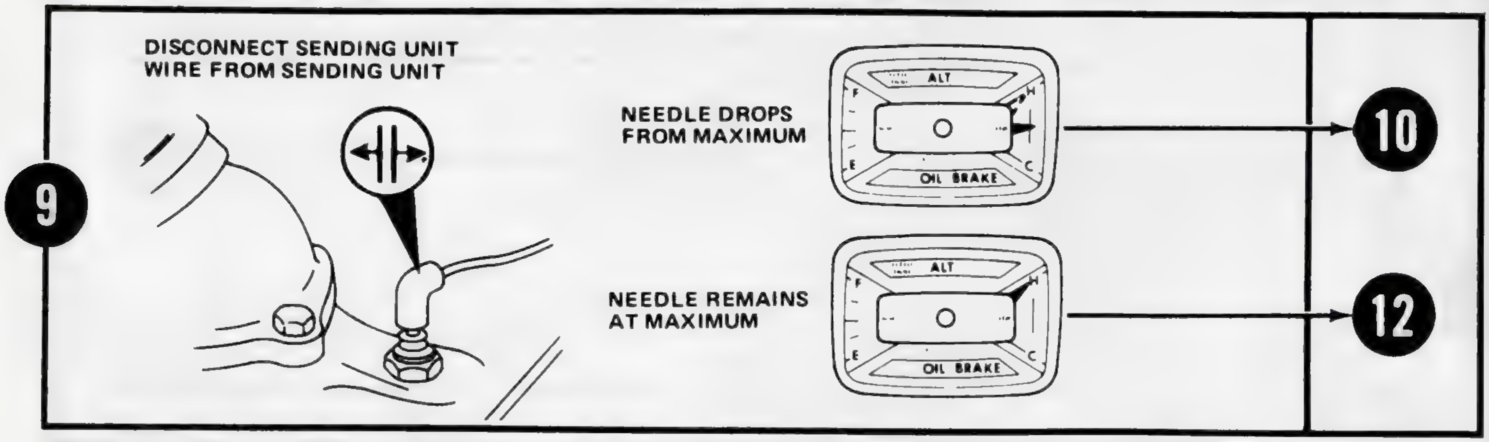


8

REPAIR GROUND

NEEDLE DROPS FROM MAXIMUM → STOP

NEEDLE REMAINS AT MAXIMUM → 9

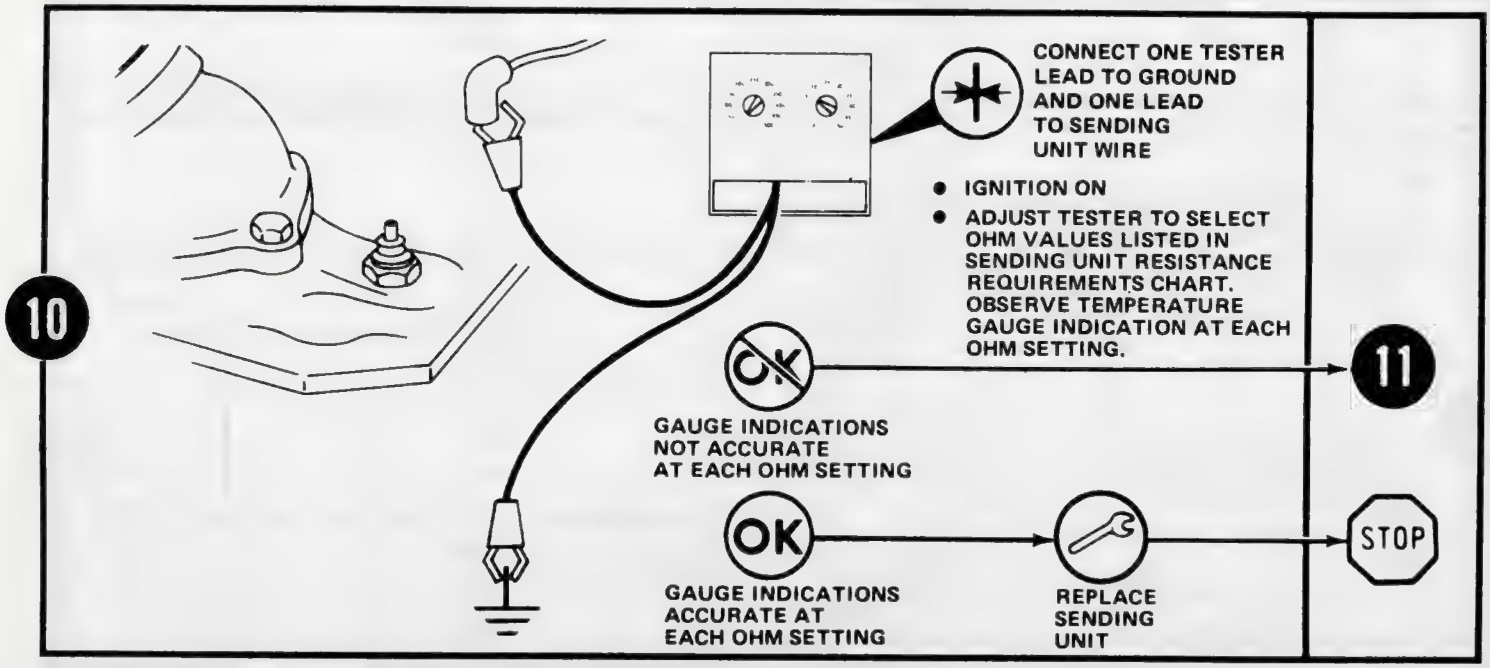


9

DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT

NEEDLE DROPS FROM MAXIMUM → 10

NEEDLE REMAINS AT MAXIMUM → 12



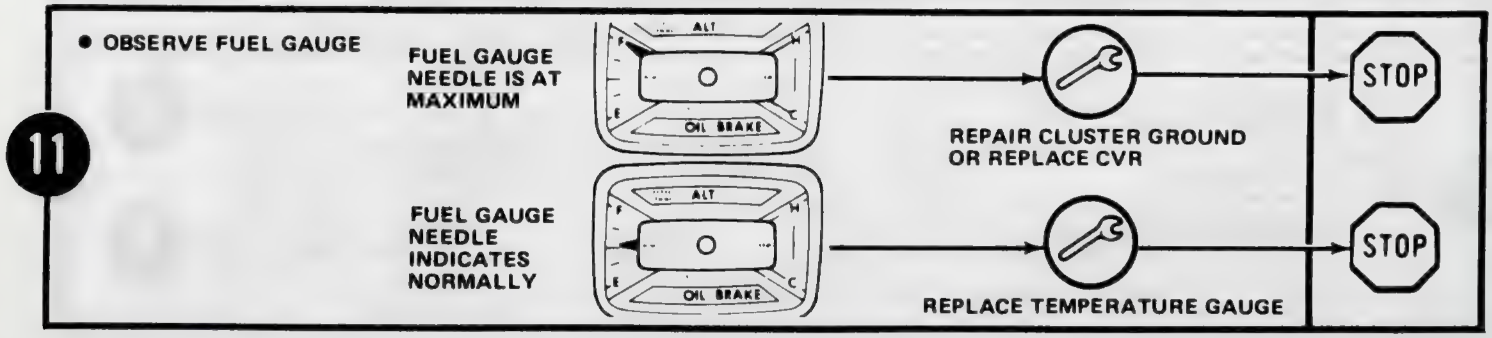
10

CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE TEMPERATURE GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 11

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP



11

- OBSERVE FUEL GAUGE

FUEL GAUGE NEEDLE IS AT MAXIMUM → REPAIR CLUSTER GROUND OR REPLACE CVR → STOP

FUEL GAUGE NEEDLE INDICATES NORMALLY → REPLACE TEMPERATURE GAUGE → STOP

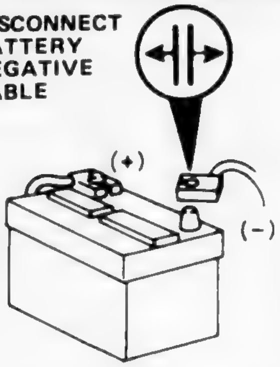
80738C

Chart 13

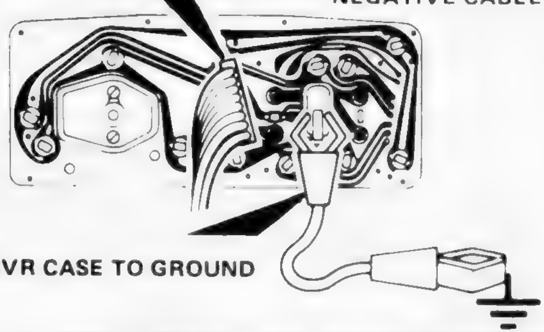
STEP **SEQUENCE** **RESULT**

12

DISCONNECT BATTERY NEGATIVE CABLE

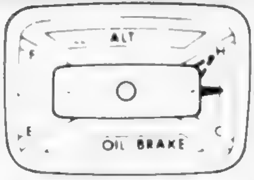


REMOVE INSTRUMENT CLUSTER. DO NOT DISCONNECT WIRE HARNESS

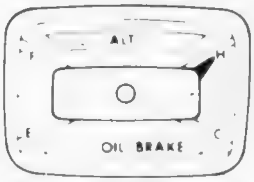


CONNECT JUMPER FROM CVR CASE TO GROUND

CONNECT BATTERY NEGATIVE CABLE



NEEDLE DROPS FROM MAXIMUM → **13**



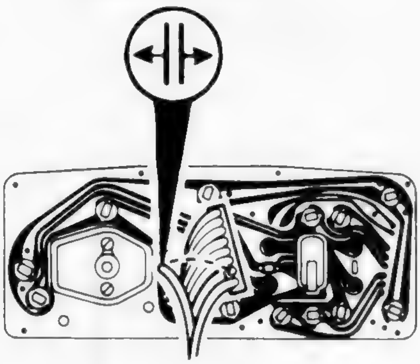
NEEDLE REMAINS AT MAXIMUM → **14**

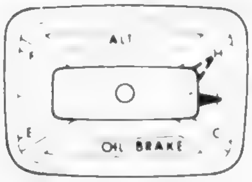
13

REPAIR CLUSTER GROUND WIRE → STOP

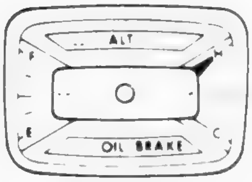
14

DISCONNECT SENDING UNIT WIRE FROM CLUSTER



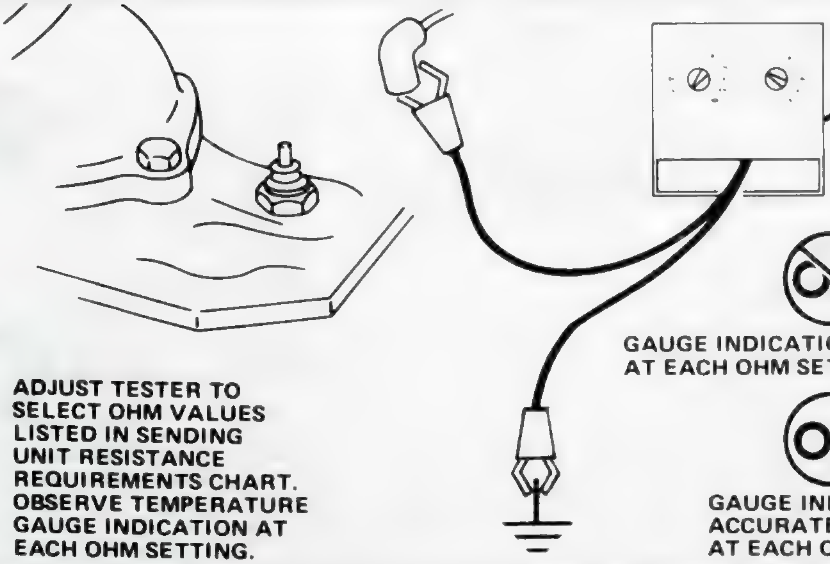


NEEDLE DROPS FROM MAXIMUM → REPAIR OR REPLACE SENDING UNIT WIRE → STOP



NEEDLE REMAINS AT MAXIMUM → REPLACE CIRCUIT BOARD → STOP

15



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE TEMPERATURE GAUGE INDICATION AT EACH OHM SETTING.

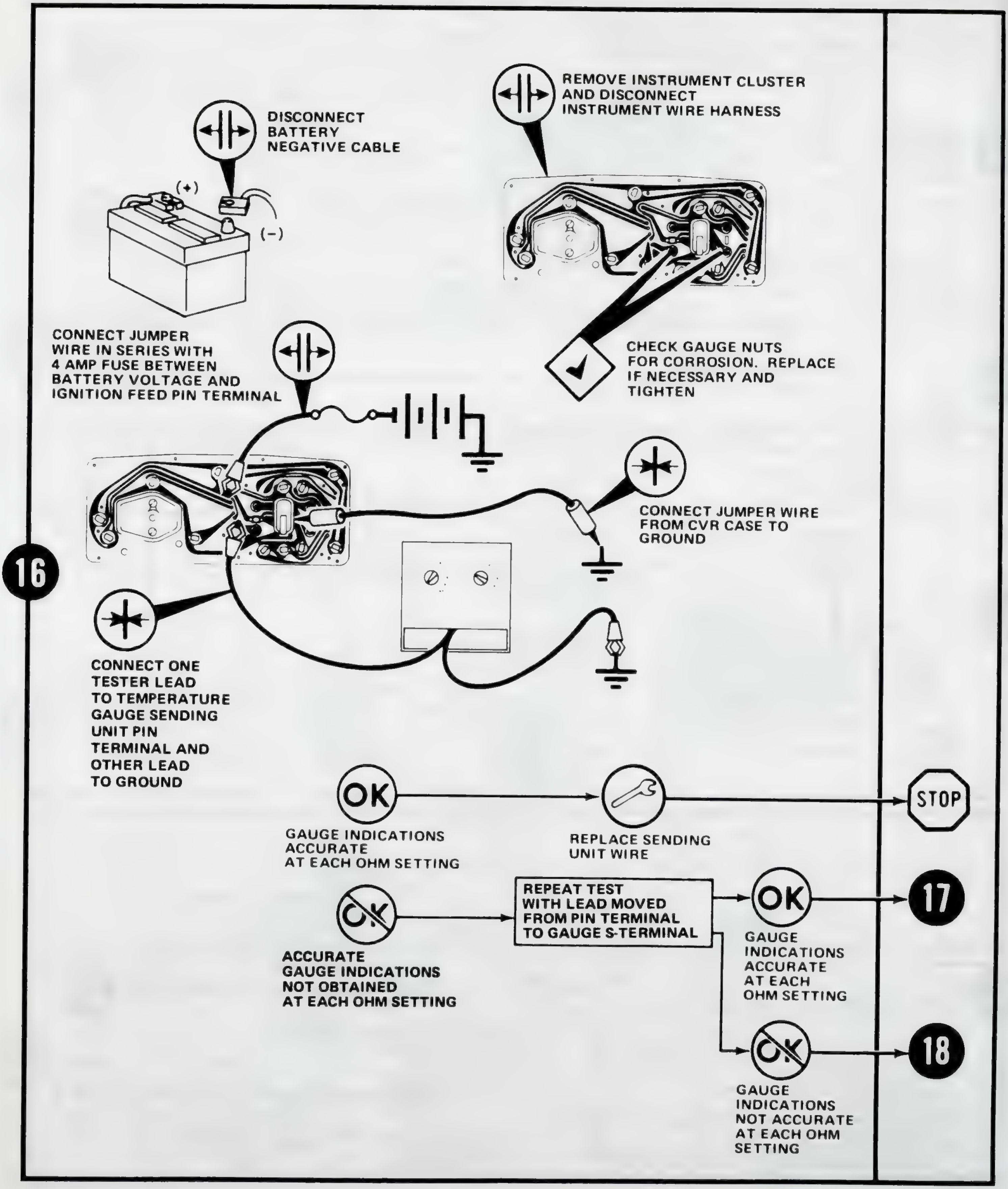
OK (crossed) GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → **16**

OK GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

80738D

Chart 13

STEP **SEQUENCE** **RESULT**



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRE HARNESS

CHECK GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES WITH 4 AMP FUSE BETWEEN BATTERY VOLTAGE AND IGNITION FEED PIN TERMINAL

CONNECT JUMPER WIRE FROM CVR CASE TO GROUND

CONNECT ONE TESTER LEAD TO TEMPERATURE GAUGE SENDING UNIT PIN TERMINAL AND OTHER LEAD TO GROUND

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

REPLACE SENDING UNIT WIRE

ACCURATE GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING

REPEAT TEST WITH LEAD MOVED FROM PIN TERMINAL TO GAUGE S-TERMINAL

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

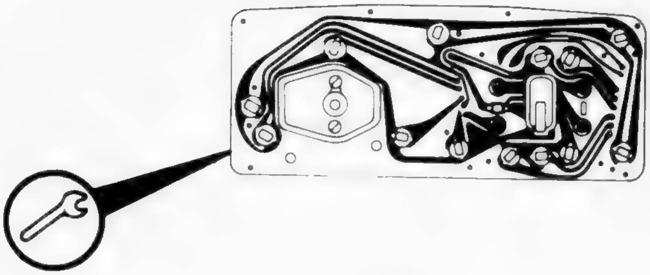
80738E

Chart 13

STEP **SEQUENCE** **RESULT**

17

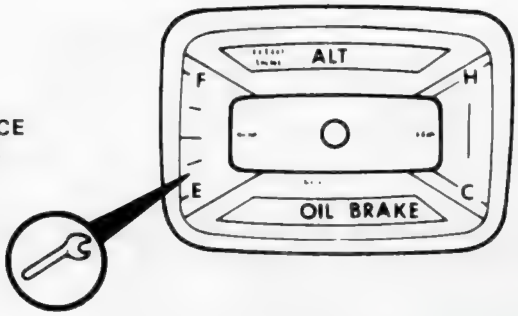
REPLACE
CIRCUIT
BOARD



STOP

18

REPLACE
GAUGE



STOP

80738F

TEMPERATURE GAUGE—MAGNETIC DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A — General Information for details on how to use this DARS chart.

PROBLEM: TEMPERATURE GAUGE NOT FUNCTIONING PROPERLY

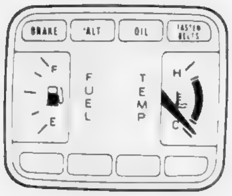
MAGNETIC TYPE

Chart 14

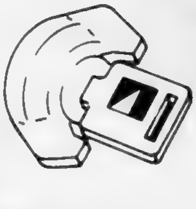
STEP **SEQUENCE** **RESULT**

1

- NOTE POSITION OF TEMPERATURE GAUGE NEEDLE



- TURN IGNITION ON AND WAIT 2 MINUTES FOR GAUGE TO WARM UP



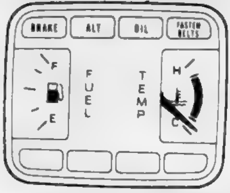
BEFORE STARTING TEST:

✓ ENGINE MUST BE WARM

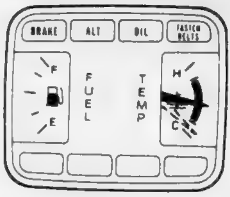
✓ FUEL TANK MUST BE NEITHER COMPLETELY FULL NOR COMPLETELY EMPTY

- OBSERVE NEEDLE

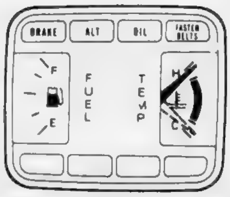
NEEDLE DOES NOT MOVE → 2



NEEDLE MOVES → 15



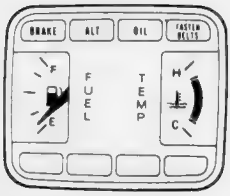
NEEDLE MOVES TO MAXIMUM AND STAYS → 7



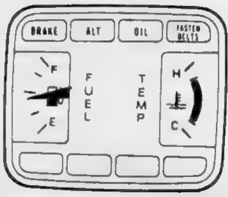
2

- OBSERVE FUEL GAUGE

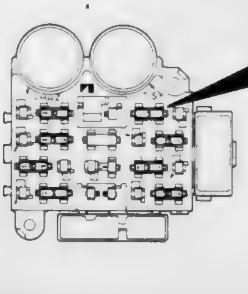
FUEL GAUGE NEEDLE DOES NOT MOVE → 3



FUEL GAUGE NEEDLE INDICATES PROPERLY → 4



3



✓ CHECK 5-AMP FUSE AT FUSE PANEL

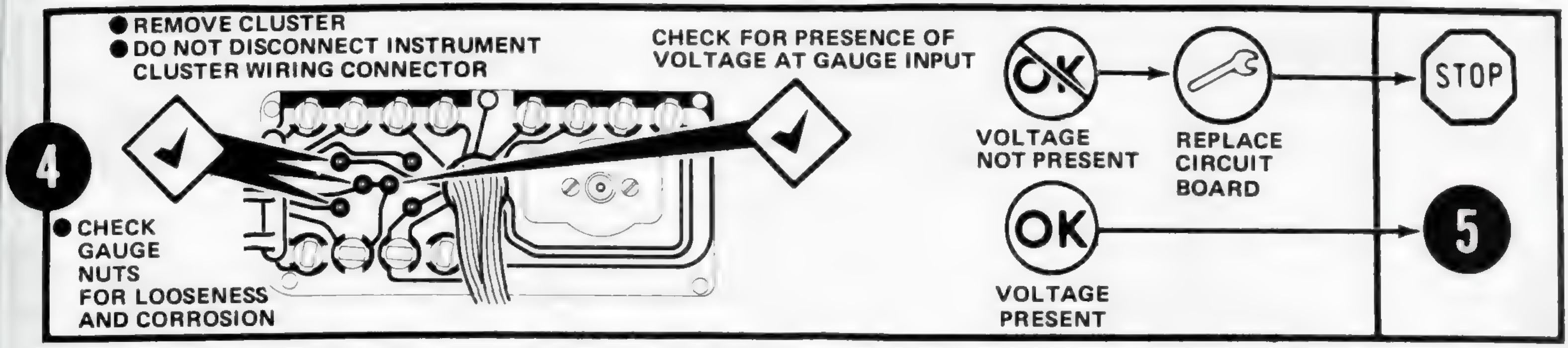
FUSE BLOWN → GO TO CHART 9 STEP 1

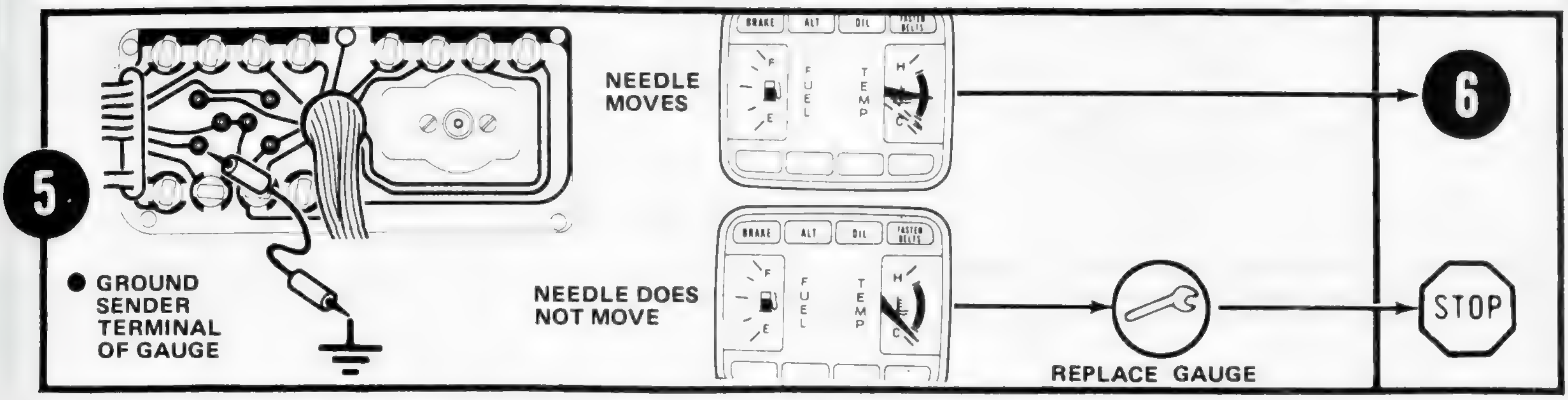
FUSE NOT BLOWN → GO TO CHART 10 STEP 1

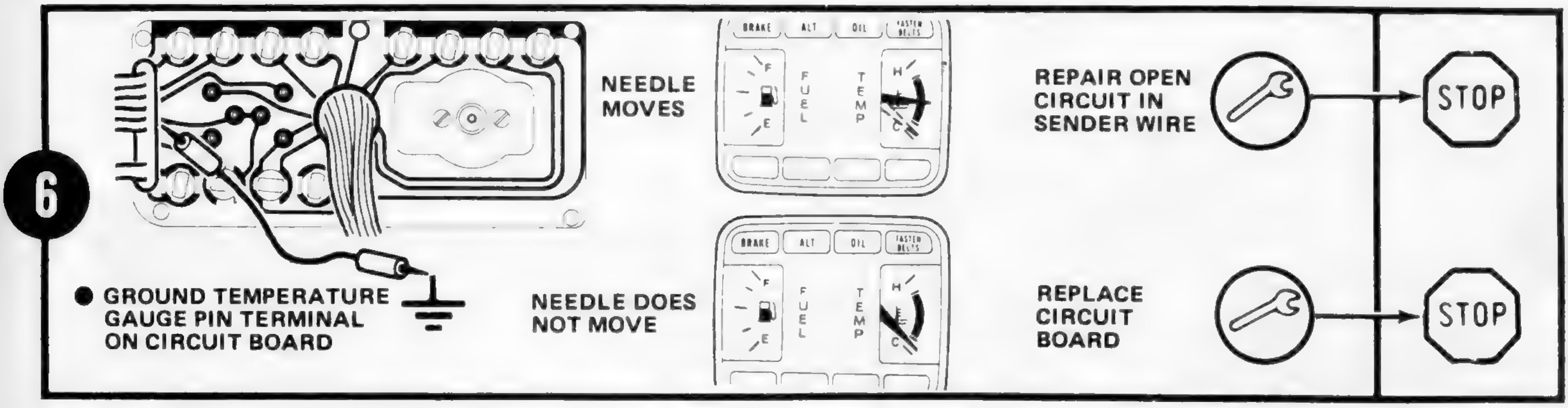
80739A

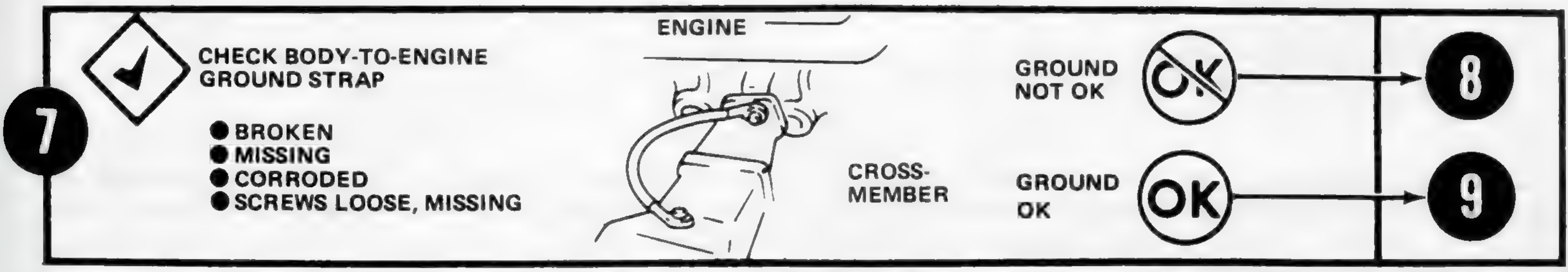
Chart 14

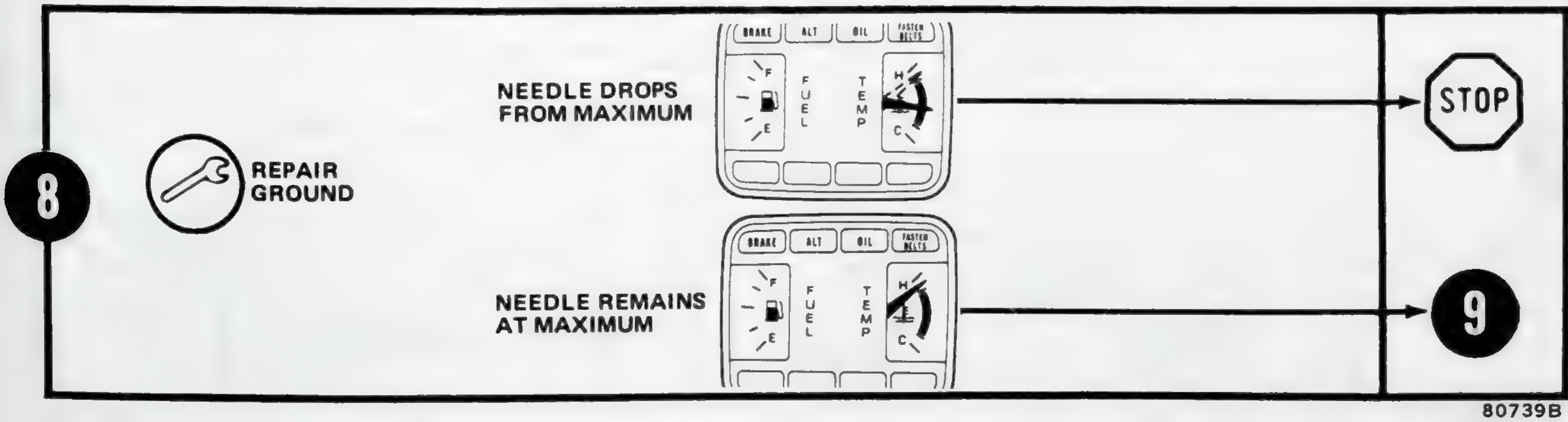
STEP SEQUENCE RESULT











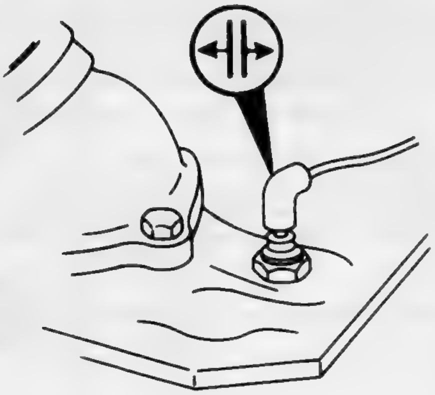
80739B

Chart 14

STEP **SEQUENCE** **RESULT**

9

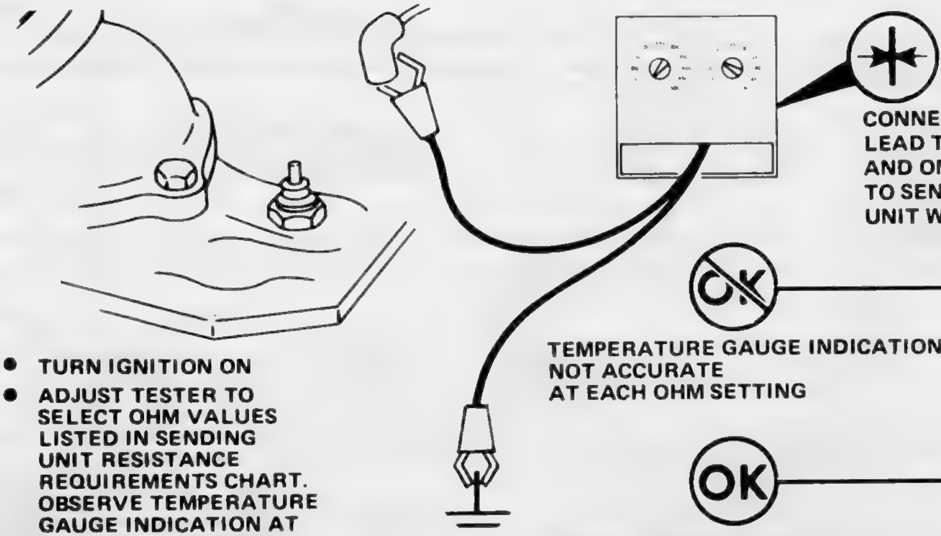
DISCONNECT SENDING UNIT WIRE FROM SENDING UNIT



NEEDLE DROPS FROM MAXIMUM → 10

NEEDLE REMAINS AT MAXIMUM → 12

10



CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

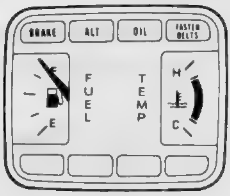
- TURN IGNITION ON
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE TEMPERATURE GAUGE INDICATION AT EACH OHM SETTING.

~~OK~~ TEMPERATURE GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → 11

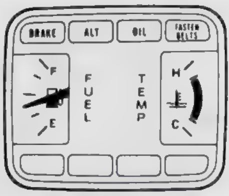
OK TEMPERATURE GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

11

- OBSERVE FUEL GAUGE



FUEL GAUGE NEEDLE IS AT MAXIMUM → REPAIR CLUSTER GROUND → STOP

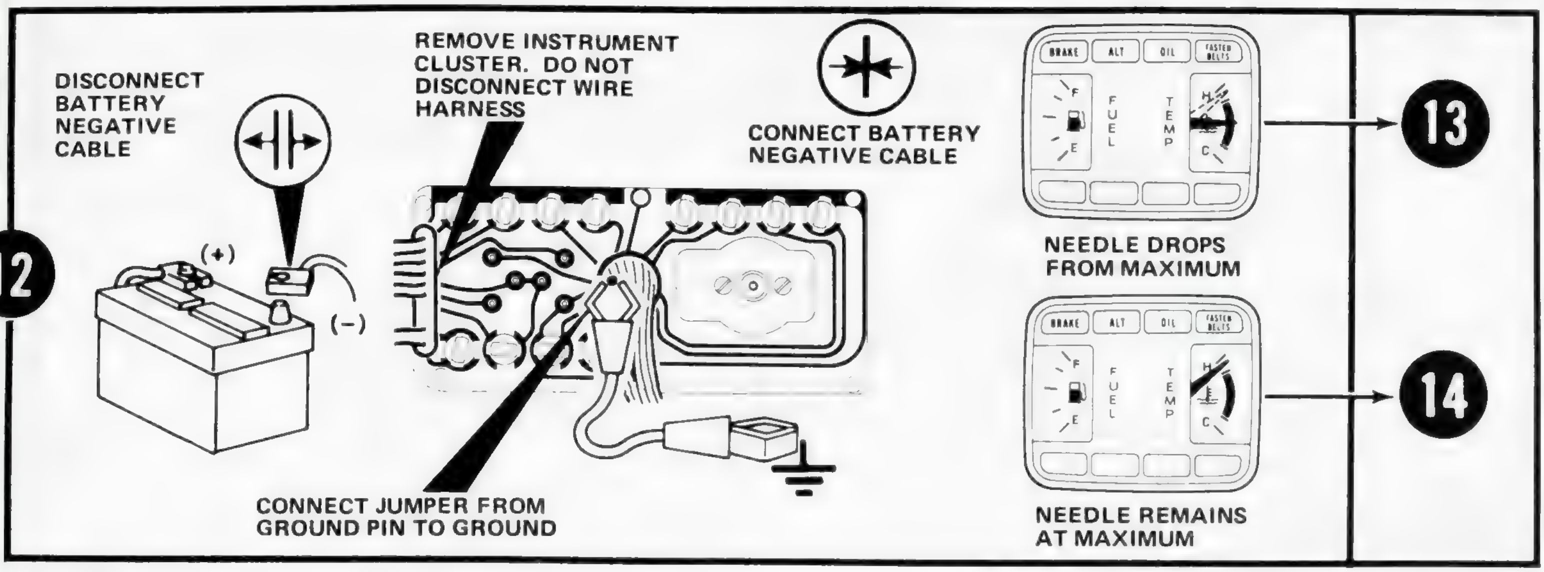


FUEL GAUGE NEEDLE INDICATES NORMALLY → REPLACE TEMPERATURE GAUGE → STOP

80739C

Chart 14

STEP **SEQUENCE** **RESULT**



12

DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER. DO NOT DISCONNECT WIRE HARNESS

CONNECT JUMPER FROM GROUND PIN TO GROUND

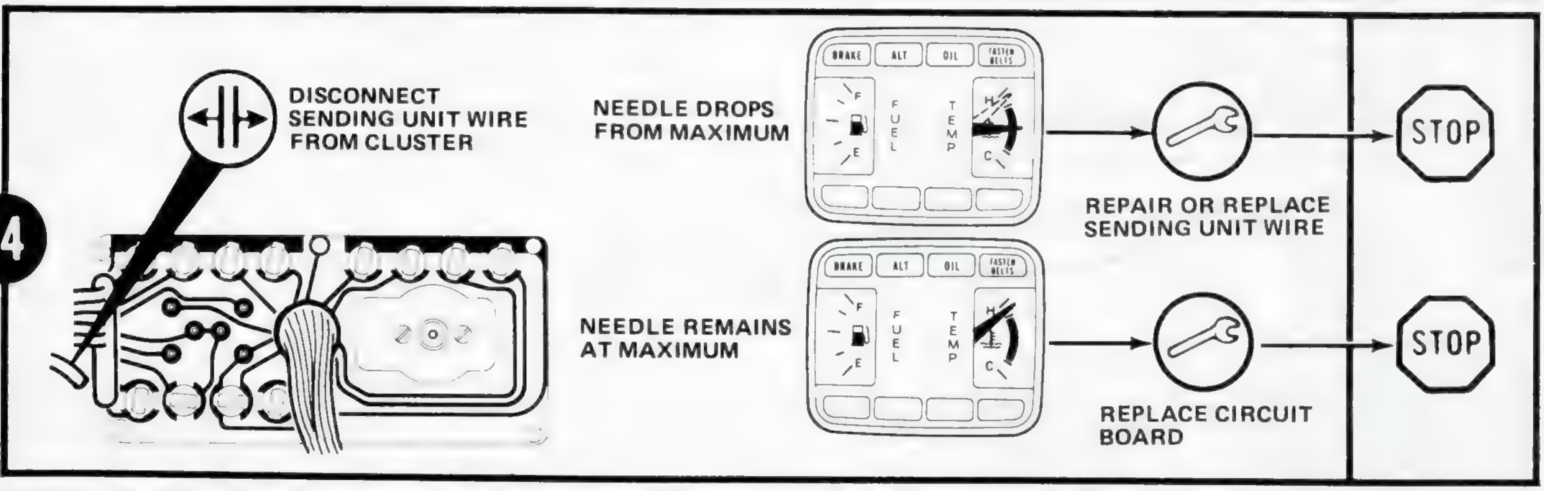
CONNECT BATTERY NEGATIVE CABLE

NEEDLE DROPS FROM MAXIMUM → **13**

NEEDLE REMAINS AT MAXIMUM → **14**

13

REPLACE CLUSTER GROUND WIRE → STOP

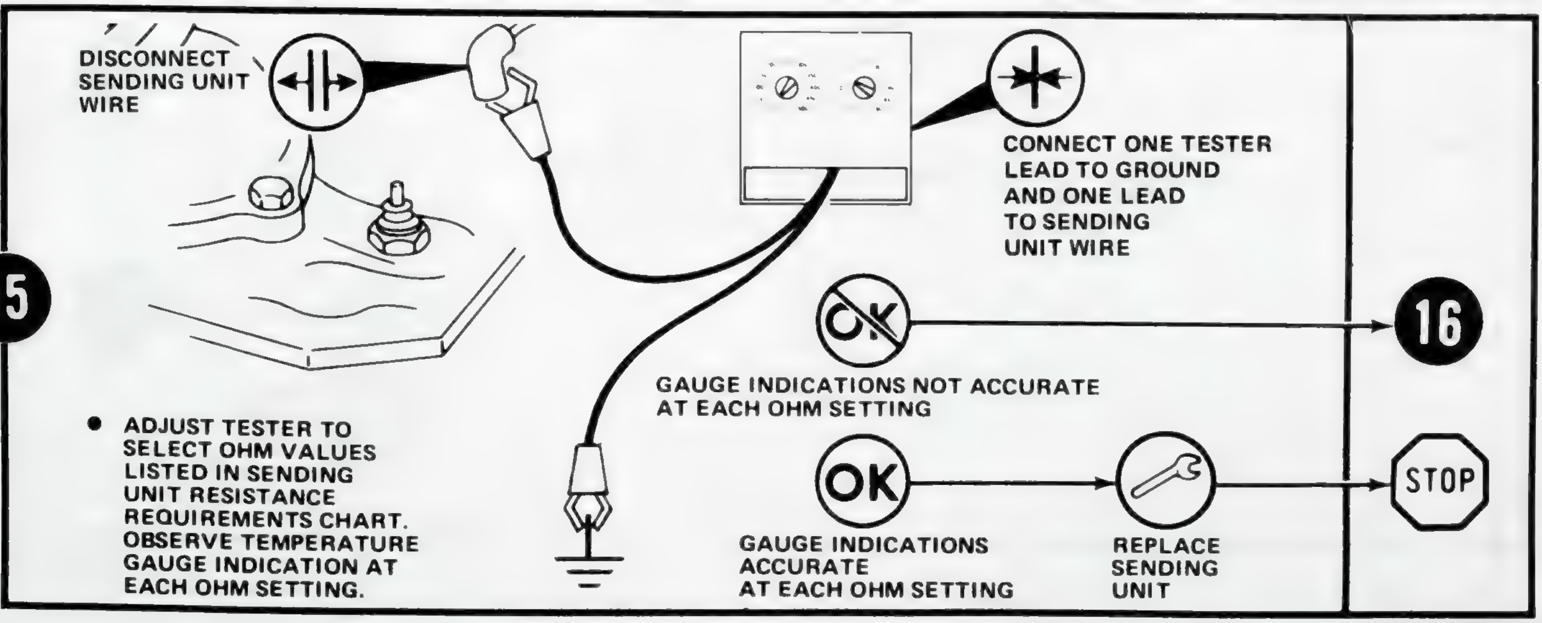


14

DISCONNECT SENDING UNIT WIRE FROM CLUSTER

NEEDLE DROPS FROM MAXIMUM → REPAIR OR REPLACE SENDING UNIT WIRE → STOP

NEEDLE REMAINS AT MAXIMUM → REPLACE CIRCUIT BOARD → STOP



15

DISCONNECT SENDING UNIT WIRE

CONNECT ONE TESTER LEAD TO GROUND AND ONE LEAD TO SENDING UNIT WIRE

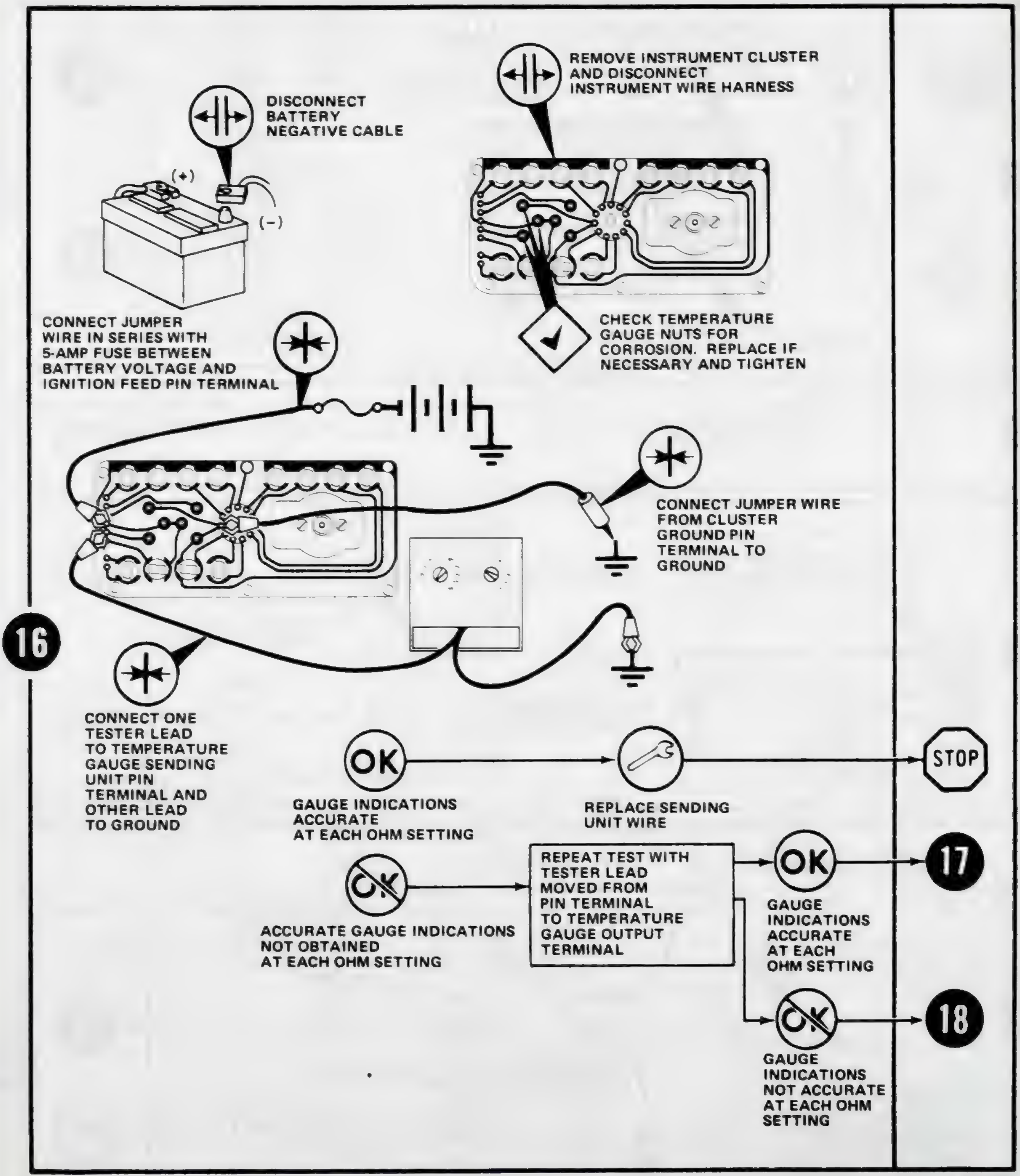
- ADJUST TESTER TO SELECT OHM VALUES LISTED IN SENDING UNIT RESISTANCE REQUIREMENTS CHART. OBSERVE TEMPERATURE GAUGE INDICATION AT EACH OHM SETTING.

GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING → **16**

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING → REPLACE SENDING UNIT → STOP

Chart 14

STEP **SEQUENCE** **RESULT**



DISCONNECT BATTERY NEGATIVE CABLE

REMOVE INSTRUMENT CLUSTER AND DISCONNECT INSTRUMENT WIRE HARNESS

CHECK TEMPERATURE GAUGE NUTS FOR CORROSION. REPLACE IF NECESSARY AND TIGHTEN

CONNECT JUMPER WIRE IN SERIES WITH 5-AMP FUSE BETWEEN BATTERY VOLTAGE AND IGNITION FEED PIN TERMINAL

CONNECT JUMPER WIRE FROM CLUSTER GROUND PIN TERMINAL TO GROUND

CONNECT ONE TESTER LEAD TO TEMPERATURE GAUGE SENDING UNIT PIN TERMINAL AND OTHER LEAD TO GROUND

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

REPLACE SENDING UNIT WIRE

ACCURATE GAUGE INDICATIONS NOT OBTAINED AT EACH OHM SETTING

REPEAT TEST WITH TESTER LEAD MOVED FROM PIN TERMINAL TO TEMPERATURE GAUGE OUTPUT TERMINAL

GAUGE INDICATIONS ACCURATE AT EACH OHM SETTING

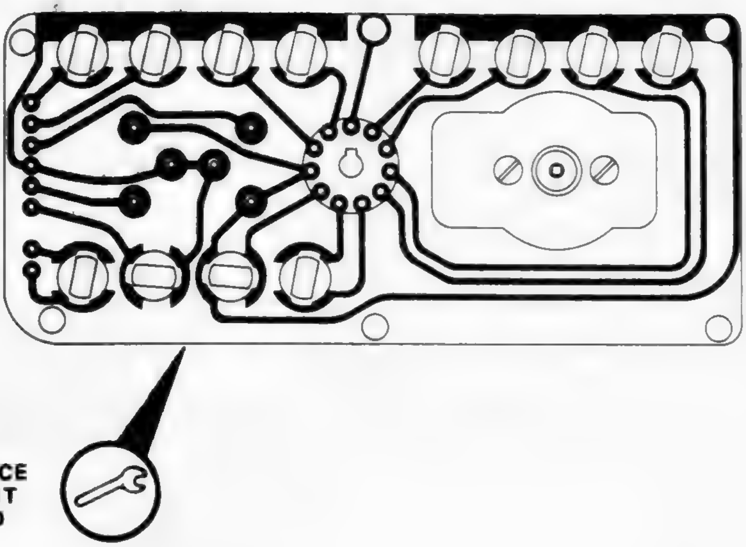
GAUGE INDICATIONS NOT ACCURATE AT EACH OHM SETTING

80739E

Chart 14

STEP **SEQUENCE** **RESULT**

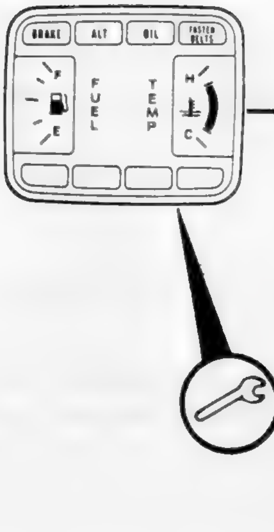
17



REPLACE CIRCUIT BOARD

→ STOP

18



REPLACE GAUGE

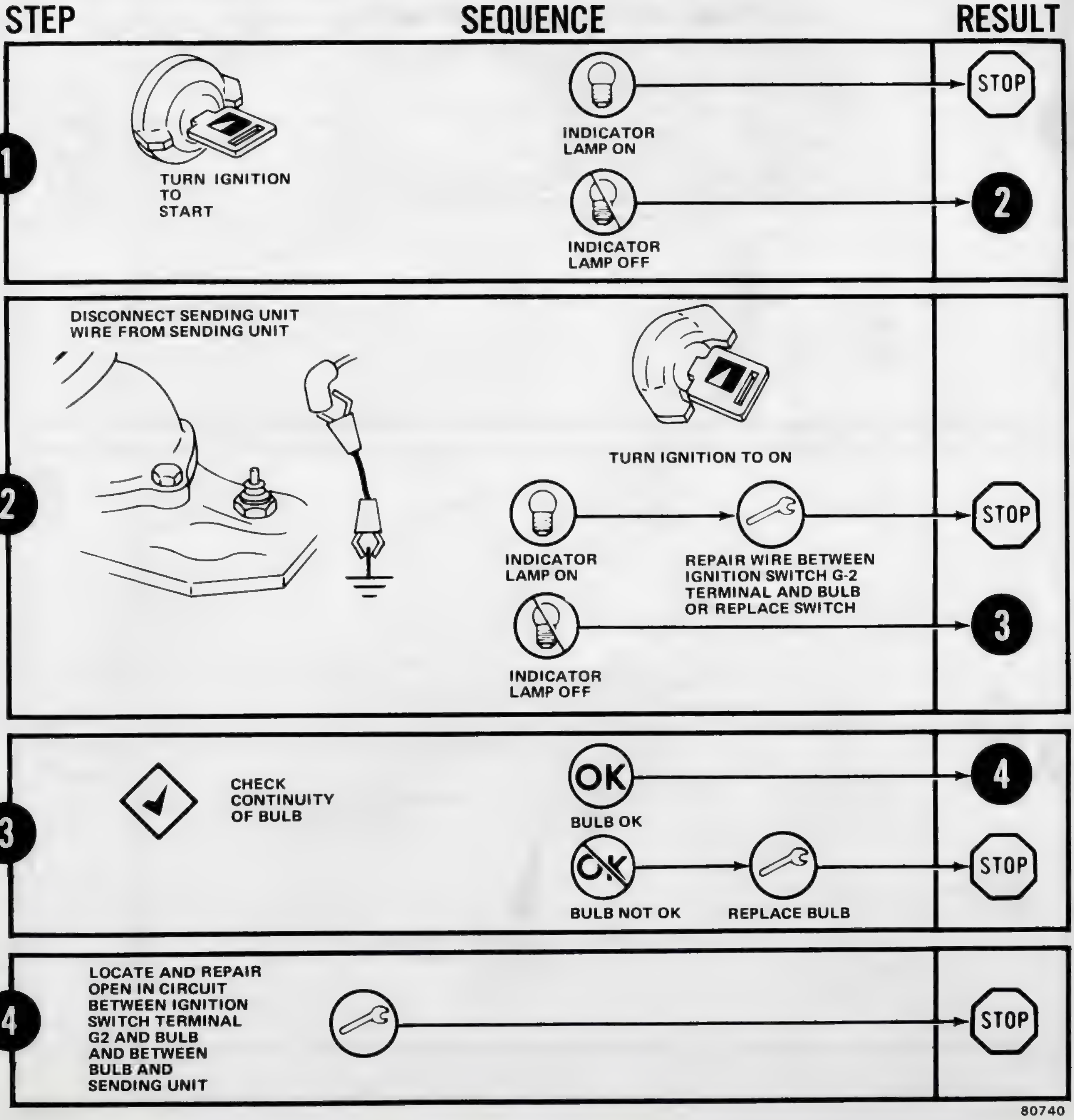
→ STOP

TEMPERATURE INDICATOR LAMP—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: TEMPERATURE INDICATOR LAMP DOES NOT LIGHT WITH IGNITION IN START POSITION

Chart 15



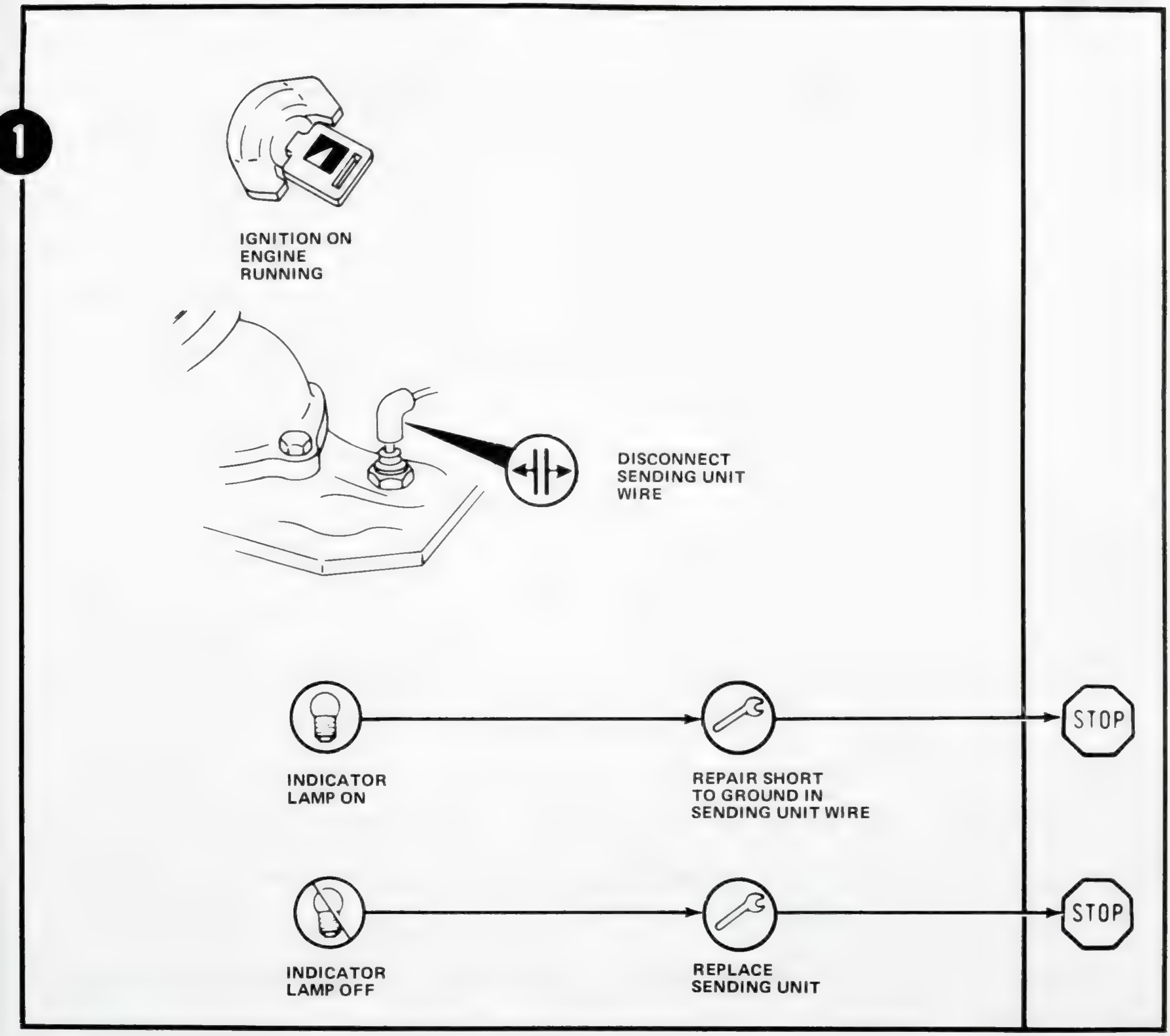
TEMPERATURE INDICATOR LAMP—DIAGNOSIS AND REPAIR SIMPLIFICATION (DARS) CHART

Note: Refer to Chapter A – General Information for details on how to use this DARS chart.

PROBLEM: TEMPERATURE INDICATOR LAMP DOES NOT GO OFF WITH ENGINE RUNNING (NO OVERHEAT CONDITION)

Chart 16

STEP **SEQUENCE** **RESULT**



80741

NOTES

CIRCUITS AND SCHEMATICS

The information on the following pages is arranged by car line. Locate the appropriate page and fold the flap outward. Note that the separate indicator and gauge schematics are printed on the fold-out.

80233

For convenient reference while working through a diagnosis procedure, leave the flap folded out while referring to the appropriate DARS charts.

80234

SPECIFICATIONS—PACER

Fuel Gauge Sending Unit Resistance (Ohms)

E	1/4	1/2	3/4	F
61	39	27	20	11

80451

Fuel Gauge Resistance (Internal)

S_1 to A_1	15 ± 0.3 ohms

80452

Oil Pressure Indicator Sending Unit Calibration

Open	Above 4-6 psi
Closed	Below 4-6 psi

80453

Temperature Indicator Sending Unit Calibration

Open	Below $250^{\circ} \pm 5^{\circ}$ F
Closed	Above $250^{\circ} \pm 5^{\circ}$ F

80454

Circuits and Schematics

Pacer

SPECIFICATIONS—GREMLIN, CONCORD AND AMX

Fuel Gauge Sending Unit Resistance (Ohms)

E	1/4	1/2	3/4	F
248	151	105	65	31

80455

Fuel Gauge Resistance (Internal)

I to S	81.6 ohms ± 5%
S to G	327.5 ohms ± 5%

80456

Oil Pressure Indicator Sending Unit Calibration

Open	Above 4-6 psi
Closed	Below 4-6 psi

80457

Temperature Gauge Sending Unit Resistance (Ohms)

C (Cold)	Bottom of Band	Top of Band	H (Hot)
353 ohms	192 ohms	73.9 ohms	45.2 ohms
147°F	180°F	242°F	280°F

80458

Temperature Gauge Resistance (Internal)

I to S	81.6 ohms ± 5%
S to G	327.5 ohms ± 5%

80459

Circuits and Schematics

Gremlin, Concord and AMX

SPECIFICATIONS—MATADOR

Fuel Gauge Sending Unit Resistance (Ohms)

E	1/4	1/2	3/4	F
61	37	26	19	11

80460

Fuel Gauge Resistance (Internal)

S_1 to A_1	12-16 ohms

80461

Oil Pressure Indicator Sending Unit Calibration

Open	Above 4-6 psi
Closed	Below 4-6 psi

80462

Temperature Gauge Sending Unit Resistance (Ohms)

C (Cold)	Beginning of Band	Top of Band	H (Hot)
130° F	185° F	245° F	268° F
73 ohms	28 ohms	13 ohms	9 ohms

80463

Temperature Gauge Resistance (Internal)

S_2 to A_2	12-16 ohms

80464

Circuits and Schematics

Matador

SPECIFICATIONS—RALLY PACKAGE

Ammeter Calibration

Indicated	Actual
+60	53-67
+30	26-34

80465

Oil Pressure Sending Unit Resistance (Ohms)

0 psi	60 psi
240	67

80466

Oil Pressure Gauge Resistance (Internal)

I to S	81.6 ohms ± 5%
S to G	327.5 ohms ± 5%

80467

Temperature Gauge Sending Unit Resistance (Ohms)

190°	280°
114	48.8

80468

Temperature Gauge Resistance (Internal)

I to S	81.6 ohms ± 5%
S to G	327.5 ohms ± 5%

80469

Tachometer Calibration

Engine	Frequency*	Calibration (RPM)
4 CYLINDER	0 Hz	0 ± 25
	50 Hz	1500 ± 120
	150 Hz	4500 ± 120
6 CYLINDER	0 Hz	0 ± 25
	75 Hz	1500 ± 120
	225 Hz	4500 ± 120
8 CYLINDER	0 Hz	0 ± 25
	100 Hz	1500 ± 120
	300 Hz	4500 ± 220

*Using Square-Wave Generator

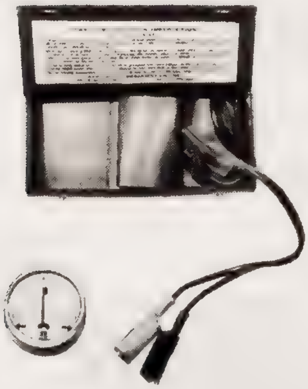
80470

Circuits and Schematics

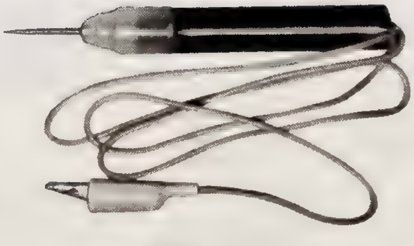
Rally Package

Special Tools

J-24538
FUEL AND TEMPERATURE
GAUGE TESTER



J-8681
SHORT CHECKER



J-21008
CONTINUITY LIGHT

ALPHABETICAL INDEX

NOTES

NOTES

NOTES

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WIRING DIAGRAMS

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Component Grid Locator

Pacer

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A/C Thermostat	D-4
Accessory Light Connector	E-7
Alternator, 6 Cylinder (Delco)	C-2
Auto. Trans. Neutral & Back-up Light Switch	B-2
Back-up Lamp, Left Rear	D-11
Back-up Lamp, Right Rear	B-11
Battery	D-2
Blower Motor	A-4
Blower Motor Resistor	A-5
Body Ground	C-11 & D-11
Body Ground on Dash Panel	D-2
Body Harness Connector	E-8
Brake Failure Warning Light Switch	C-9
Electronic Control Unit	A-3
Cigar Lighter	A-7
Coil	B-2
Courtesy Lamp, Connector	E-7
Dash Connector	D-4
Dimmer Switch	E-4 & E-5
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Directional Signal Switch	C-8
Distributor	B-2
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Door Switch, Right	A-9
Fuse Panel	A-9 & E-6
Fusible Link Horn Relay	D-2
Fusible Link, Ignition Switch Circuit	B-7 & B-8
Fusible Link, Splice "L"	D-3
Fusible Link, Starter Main Wire Harness	D-2
Hazard Flasher	D-5
Headlamp, Left Side	D-1
Headlamp, Right Side	B-1
Headlamp Switch	D-6
Headlamp Warning Buzzer	E-8
Headlamp & Wiper Switch Light	B-6
Heater Blower Switch	A-5
Heater Control Lamp	B-5
Horn (High Note, Optional)	B-1
Horn (Low Note)	D-1
Horn Contact	C-8
Horn Relay	E-2
Ignition Switch	B-8
Instrument Cluster Circuit Panel	A-6 & B-6
Key Alarm Contacts	C-8
Key & Headlamp Warning Buzzer	E-8
License Lamp Assembly (66 Only)	C-11
License Lamp Assembly, Left (68 Only)	D-11
License Lamp Assembly, Right (68 Only)	C-11
Liftgate Switch (68 Only)	B-11
Liftgate Switch (66 Only)	D-9
Oil Pressure Sending Unit	B-3
Parking Brake Light Switch	C-9
Parking Lamp, Left Side	E-1
Parking Lamp, Right Side	A-1
Seat Belt Buzzer	D-8
Seat Belt Switch, Driver	D-9
Sending Unit, Gas Tank	D-10
Sending Unit, Water Temperature	B-3
Side Marker Lamp, Left Front	E-1
Side Marker Lamp, Left Rear	E-11

NOMENCLATURE	LOCATION
Side Marker Lamp, Right Front	A-1
Side Marker Lamp, Right Rear	A-11
Splice "A"	D-5
Splice "B"	D-7
Splice "C"	D-3
Splice "E"	A-7
Splice "J"	B-5
Splice "H"	A-8
Splice "L"	D-3
Splice "P"	E-1
Splice "U"	C-11
Splice "V"	D-10
Splice "W"	D-10
Splice "X"	B-1
Splice "Z"	D-1
Starter	D-2
Starter Solenoid	D-2
Steering Column Connector	D-7 & D-8
Stoplight Switch	D-8
Tail Lamp Assembly, Left Rear	E-11
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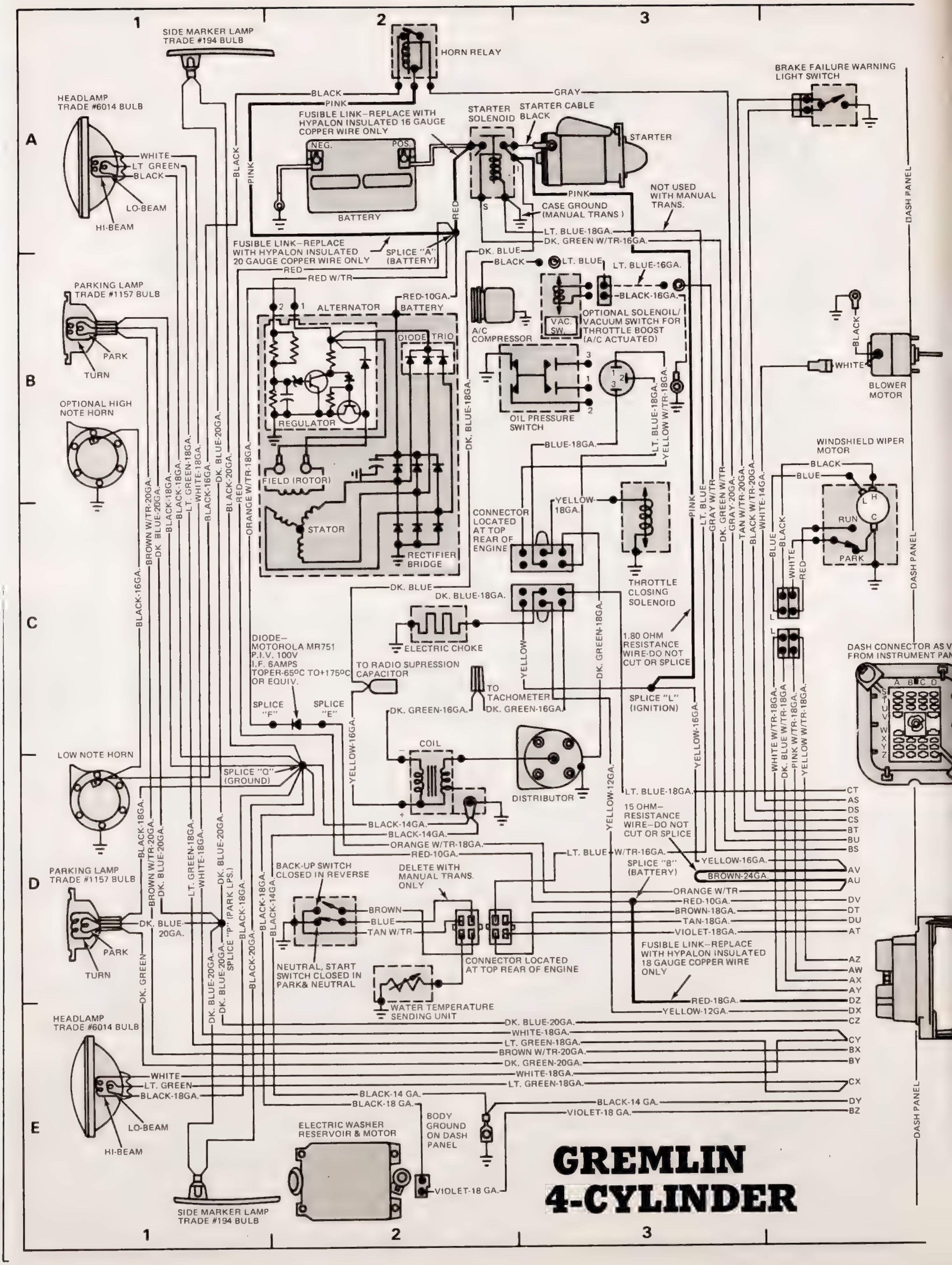
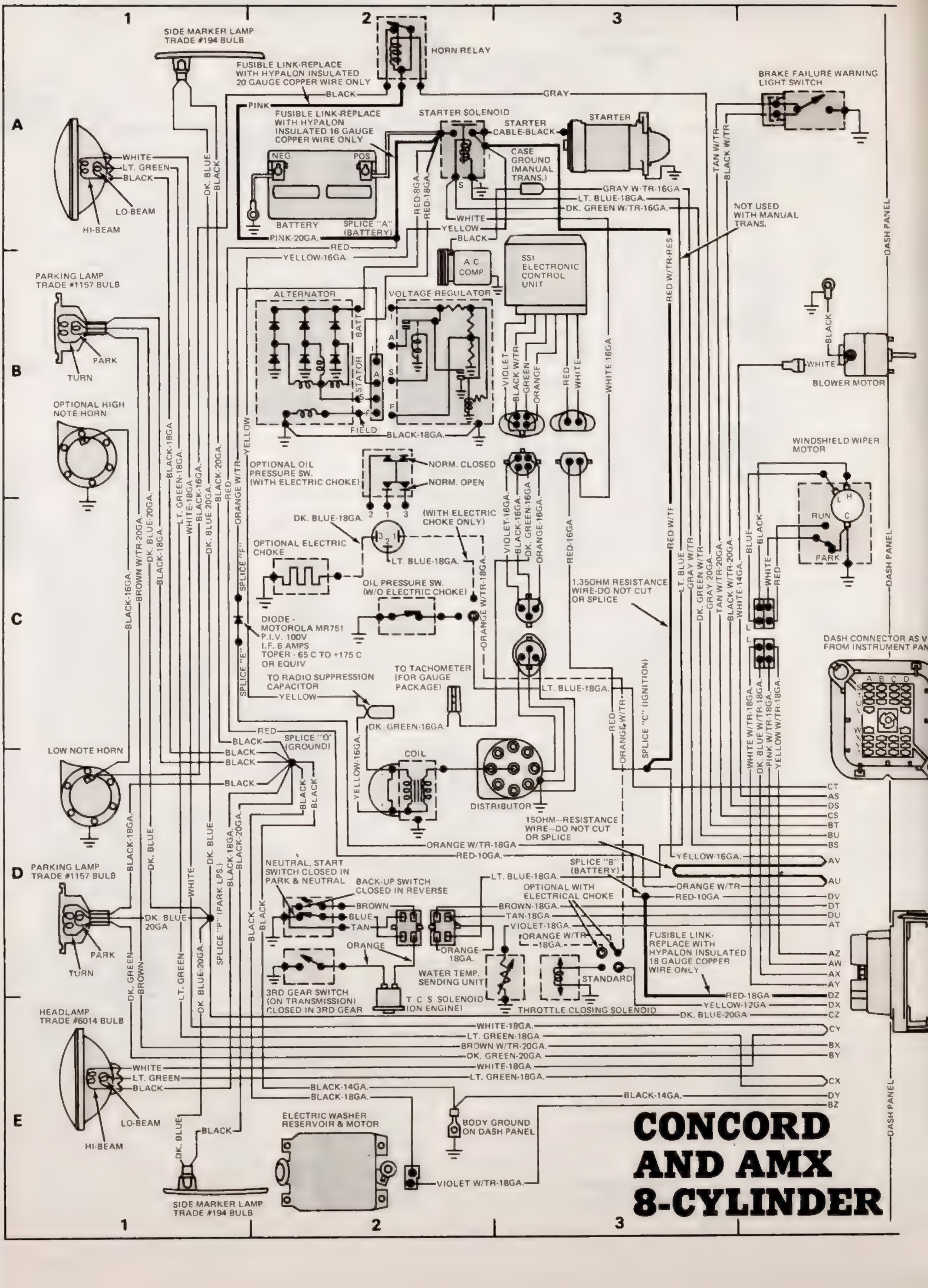
Thermo Timer	D-8 & D-9
Third Gear Switch (On Trans.)	B-2
Throttle Closing Solenoid	B-3
Transmission Control Spark (TCS) Solenoid	B-2
Windshield Washer Reservoir & Motor, Electric	A-2
Windshield Circuit Breaker	C-6
Windshield Wiper Motor	C-3
Windshield Wiper Switch	C-5

Wiring Diagram
Pacer
60 Series

GREMLIN
4-CYLINDER



Wiring Diagram
Gremlin
40 Series



CONCORD AND AMX 8-CYLINDER

Wiring Diagram
Concord and AMX
01 Series

Component Grid Locator
Matador 10 Series

NOMENCLATURE	LOCATION
Accessory Connector	E-6
A/C Compressor	C-2
A/C Temperature Sensor	C-1
A/C Thermostat	B-5
A/C Micro Switch Connector	B-5
Alternator, Six-Cyl. (Delco)	C-2
Alternator, Eight-Cyl. (Motorcraft)	B-2
Ash Receiver Lamp	A-7
Auto. Trans. Neutral & Back-up Lamp Switch	D-2
Back-up Lamp, Left	C-11
Back-up Lamp, Right	C-11
Battery	A-2
Blower Motor	B-4
Blower Motor Resistor	B-4
Body Ground	C-10
Body Ground on Dash Panel	D-2
Body Harness Connector	E-8
Brake Failure Warning Light Switch	A-4
Cigar Lighter	A-7
Clock	A-6
Coil	C-2
Courtesy Lamp, Left Side	D-9
Courtesy Lamp, Right Side	B-9
Dash Connector	D-4
Dimmer Switch	E-5
Directional Signal Flasher	D-7
Directional Signal Switch	C-8
Distributor	C-2
Dome Lamp	C-10
Door Switch, Left	E-9
Door Switch, Right	B-9
Fuse Panel	A-10 & E-6
Fusible Link, Horn Relay	A-2
Fusible Link, Ignition Switch Solenoid Circuit	A-7
Fusible Link, Starter Solenoid	A-2
Glove Box Lamp	A-9
Hazard Flasher	D-6
Headlamp, Left Side	E-1
Headlamp, Right Side	A-1
Headlamp Switch	D-6
Headlamp & Wiper Switch Lamp	C-6
Heater Rear Window Connector	D-8
Heater Blower Switch	A-5
Heater Control Lamp	A-5
Horn Switch	C-7
Horn, Left Side	D-1
Horn Relay	A-2
Horn, Right Side	B-1
Ignition Switch	B-8
Instrument Cluster Circuit Panel	B-6
Instrument Panel Ground	A-7
Key Alarm Switch	C-7
Key & Headlamp Warning Buzzer	C-6
License Lamp Assembly	C-11
Lamp Ground Screw In Trunk	C-10
Oil Pressure Sending Unit	B-3 & C-3
Parking Brake Lamp Switch	B-7
Parking Lamp, Left Side	D-1
Parking Lamp, Right Side	B-1
Radio Connector	B-5
Resistance Wire, Splice "L"	D-3
Seat Belt Buzzer/Timer	C-8

NOMENCLATURE	LOCATION
Sending Unit, Gas Tank	D-10
Sending Unit, Water Temperature	D-2
Side Marker Lamp, Left Front	E-1
Side Marker Lamp, Left Rear	E-10
Side Marker Lamp, Right Front	A-1
Side Marker Lamp, Right Rear	A-10
Splice "A"	A-2
Splice "D"	D-6
Splice "E"	A-7
Splice "F"	A-6
Splice "H"	C-7
Splice "J"	A-7
Splice "L"	D-3
Splice "N"	E-1
Splice "P"	B-1
Splice "Q"	D-2
Splice "R"	B-1
Splice "S"	E-10
Splice "T"	A-10
Splice "U"	C-11
Splice "V"	C-10
Splice "W"	D-10
SSI Electronic Control Unit	A-3
Starter	B-3
Starter Solenoid	A-3
Steering Column Connector	C-7
Stop Lamp Switch	D-8
Tail & Stop Lamp, Left Inner	D-11
Tail & Stop Lamp, Left Outer	E-11
Tail & Stop Lamp, Right Inner	B-11
Tail & Stop Lamp, Right Outer	A-11
Third Gear Switch (On Trans.)	C-2
Throttle Closing Solenoid	D-2
Transmission Control Spark (TCS) Solenoid	D-2
Voltage Regulator, Eight-Cyl.	B-2
Windshield Washer Reservoir & Motor, Electric	E-2
Windshield Wiper Motor	C-4
Windshield Wiper Switch	C-6

Wiring Diagram
Matador
10 Series

Component Grid Locator
Matador 80 Series

NOMENCLATURE	LOCATION
A/C Compressor	C-1
A/C Micro Switch Connector	B-5
A/C Temperature Sensor	C-1
A/C Thermostat	B-5
Alternator, Six-Cyl. (Delco)	B-2 & C-2
Alternator, Eight-Cyl. (Motorcraft)	B-2
Ash Receiver Lamp	A-7
Auto. Trans. Neutral & Back-up Lamp Switch	D-2
Back-up Lamp, Left	D-11
Back-up Lamp, Right	B-11
Battery	A-2
Blower Motor	B-4
Blower Motor Resistor	B-4
Body Ground	C-11
Body Ground on Dash Panel	A-7
Body Harness Connector	E-8
Brake Failure Warning Light Switch	A-4
SSI Module	A-3
Cargo Lamp (Wagon Only)	C-10
Cargo Lamp Switch (Wagon Only)	C-10
Cigar Lighter	A-7
Clock	A-5
Coil	C-2
Courtesy Lamp, Left Side	D-9
Courtesy Lamp, Right Side	B-9
Dash Connector	C-4
Dimmer Switch	E-5
Directional Signal Flasher	E-7
Directional Signal Switch	C-7 & C-8
Distributor	C-2
Dome Lamp	C-10
Door Switch, Left Front	D-8
Door Switch, Left Rear	E-8
Door Switch, Right Front	B-9
Door Switch, Right Rear	A-9
Fuse Panel	A-9 & E-6
Fusible Link, Horn Relay	A-2
Fusible Link, Ignition Switch Solenoid Circuit	A-7 & B-7
Fusible Link, Starter Solenoid	A-2
Glove Box Lamp	A-8
Hazard Flasher	D-6
Headlamp, Left Side	E-1
Headlamp, Right Side	A-1
Headlamp Switch	D-6
Headlamp & Wiper Switch Light	C-6
Heater Blower Switch	A-5
Heater Control Lamp	A-5
Horn Contact	C-7
Horn, Left Side (Low)	D-1
Horn Relay	A-2
Horn, Right Side (High)	B-1
Ignition Switch	B-8
Instrument Cluster Circuit Panel	A-6 & B-6
Instrument Panel Ground	A-7
Key Alarm Contacts	C-7
Key & Headlamp Warning Buzzer	C-6
License Lamp Assembly	C-11
Light Ground Screw in Trunk	C-11
Oil Pressure Sending Unit	C-3
Parking Brake Light Switch	B-7
Parking Lamp, Left Side	D-1
Parking Lamp, Right Side	B-1
Radio Connector	B-5

NOMENCLATURE	LOCATION
Resistance Wire, Splice "L"	D-3
Seat Belt Buzzer	C-8
Sending Unit, Gas Tank	D-10
Sending Unit, Water Temperature	D-2
Side Marker Lamp, Left Front	E-1
Side Marker Lamp, Left Rear	E-11
Side Marker Lamp, Right Front	A-1
Side Marker Lamp, Right Rear	A-11
Splice "A"	A-2
Splice "B"	B-2
Splice "C"	D-7
Splice "D"	D-6
Splice "E"	A-7
Splice "F"	A-6
Splice "H"	B-7
Splice "J"	A-6
Splice "L"	D-3
Splice "N"	E-1
Splice "P"	B-1
Splice "Q"	D-1
Splice "R"	B-1
Splice "S"	E-11
Splice "T"	B-10
Splice "U"	C-11
Splice "V"	D-10
Splice "W"	D-10
Starter	B-3
Starter Solenoid	A-2
Steering Column Connector	C-7
Stoplight Switch	D-7
Tail & Stop Lamp, Left Inner	D-11
Tail & Stop Lamp, Left Outer	E-11
Tail & Stop Lamp, Right Inner	B-11
Tail & Stop Lamp, Right Outer	A-11
Thermo Timer	C-9
Third Gear Switch (On Trans.)	C-2
Throttle Closing Solenoid	D-2
Transmission Control Spark (TCS) Solenoid	D-2
Trunk Lamp	D-10
Voltage Regulator, Eight-Cyl.	B-2
Windshield Washer Reservoir & Motor, Electric	E-2
Windshield Wiper Motor	C-4
Windshield Wiper Switch	C-6

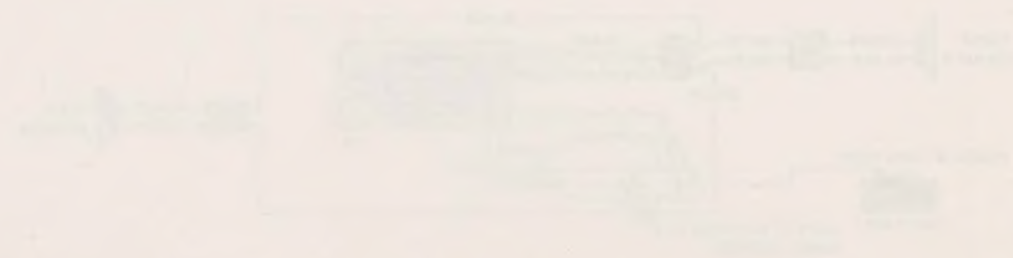
Wiring Diagram
Matador
80 Series

Accessory Diagrams

Pacer

Accessory Diagrams
Gremlin, Concord and AMX

Accessory Diagrams
Matador 10-80



ACCESSORY WIRING DIAGRAMS MATADOR 10-80 SERIES

AMC