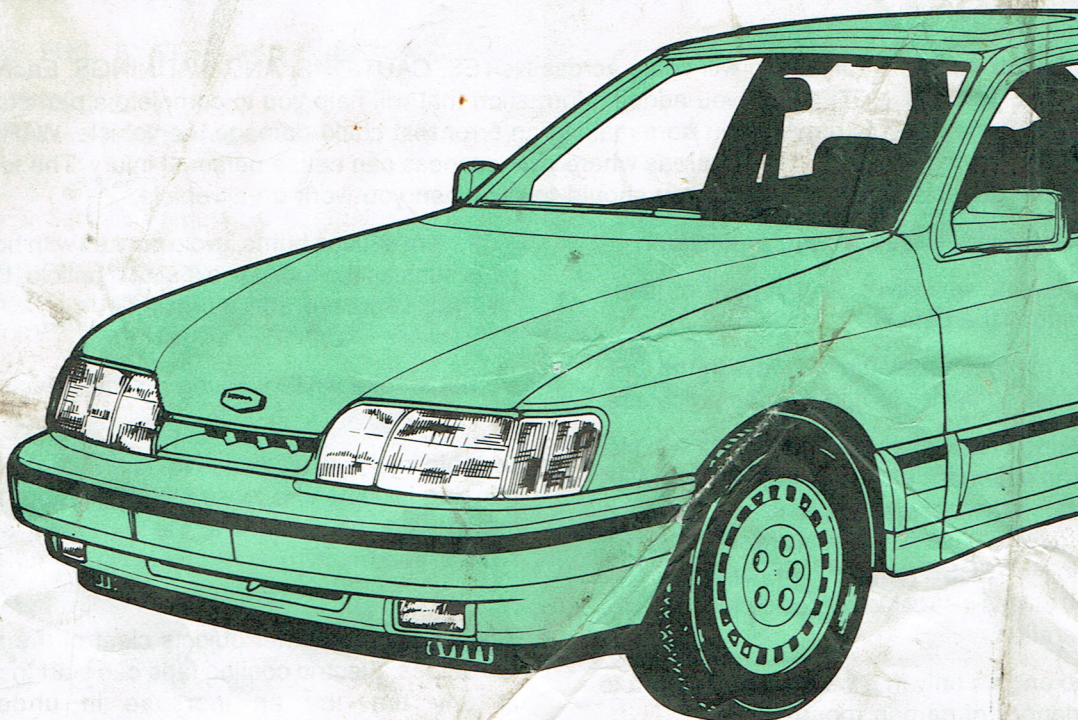


**1988**



## **Scorpio Service Features**



**Ford Parts and Service Division  
Training and Publications Department**



## IMPORTANT SAFETY NOTICE

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from instructions provided in this manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

As you read through the procedures, you will come across NOTES, CAUTIONS, AND WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific service operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific service operation.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on the vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle. Tie long hair securely behind head.
- Keep hands and other objects clear of the radiator fan blades. Electric cooling fans can start to operate at any time by an increase in under-hood temperatures, even though the ignition is in the OFF position. Therefore, care should be taken to insure that the electric cooling fan is completely disconnected when working under the hood.

The recommendations and suggestions contained in this manual are made to assist the dealer in improving his dealership parts and/or service department operations. These recommendations and suggestions do not supersede or override the provisions of the Warranty and Policy Manual, and in any cases where there may be a conflict, the provisions of the Warranty and Policy Manual shall govern.

The descriptions, testing procedures, and specifications in this handbook were in effect at the time the handbook was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications, design, or testing procedures without notice and without incurring obligation. Any reference to brand names in this manual is intended merely as an example of the types of tools, lubricants, materials, etc. recommended for use. Equivalents if available may be used. The right is reserved to make changes at any time without notice.



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## INTRODUCTION

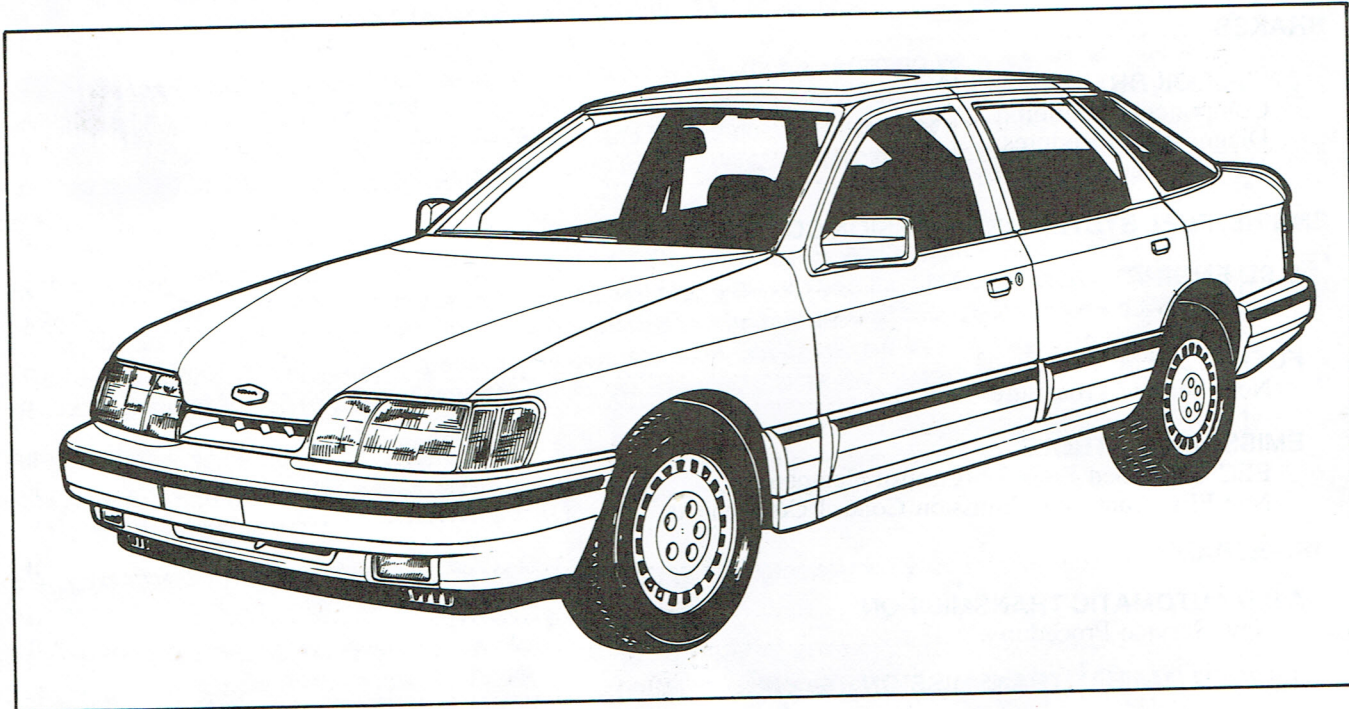


Figure 1, 1988 Scorpio

The Scorpio is a rear wheel drive, 5-passenger, 4-door hatchback. The Merkur Scorpio is designed as a prestigious European luxury touring sedan, blending clean exterior styling and luxurious interior appointments.

The purpose of this book is to provide an initial introduction to the many new features found on the Scorpio.

The Scorpio is available with the following engine and transmissions:

- A 2.9L V-6 with electronic fuel injection as standard equipment (this engine is very similar to the one used in the Ranger/Bronco II).
- A 4-speed automatic transmission (A4LD) which includes a lock up converter and overdrive.
- A 5-speed manual (G5S - Hummer) unit which provides overdrive in fifth gear.

Several of the components or service procedures of the Scorpio are unique or different from those currently used. These will be covered in detail in this book. These components/service procedures include:

- Anti-Lock Brake System (ABS)
- Front and rear spindle bearings
- Collapsible steering column with adjustable steering wheel for tilt and reach

- ZF power steering gear
- 2.9L V-6 engine
- A4LD automatic transmission

Coverage of electrical and body components/service procedures in this manual are handled on a selected component basis, because there are several unique to the Scorpio. Those given attention to include:

- Quick release doors
- Auxiliary warning system
- Speed control system
- High security lock system
- Rear power seat recliner
- Automatic temperature control system
- Taillight bulb replacement
- Instrument panel pad (location of fuses, relays and control modules)
- Audio system with rear defroster grid antenna

At the end of the manual is an appendix which provides service information which may be useful to the service technician. The Appendix items include vehicle specifications and new special service tools.



# BRAKES

## ANTI-LOCK BRAKE SYSTEM

The anti-lock brake system (ABS) (Fig. 2) used in the Scorpio is very similar to the one used on the Mark VII. The major difference is in the hydraulic unit which is a single piston configuration rather than the dual piston type.

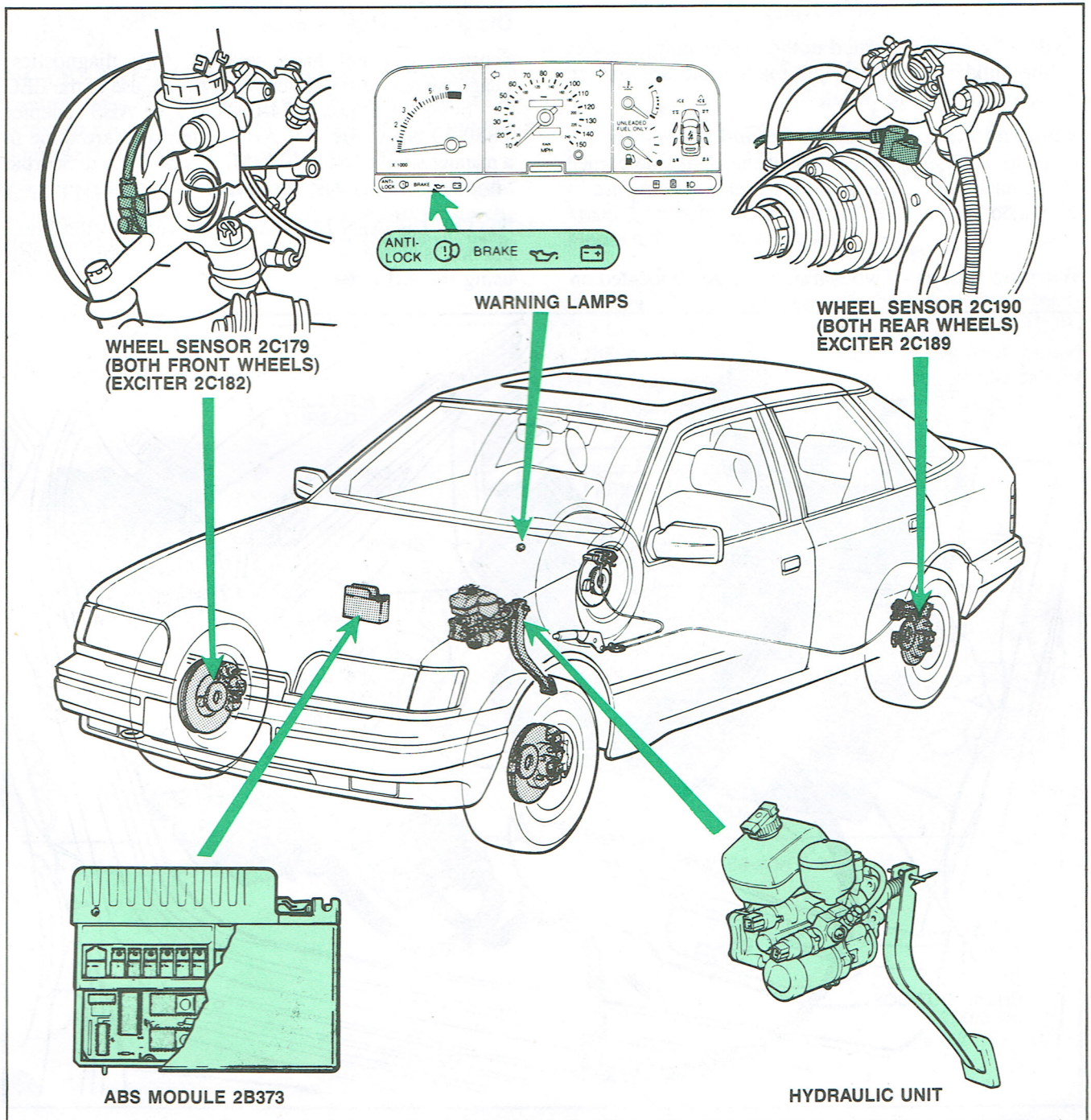


Figure 2, Antilock Brake System Component Location



## BRAKES

### Component Location

**Wheel Sensors** - Located in the front knuckles and rear spindle arms, these are each retained by a single bolt. The sensors require no adjustment in service.

**ABS Module** - Located behind the glove box on the passengers side of the vehicle. It cannot be repaired. When defective it must be replaced.

**Hydraulic Unit** - Located in the engine compartment on the bulkhead. Service kits for Scorpio are similar to those available for Mark VII.

**Main and Pump Relays, Diodes and Fuses** - The relays and diodes are located under the right side corner of the dash panel. The anti-lock brake system fuse is contained in the fuse box above the glove compartment.

**Warning Lamps** - Two warning lamps are located on

the lower part of the instrument panel to the left of the steering column. They are:

- ABS warning lamp
- "Brake" warning lamp with its three functions for low brake fluid level, low hydraulic pressure and parking brake on indications.

### Diagnostic Procedures

Scorpio does not have self-test ABS diagnostics. Diagnosing the ABS system requires the use of the EEC IV break out box 014-00322 and ABS adapter T85P-50-ASA (Fig. 3). ABS diagnostics are done in a manner similar to the 1986 Mark VII. Refer to Scorpio Shop Manual for test procedure.

**NOTE:** The ABS Module is removed and the break out box is connected to the vehicle ABS wiring harness using the ABS adapter.

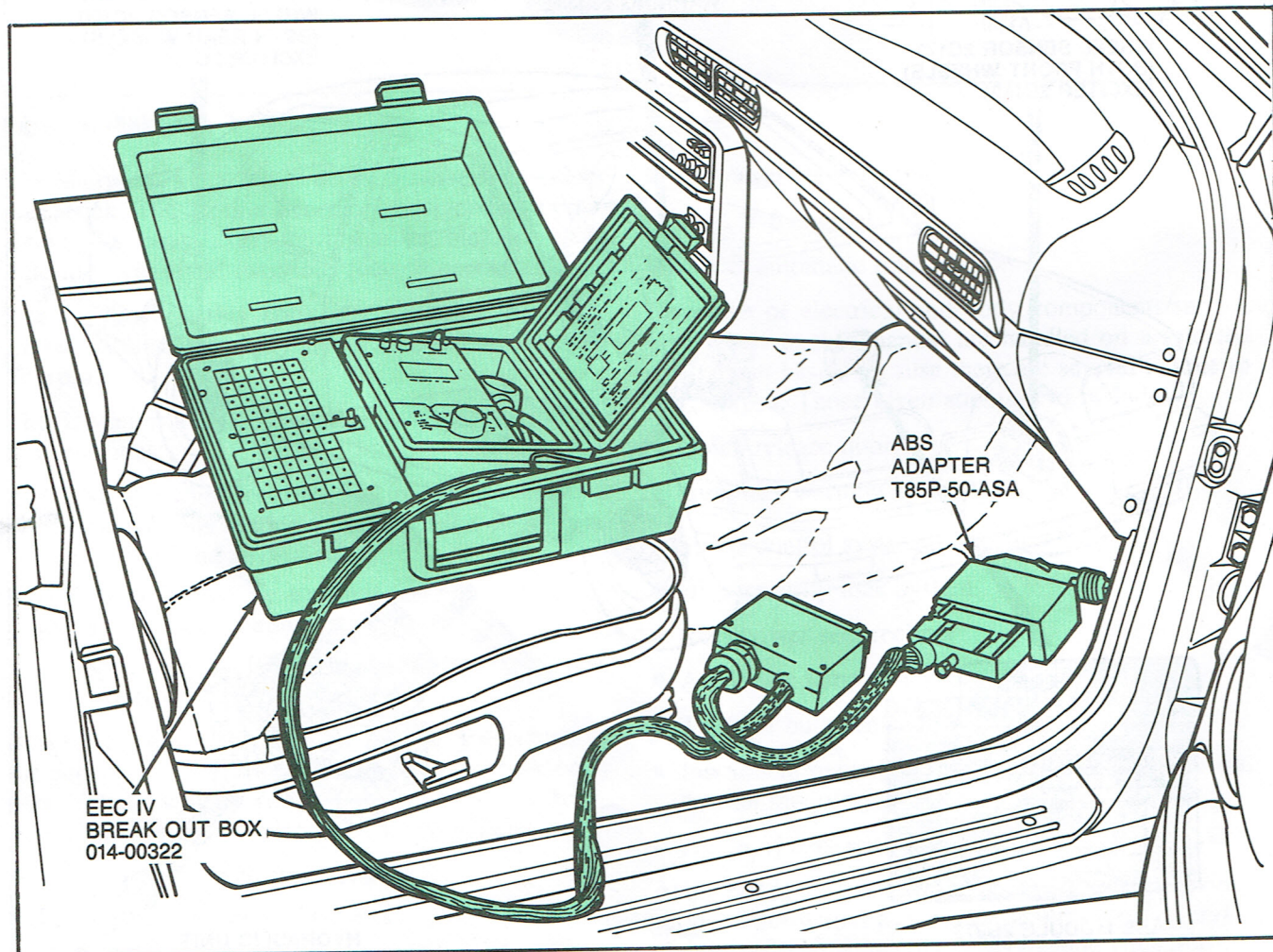


Figure 3, ABS Adapter and EEC IV Break Out Box



# BRAKES

## New Service Procedures

New service procedures on the brake system are primarily found in the overhaul of the rear calipers (Fig. 4). Service procedures on the rear calipers are similar to service on other calipers except for the installation of the snap ring in the caliper housing. This procedure requires the use of special tool T87P-2588-B (Fig. 5).

**NOTE:** T87P-2588-B contains four separate components. Tools B1, B2 and B3 are used on the Scorpio rear caliper. Tool B4 is used only on the Thunderbird Turbo Coupe rear caliper.

**CAUTION:** Do not attempt a rear caliper rebuild without the correct special tools. The caliper can be disassembled, but correct assembly is difficult without them.

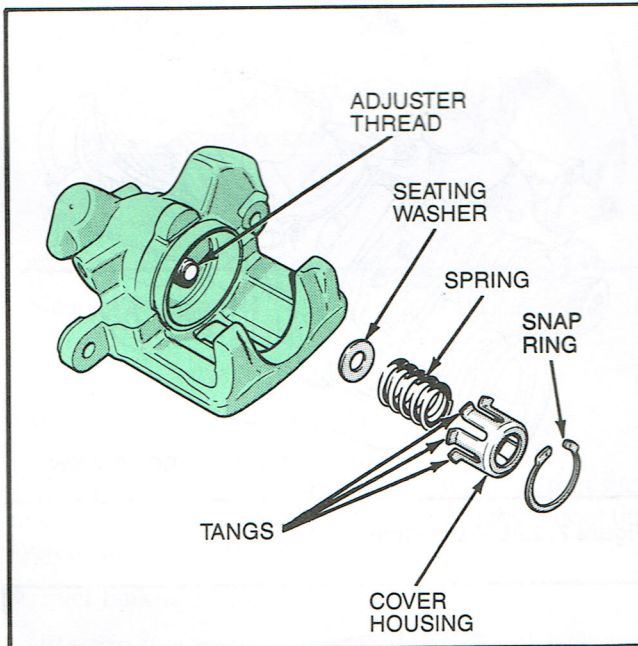


Figure 4, Rear Caliper Assembly (2553)

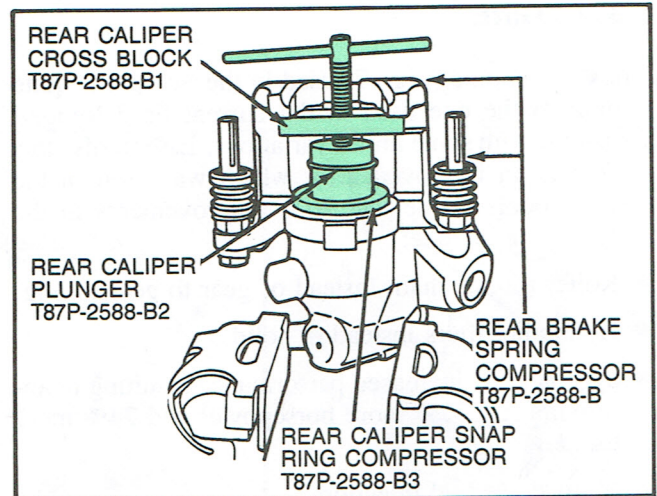


Figure 5, T87P-2588-B In Use

Another important procedure to be aware of is retracting the caliper piston. This requires the use of T87P-2588-A. During this procedure the piston is turned on the adjuster thread to draw it back into the caliper (Fig. 6) so that new brake pads can be installed.

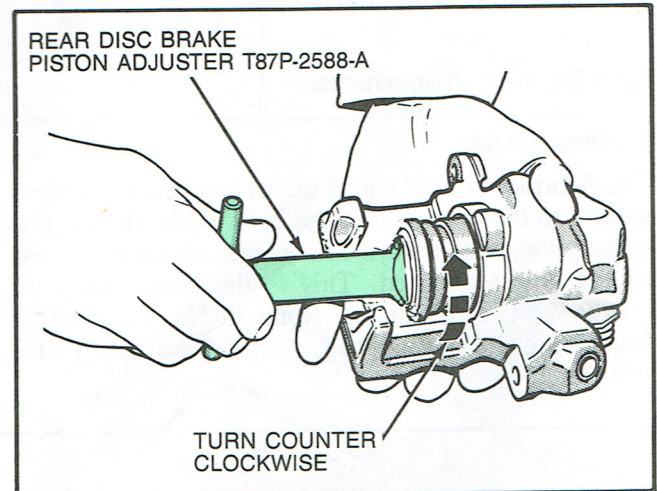


Figure 6, T87P-2588-A In Use



# ENGINE, FUEL SYSTEM AND EMISSION CONTROLS

## 2.9L ENGINE

The 2.9L engine (Fig. 7) used in the Scorpio is quite similar to the one used in the current Ford Ranger/Bronco II with some minor variations. Essentially, this engine is an improved 2.8L which was used in the Capri models in the late 70's. Improvements in the 2.9L engine include:

- Roller timing chain instead of gear to gear timing.
- Hydraulic lifters instead of solid.
- Significantly increased performance resulting in approximately 22% more horsepower and 24% more torque.
- Multi-point fuel injection.
- Tuned runner length intake system.
- Lightweight aluminum front cover.
- Crankshaft windage tray.
- EEC IV electronic engine control system.
- "Fastburn" combustion chambers.
- Weight and friction reductions.

## New Service Procedures

### Cooling System

The Scorpio radiator cap (Fig. 8) is a screw on type, similar to the one used on the 2.4L Turbo diesel. For testing the cooling system, a special pressure test adapter must be used. This is the same one used on the 2.4L turbo diesel, Rotunda No. 021-00035. For testing the radiator cap, use Radiator Cap Tester 021-00052.

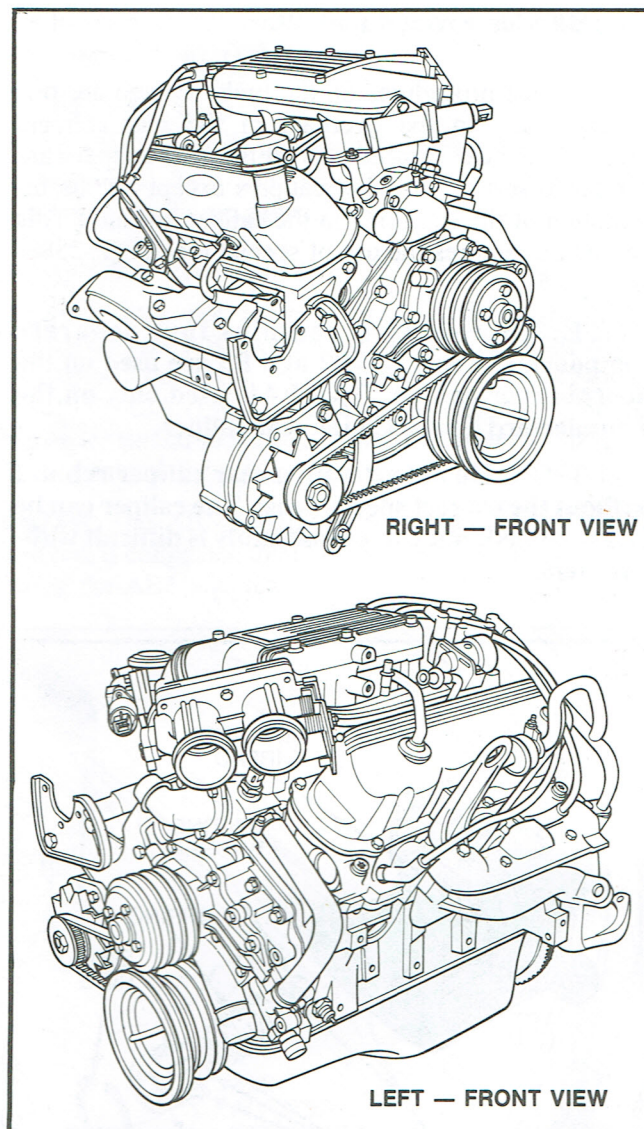


Figure 7, 2.9L V-6 Engine

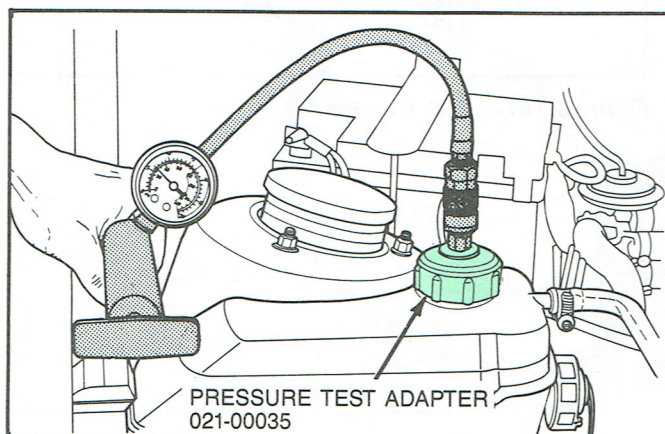
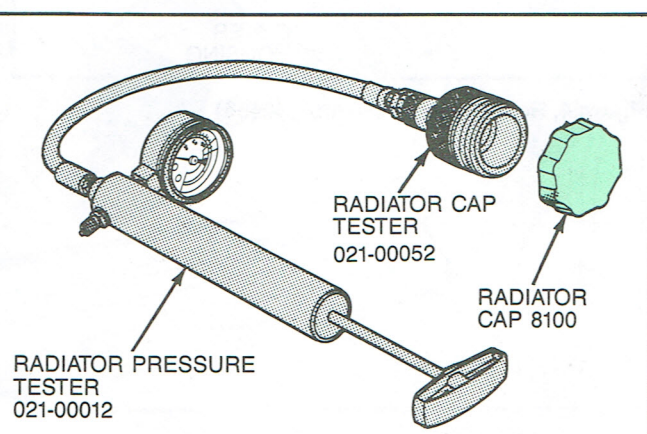


Figure 8, Scorpio Cooling System Testing





# ENGINE, FUEL SYSTEM AND EMISSION CONTROLS

To remove the engine fan for repairs or for water pump service, use these tools to hold the pulley hub and loosen the fan (Fig. 9).

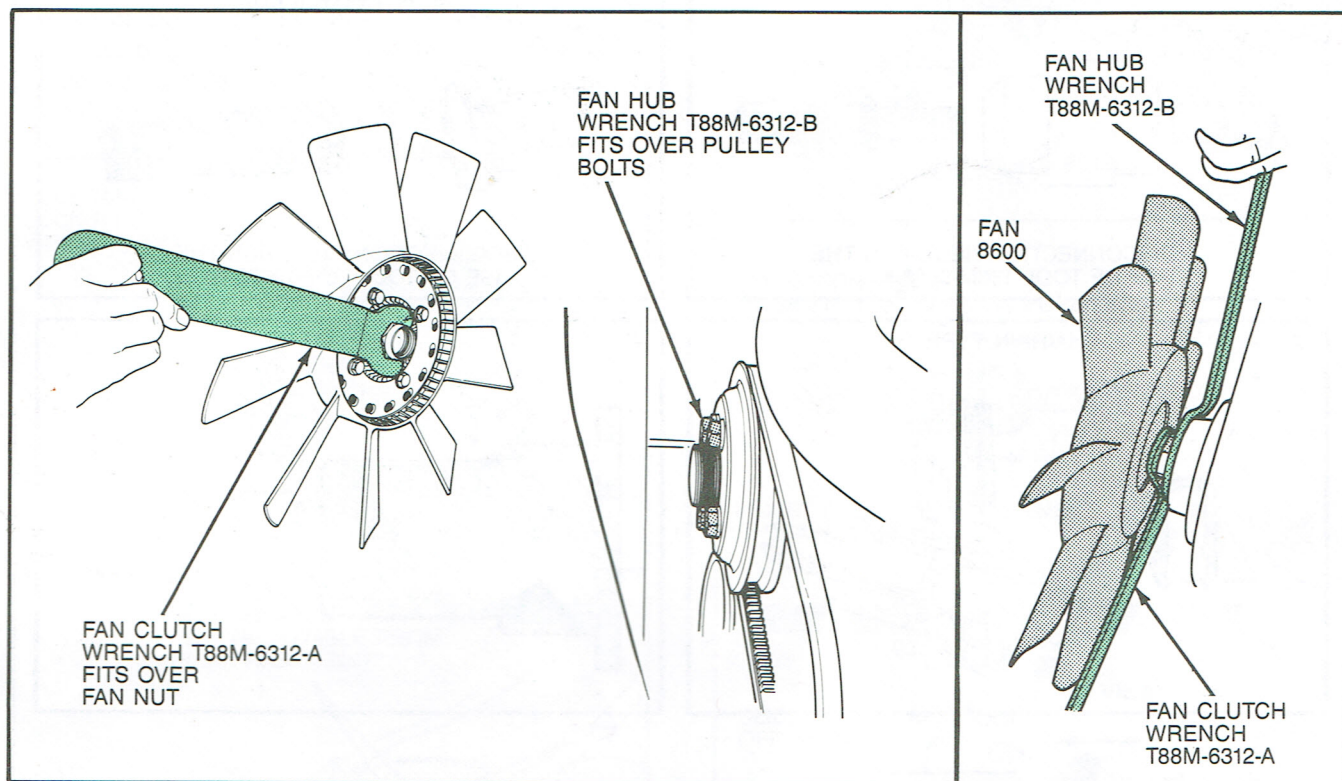


Figure 9, Fan Removal

## FUEL SYSTEM

The Scorpio uses an electronically controlled port fuel injection system. Special points to remember about the system include:

- Fuel tank is made of plastic.
- Electric fuel pump is mounted in the fuel tank and is retained by a plastic lock ring with a band clamp.
- Fuel is filtered in a high capacity fuel filter mounted on the left hand side of the underbody, beneath the rear seat area.
- Fuel filler door is electrically released by a switch located in the console. A manual release is located in the jack stowage compartment (this is a simple pull cord mechanism).
- The fuel rail is the same as that used for the 2.9L Ranger/Bronco II. A Schraeder Valve is available for fuel pressure testing (Fig. 10).

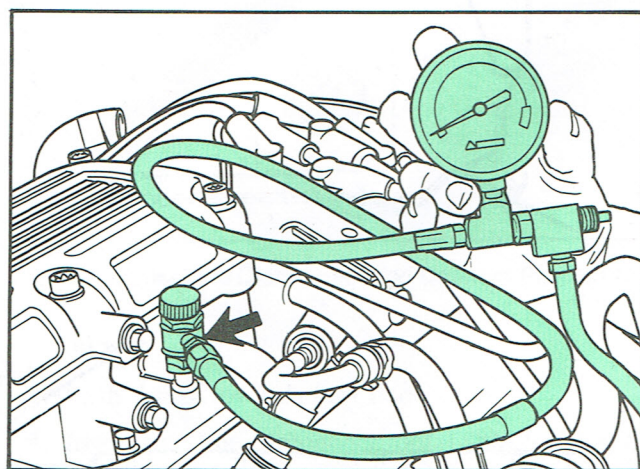


Figure 10, Schraeder Valve

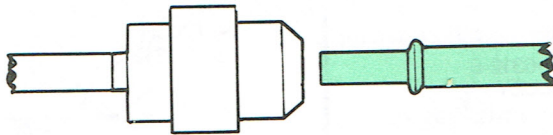
- There are four different types of fuel line couplings used on the Scorpio (Fig. 11). Only one of the couplings requires a new special tool for disassembly.



# ENGINE, FUEL SYSTEM AND EMISSION CONTROLS

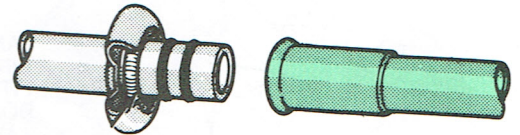
## FUEL SYSTEM PUSH CONNECT FITTINGS

1. ENCLOSED TYPE



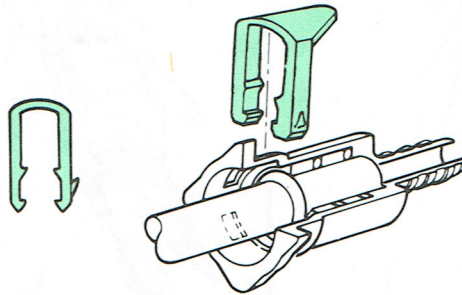
DISCONNECTION REQUIRES THE  
USE OF TOOL T88M-9550-A

3. SPRING-LOCK (3/8)



DISCONNECTION REQUIRES THE  
USE OF TOOL T81P-19623-G1

2. HAIRPIN TYPE



4. PUSH-FIT

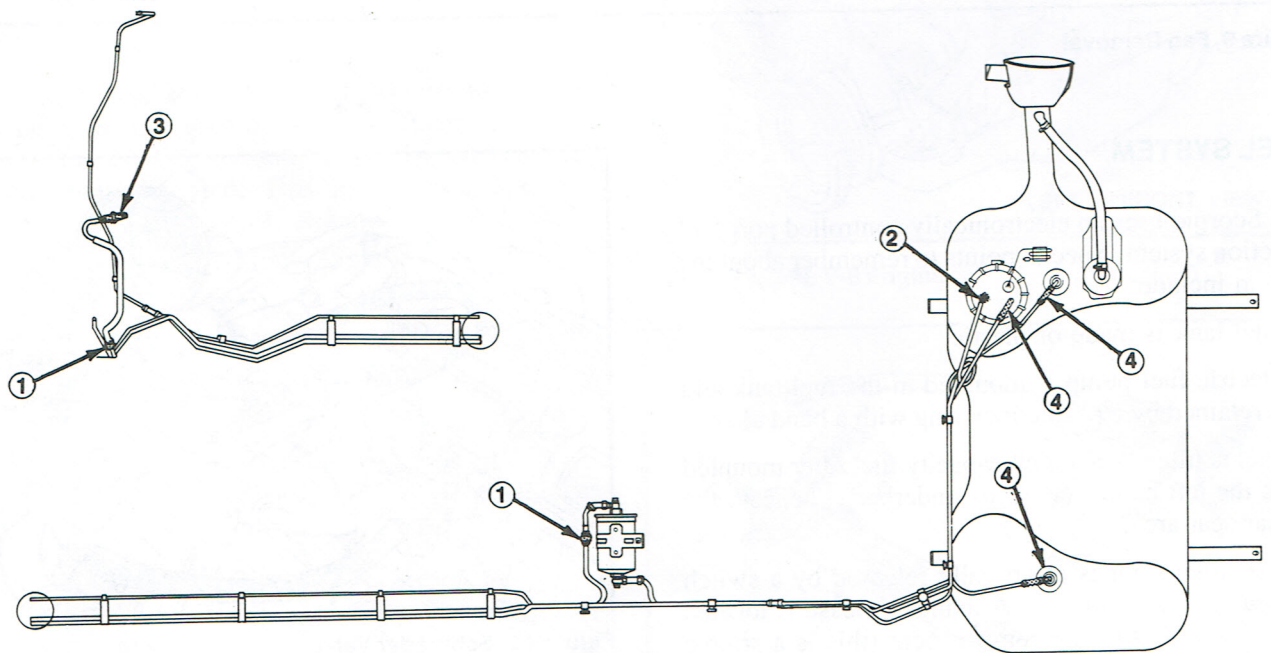
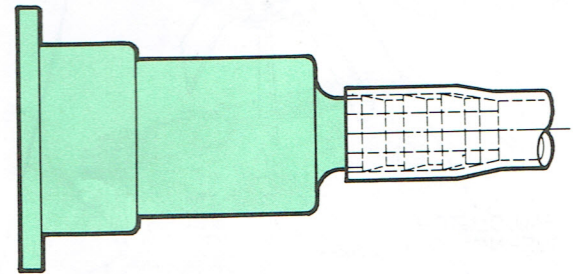


Figure 11, Scorpio Fuel System and Couplings



# ENGINE, FUEL SYSTEM AND EMISSION CONTROLS

## New Service Procedures

Tool T88M-9275-A or equivalent, is required to correctly torque the plastic fuel tank lock ring (Fig. 12). Whenever installing the lock ring, assure that it is tightened to specifications. Insufficient or excessive torque would affect the fuel pump mounting, which is retained by the lock ring.

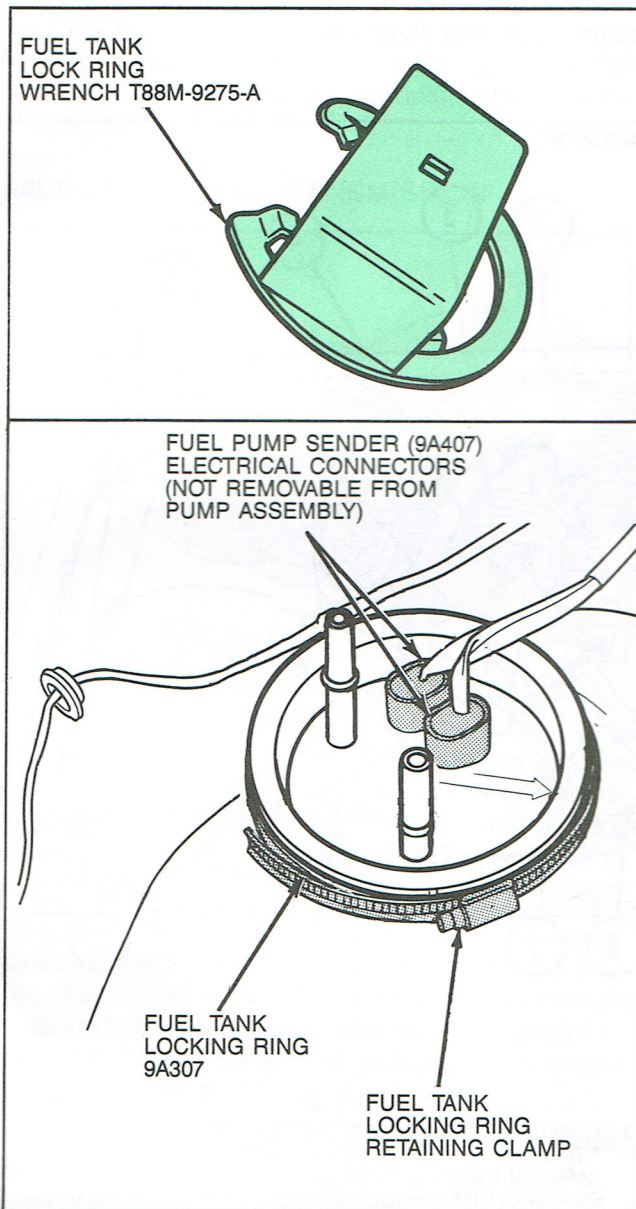


Figure 12, Installing Fuel Pump Lock Ring

The enclosed type fuel coupling requires tool T88M-9550-A or equivalent, to release the fuel line from the coupling. Use the following procedure (refer to Fig. 13) to disconnect and connect the fuel line:

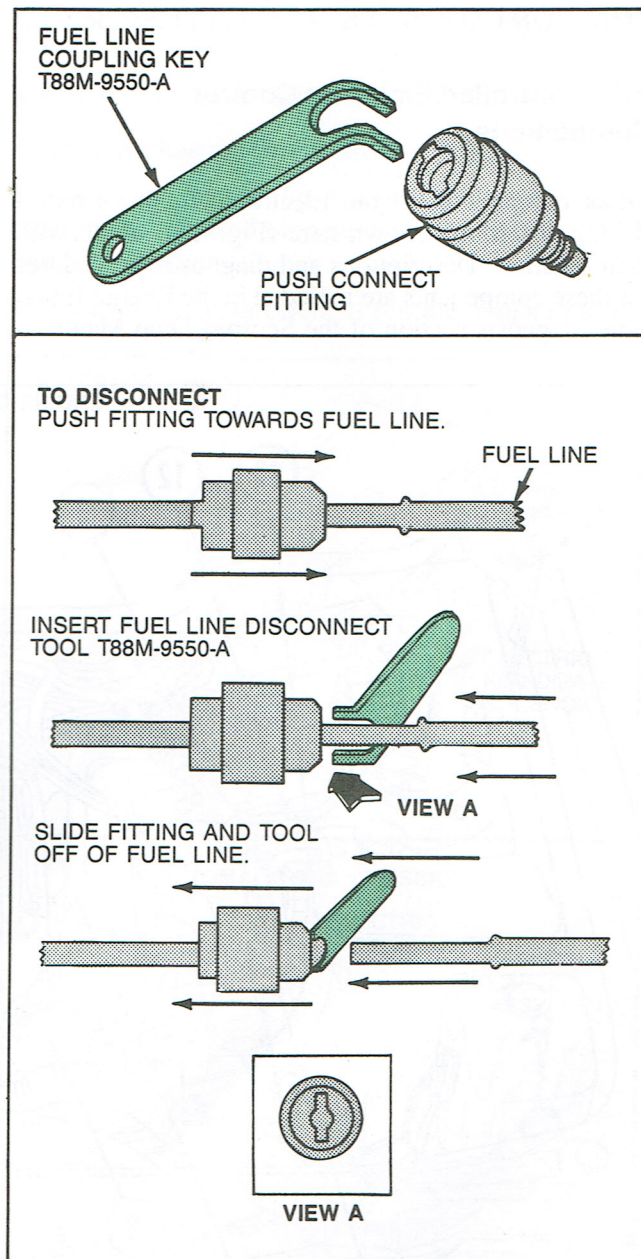


Figure 13, Fuel Line Disconnect and Connect Procedure

## Disconnect

1. Push fitting towards fuel line
2. Insert fuel line disconnect tool T88M-9550-A or equivalent.
3. Slide fitting and tool off of fuel line.

## Connect

1. Make sure fuel line is clean. Slide fitting onto fuel line as far as possible.



# ENGINE, FUEL SYSTEM AND EMISSION CONTROLS

## EMISSION CONTROLS

### EEC Controlled Emission Control Components

Major components of the Electronic Engine Control (EEC) system are shown here (Fig. 14), along with their location. Descriptions and diagnostic procedures for these components are included in the Engine/Emission Diagnosis section of the Scorpio Shop Manual.

### Non-EEC Controlled Emission Control System Components

The only emission control system not controlled by the EEC system is the Positive Crankcase Ventilation (PCV) system. This is a typical closed-type system, common to other Ford vehicles.

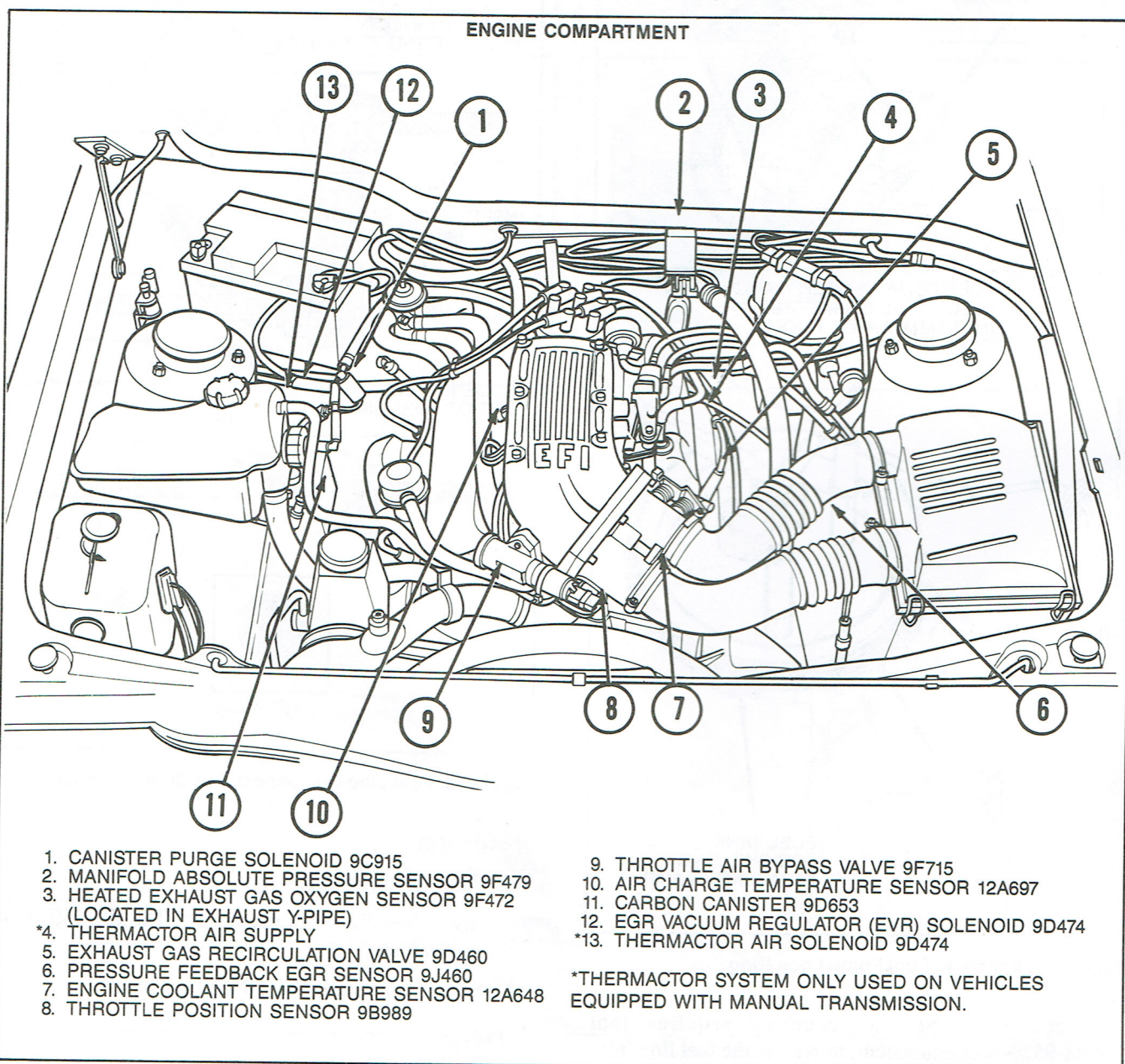


Figure 14, EEC Controlled Emission Control Components



## DRIVETRAIN

The standard equipped Scorpio comes with an A4LD automatic transmission, which has been used in some Ford vehicles since 1985. There are some minor modifications which are common only to the Scorpio which will be covered in this manual.

An optional manual transmission is available. It is the same transmission that is currently used in the Merkur XR4Ti.

For 1987 the G5S Hummer has been revised. Changes have been made to the case, cluster gear and bell housing. For more detailed information refer to the Merkur XR4Ti Update Manual.

### A4LD AUTOMATIC TRANSMISSION

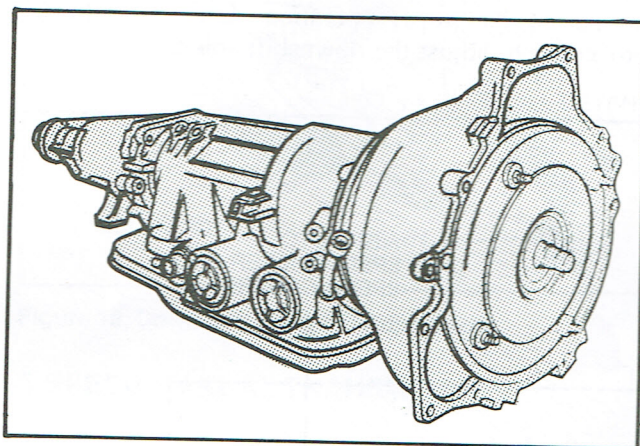


Figure 15, A4LD Automatic Transmission

The A4LD (Fig. 15) is a fully automatic transmission with four speeds forward, and one reverse. It consists of a welded lock up torque converter assembly, a three unit planetary gear train, and a hydraulic system to control gear selection and the locking torque converter.

The lock up torque converter is coupled to the engine crankshaft, and transmits engine power into the gear train. The output shaft drives the rear wheels through the driveshaft and rear axle. Gear reduction needed to match the engine to the axle takes place in the planetary gear train and in the lock up converter.

Hydraulic controls in the valve body operate a piston plate clutch in the torque converter that eliminates torque converter slip when applied.

**NOTE:** Complete A4LD information is covered in the A4LD AUTOMATIC TRANSMISSION OPERATION AND DIAGNOSIS Reference Manual, Order No. 1701-020, and A4LD AUTOMATIC TRANSMISSION DISASSEMBLY AND ASSEMBLY Reference Manual, Order No. 1701-021.

### New Service Procedures

#### Kickdown Operation and Adjustment

#### Electric Kickdown Operation

The kickdown feature (fig. 16) used on Scorpio is quite different to that used on other vehicles and comprises four main elements:

- Electric kickdown solenoid (on the transmission)

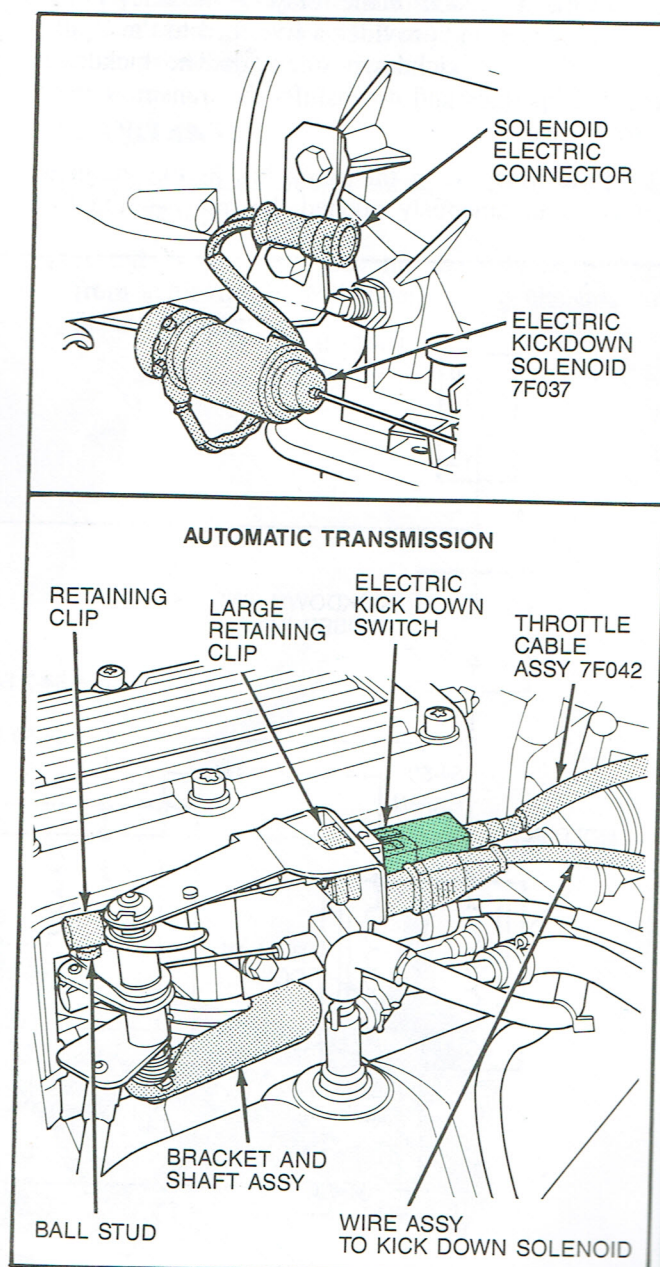


Figure 16, Kickdown Components: Kickdown Solenoid & Kickdown Switch



## DRIVETRAIN

- Kickdown switch (part of the accelerator cable)
- Kickdown time relay (under the instrument panel)
- Speed sensor (on the transmission)

Under normal and acceptable kickdown speeds when the driver depresses on the accelerator pedal the kickdown switch closes and applies a live feed to the "hold-in" coil in the kickdown solenoid.

Simultaneously the kickdown switch supplies a live feed to the time side of the relay — the relay is energized, closes and provides a live feed to the "pull-in" coil in the kickdown solenoid. The kickdown solenoid operates and downshifts the transmission to a lower gear.

The time function in the relay has at this moment almost instantaneously opened the relay — the live

feed to the "pull-in" coil is lost, but the feed directly from the throttle switch retains the "hold-in" function to maintain downshift mode.

Should the driver now release his foot from the kickdown pedal, the hold-in coil is released and the kickdown solenoid returns to its normal drive position. The electrical schematic showing how these components are interconnected is shown in figure 17.

At engine/transmission speeds in excess of 4000 RPM sensed by the speed sensor, a signal from the speed sensor to the relay overrides the relay function preventing it from operating the "pull-in" coil. Total plunger travel is approximately 4mm (3/16 in.) so a justment of the downshift solenoid is extremely important to its proper operation. Use the following procedure to adjust the downshift solenoid:

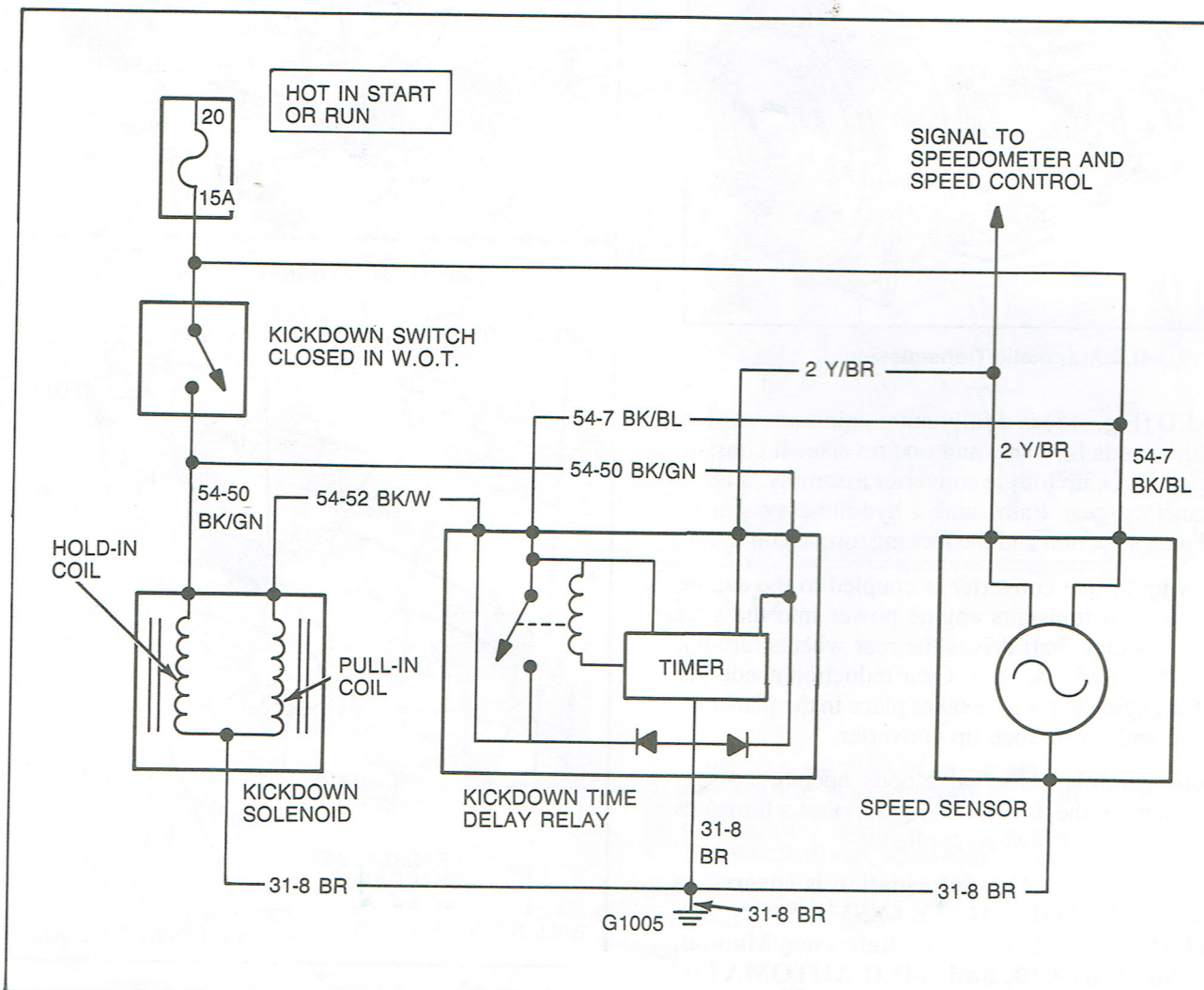


Figure 17, Kickdown Component Electrical Schematic



## DRIVETRAIN

### DOWNSHIFT SOLENOID ADJUSTMENT PROCEDURE (Fig. 18):

1. Position solenoid and bracket assembly on transmission and install mounting bolts finger tight.
2. Connect the cable end to the ball stud.
3. Move kickdown lever to full detent position (counterclockwise).
4. Turn ignition to RUN (position II) and depress accelerator pedal to W.O.T. position to energize the kickdown switch.
5. Pull the solenoid toward the front of the vehicle until a slight tension is felt on the cable. Tighten the bolts.
6. Release, then again depress the accelerator pedal to W.O.T.
7. Verify that the plunger reaches full detent position by checking whether the kickdown lever has an end clearance up to 0.2 mm (0.008 in.). Adjust as necessary.

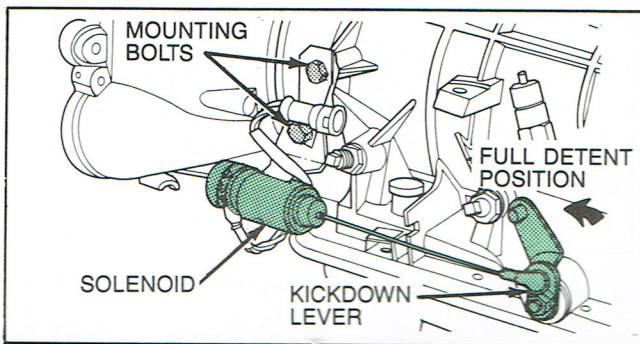


Figure 18, Downshift Solenoid Adjustment

### IMPORTANT!

- A loose adjustment will not allow the lever to reach the detent position.
- A tight adjustment prevents the solenoid plunger from achieving its full travel and results in insufficient holding force.

### 5-SPEED MANUAL TRANSMISSION

The manual transmission available with the Scorpio (Fig. 19) has three reduction gear ratios, a one-to-one gear ratio and an overdrive gear ratio. These forward ratios are provided through helical-cut, constant mesh gears. Except for gear ratios, this transmission is identical to the one used in the Merkur XR4Ti and has the same service procedures.

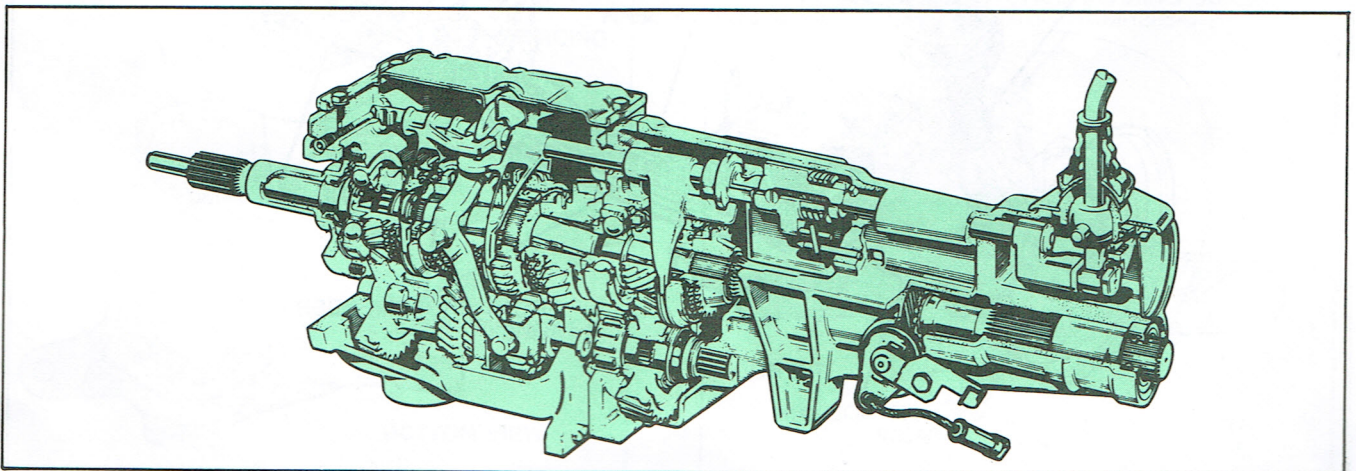


Figure 19, 5-Speed "Hummer" Manual Transmission



## WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

### WHEELS AND TIRES

The wheel profile on the Scorpio is the same as the Merkur XR4Ti. Just like the XR4Ti, the Scorpio uses special wheel weights (Fig. 20). Wheel construction prohibits the use of conventional wheel weights.

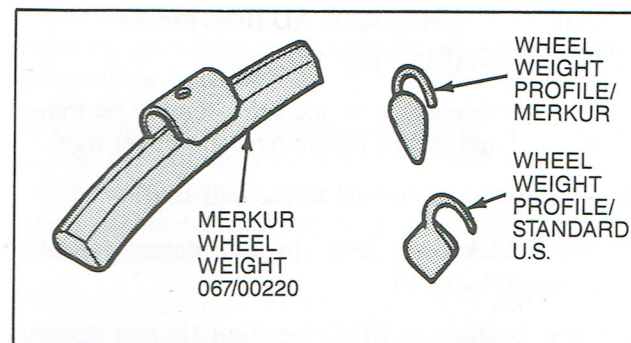


Figure 20, Wheel Weights

### FRONT SUSPENSION

The front suspension is the MacPherson strut, independent-type (Fig. 21). The upper end of the strut is anchored to the car body. The strut is isolated by rubber in the top mount which also includes a bearing pivot for smooth steering control. Maintenance-free ball joints, steering tie rods, and front suspension control arms are used. There is no lubrication requirement on these components.

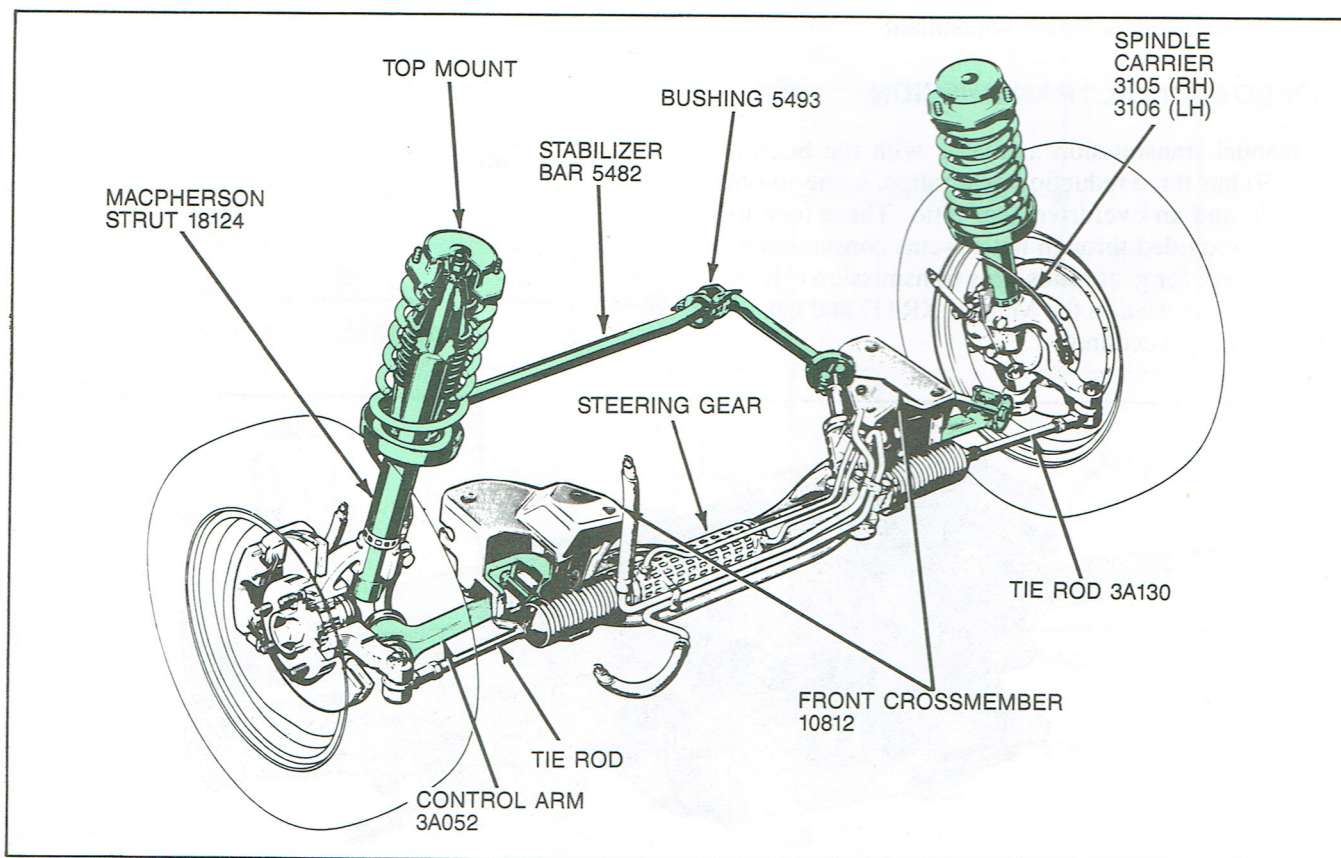


Figure 21, Scorpio Front Suspension



# WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

## New Service Procedures

New service procedures on the front suspension are primarily for the spindle bearing removal and installation procedure. The removal requires two new special tools Front Hub Forcing Cups (T88M-1225-B2) and the Front Hub Bearing Cup Remover (T88M-1225-B1) (Fig. 22).

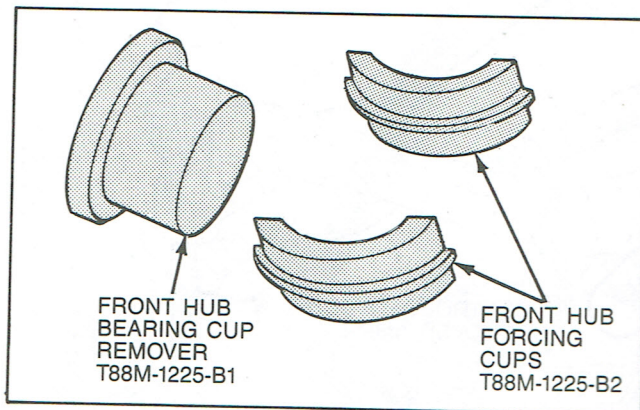


Figure 22, Front Bearing Cup Removal Special Tools

The forcing cups are used to contact the edge of the bearing cup as shown here (Fig. 23). They are necessary because of the extremely close fit between the inner and outer cups.

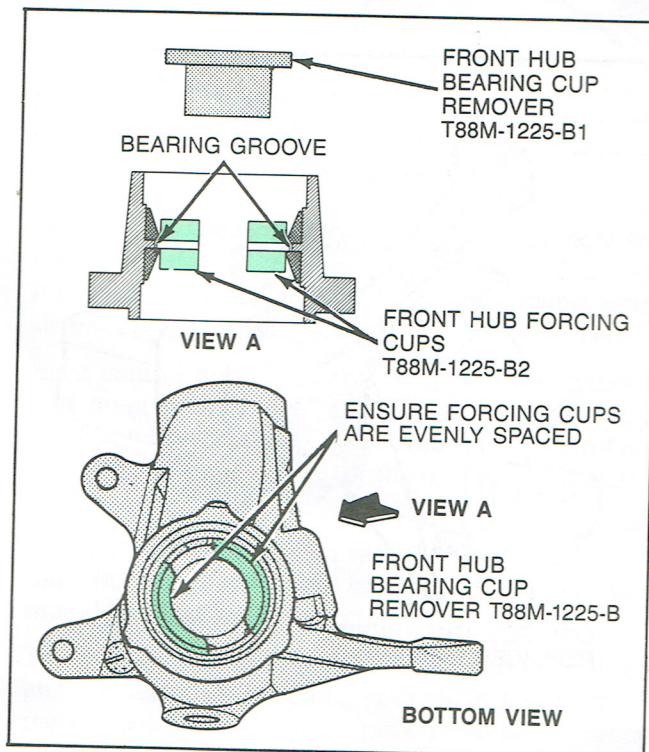


Figure 23, Forcing Cups In Position

The Front Bearing Remover pushes against the Forcing Cups to force the bearing cup out (Fig. 24). Detailed procedures for removal and installation are contained in Section 11-15 of the Scorpio Shop Manual.

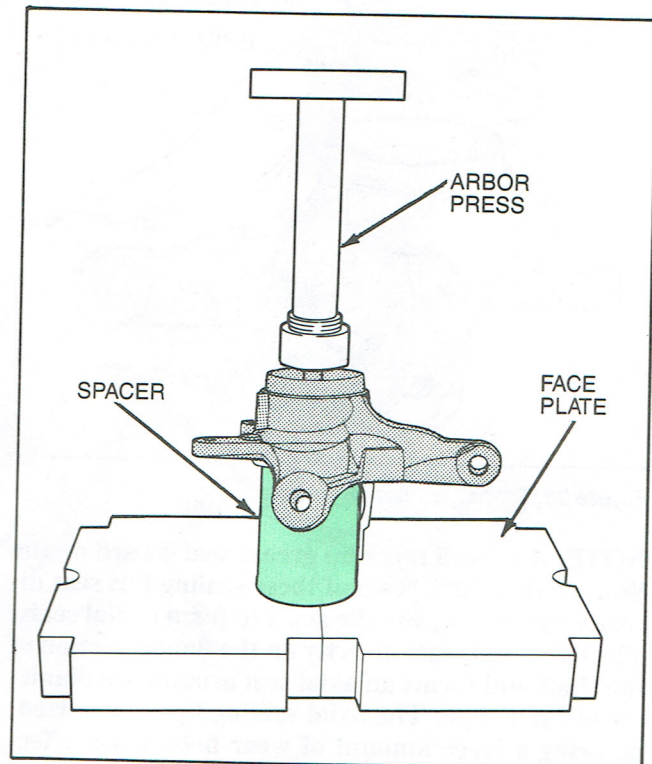


Figure 24, Removing Front Bearing Cup

The bearing cups are replaced by pressing them in with the Front Bearing Cup Replacer (T88M-1225-C) (Fig. 25)

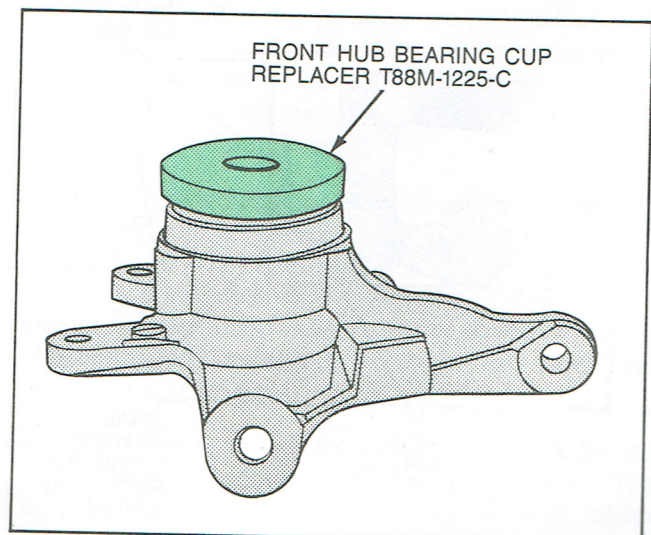


Figure 25, Front Bearing Cup Replacer



## WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

The spindle inner grease seal must be installed using Front Hub Seal Replacer (T88M-1249-A) (Fig. 26).

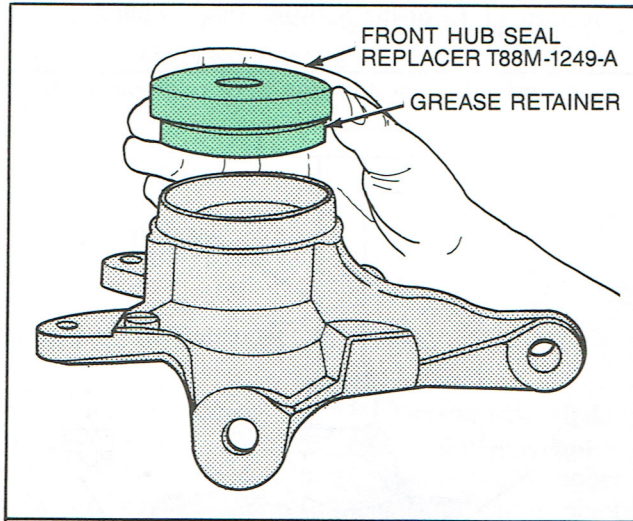


Figure 26, Front Hub Seal Replacer

**NOTE:** A special three lip grease seal is used on the Scorpio (Fig. 27). Two of these sealing lips seat directly against the spindle shaft to form radial seals. The third seal seats directly on the flange portion of the shaft and forms an axial seal around the diameter of the flange. The axial sealing lip is oversized, allowing a large amount of wear before seal effectiveness is reduced. Prior to installing new grease seals, always apply a small amount of grease between the sealing lips to act as a lubricant reservoir. This will prevent early seal lip wear.

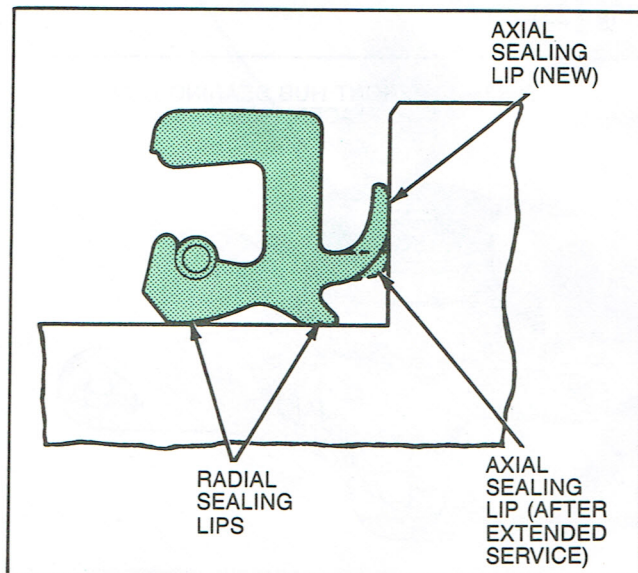


Figure 27, Three Lip Grease Seal (1131)

Another service procedure to be aware of is the removal and installation of the control arm bushing. This is accomplished with the Control Arm Bushing Remover T88M-5493-A or equivalent (Fig. 28). Control Arm Bushing Replacer T88M-5493-B or equivalent (Fig. 29).

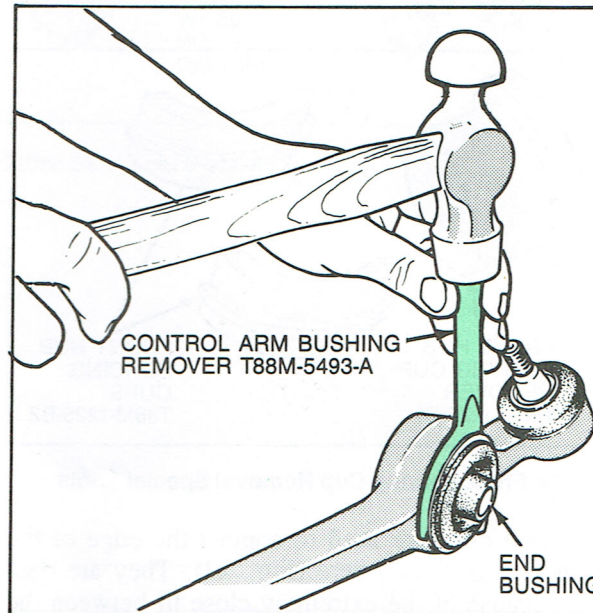


Figure 28, Control Arm Bushing Remover In Use

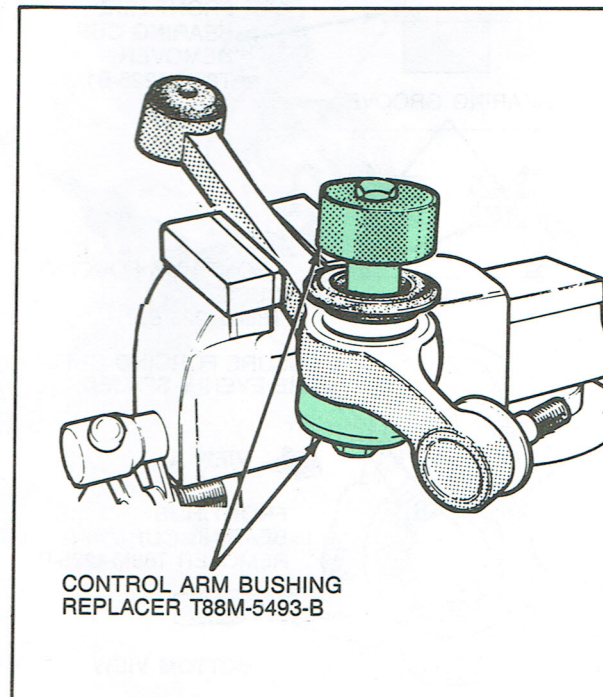
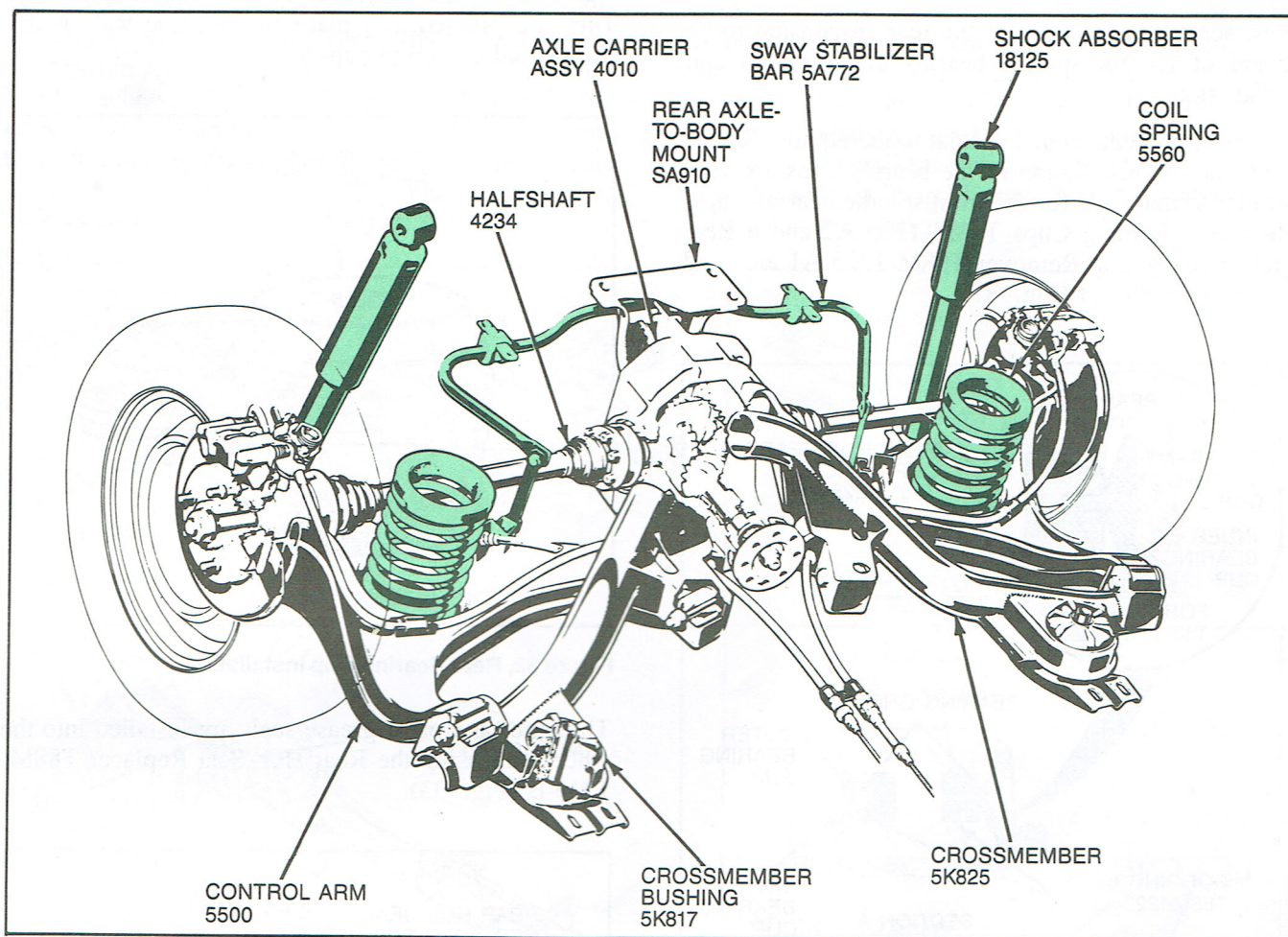


Figure 29, Control Arm Bushing Replacer In Use



# WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

## REAR SUSPENSION



**Figure 30, Independent Rear Suspension**

The Scorpio is equipped with a fully independent rear suspension that is very similar to the XR4Ti (Fig. 30). It consists of semi-trailing control arms, double acting shock absorbers, coil springs and a stabilizer bar.

Each control arm is attached to the crossmember at two pivot points. The attaching bolts pass through sleeved rubber bushings in the ends of the control arm and serve as pivot points for the up and down motion of the arms.

**NOTE:** There are special removal and replacement tools for the control arm bushings. These are past model Merkur XR4Ti special service tools.

The coil springs are mounted above the control arm and are seated in matching pockets in the body and the control arm. The body pocket contains a rubber insulator to prevent direct contact between the spring coil and the body. A jounce bumper mounted in the

center of the coil spring prevents the coil springs from becoming coil bound under severe suspension movements. Normal oscillation of the coil springs are dampened by the double acting shock absorbers mounted at the rear of the control arm.

Suspension movement is also controlled by a stabilizer bar which controls the tendency of the body to lean during a turn. The stabilizer bar is attached to the body with U-brackets and rubber insulators located on either side of the rear axle. The ends of the stabilizer bar are attached to the control arm with short links containing rubber bushings.

A tubular crossmember forms the framework for the rear suspension components and the rear axle. The crossmember is attached to the body through rubber insulators at the outboard ends and at the center through the rear axle insulator.



# WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

## New Service Procedures

New service procedures on the rear suspension to be aware of are for spindle bearing cup removal and installation.

Removal procedures and special tools required for the removal and installation of the bearing cups are very similar to that used for the front spindle bearing cups. Rear Hub Forcing Cups T88M-1225-A2 and a Rear Hub Bearing Cup Remover T88M-1225-A1 are used to get the cups out (Fig. 31).

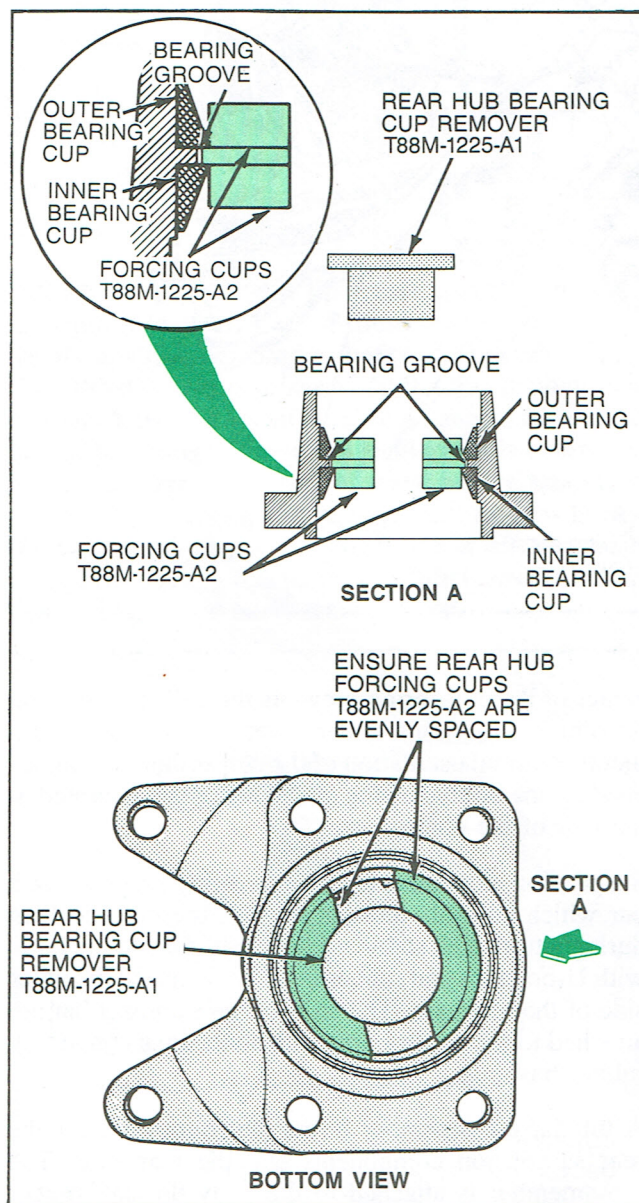


Figure 31, Rear Spindle Bearing Cup Removal

Installation of the bearing cups is done with the Rear Hub Bearing Cup Replacer T88M-1225-D (Fig. 32). They are pressed into place in the same way as the front spindle bearing cups.

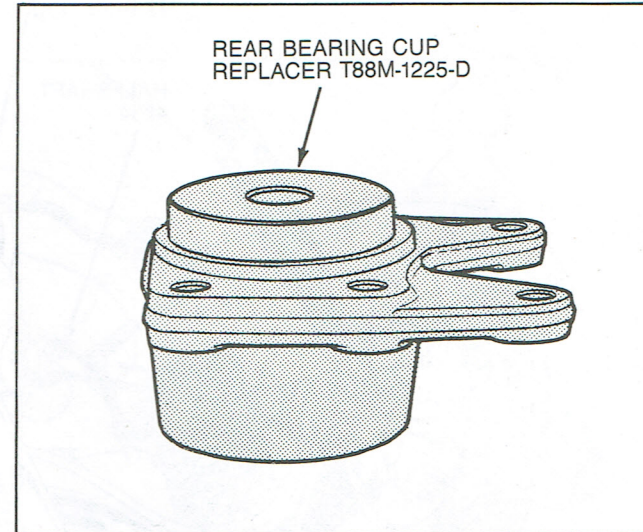


Figure 32, Rear Bearing Cup Installation

The inner and outer grease seals are installed into the wheel hub using the Rear Hub Seal Replacer T88M-1249-B (Fig. 33).

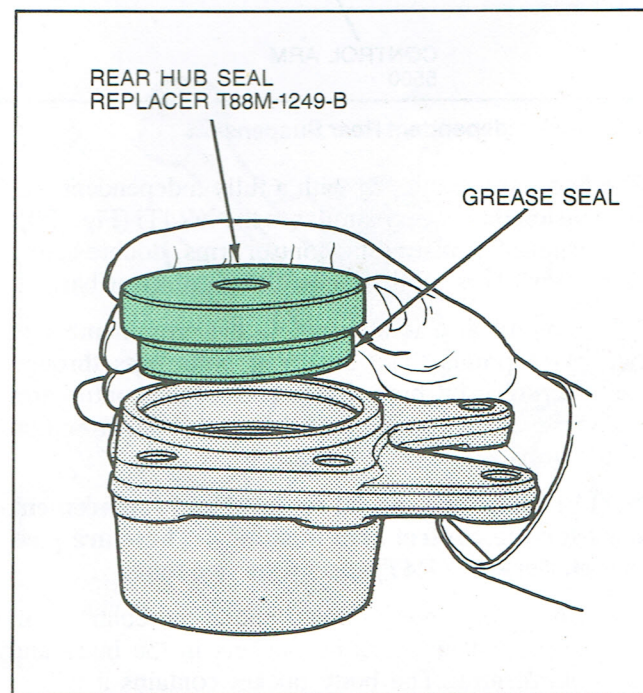


Figure 33, Grease Seal Installation



# WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

## STEERING

The Scorpio is equipped with variable-ratio rack-and-pinion power steering. The variable ratio gives a progressive feel of steering effort during cornering. This is achieved by a special gear tooth cut on the steering rack to provide a lower gear ratio when initially turning from the straight ahead position. Apart from a visual check of the system for damage or leaks, there is no routine service required.

The Scorpio is equipped with a ZF steering gear. It is the same steering gear that is used on the XR4Ti. To this point, service on the ZF steering gear currently has been replacement only. It is now fully serviceable using these newly released tools and some past model tools. Major operations are shown here (Fig. 34). Refer to the Scorpio Shop Manual, Section 13-46 for the complete service procedure.

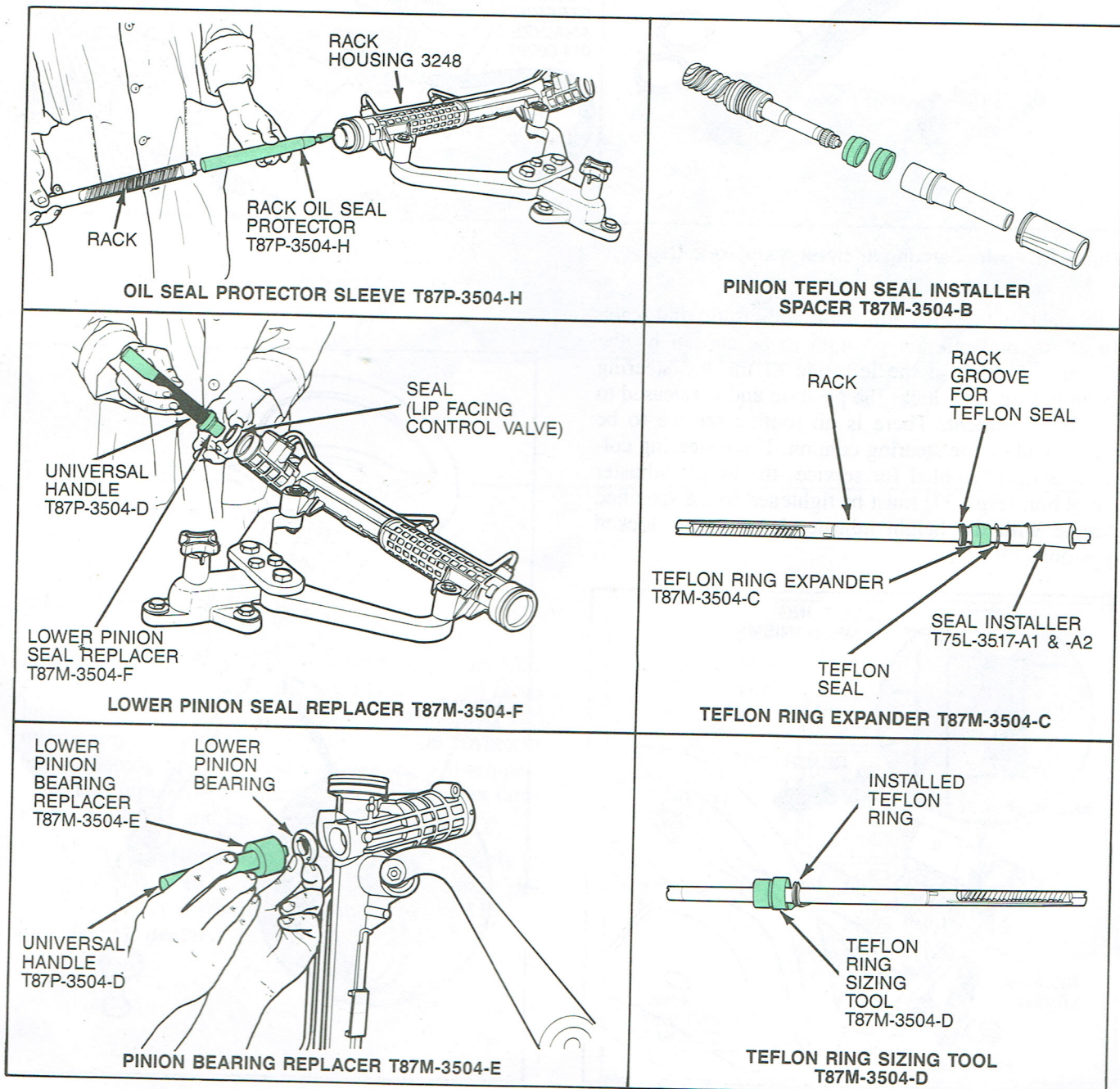


Figure 34, ZF Steering Gear Tool Set



## WHEELS AND TIRES, SUSPENSION AND STEERING SYSTEMS

Special adapters have been developed to attach the Rotunda Power Steering Analyzer to the Scorpio power steering pump (Fig. 35). These new tools are

the Power Steering Analyzer Hose Adapter 014-00208 and Power Steering Analyzer Pump Adapter 014-00209.

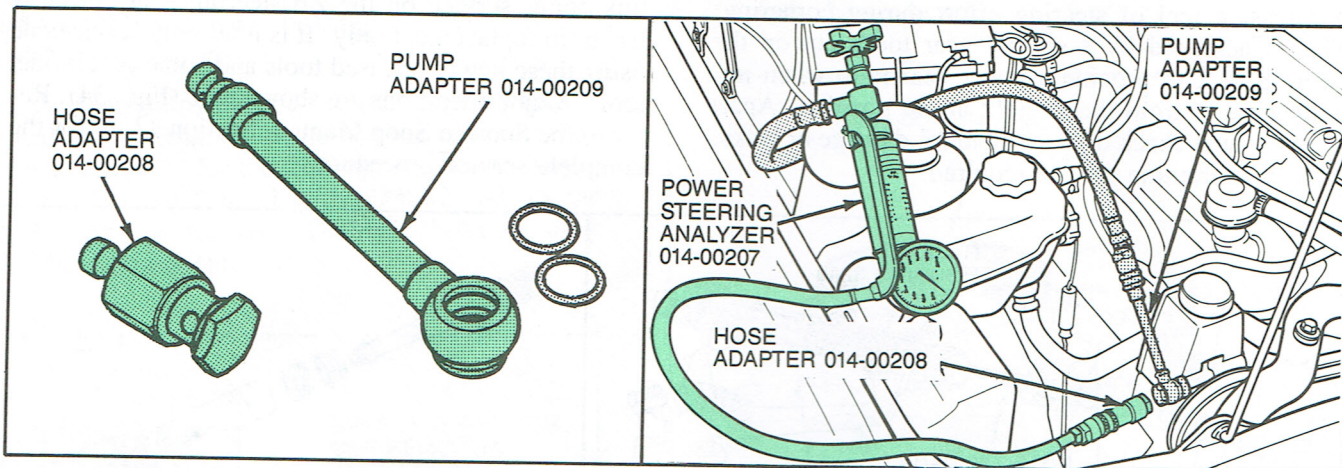


Figure 35, Power Steering Analyzer Adapters In Use.

The steering wheel is adjustable to both tilt and reach to allow the optimum position to be chosen by the driver. A lever on the left side of the steering column (Fig. 36) locks the position and is released to allow adjustment. There is no routine service to be performed on the steering column. If the steering column is disassembled for service, the height adjuster pivot bolt (Fig. 37) must be tightened to the specified torque with the height adjuster lever in the locked position.

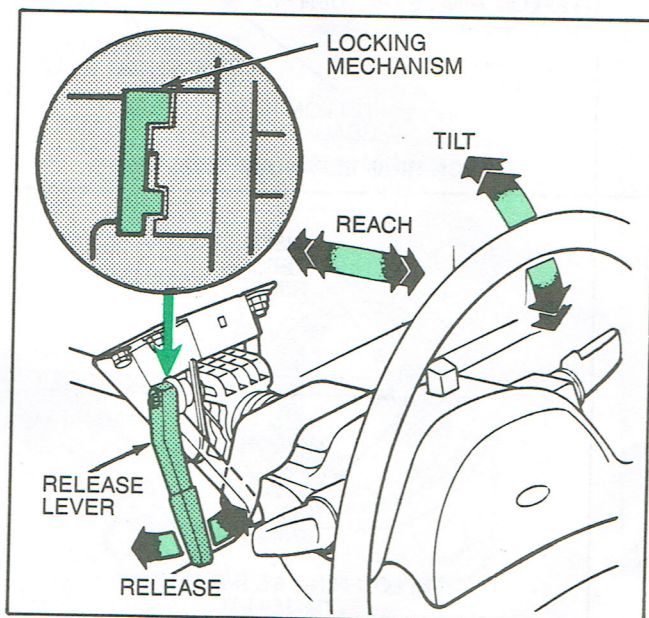


Figure 36, Adjustable Steering Column

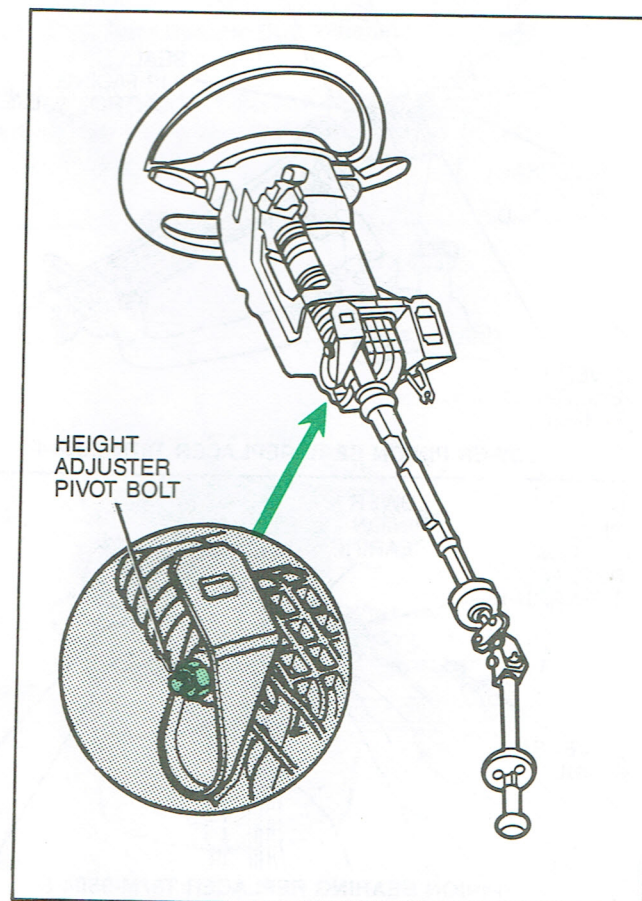


Figure 37, Height Adjuster Pivot Bolt



# HEATING AND AIR CONDITIONING

## VENTILATION

The Scorpio features a highly advanced ventilation system (Fig. 38). At the heart of this system is the automatic temperature control unit which maintains a constant passenger compartment temperature during vehicle operation. This temperature is set by the driver. One of the special features of the system is an ad-

justment control that allows rear seat passengers some control over heat and air requirements in the rear area. This control is located on the rear of the center console. Heated air flow to the rear passenger compartment is provided by ducts beneath the front seats.

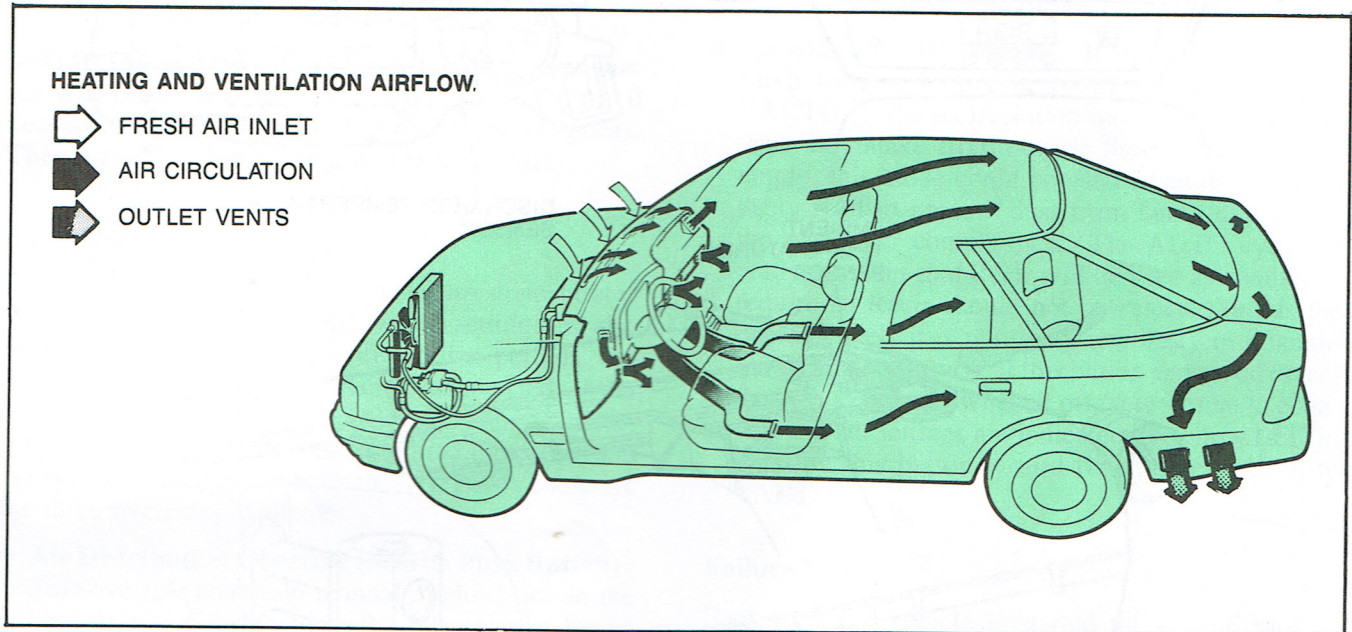


Figure 38, Ventilation System

## ATC SYSTEM

Functions of the ATC are all controlled by the ATC module, which is unique in that it is contained as an integral part of the control assembly (Fig. 39). The microcomputer inside the module controls all motors and solenoids based on a selectable set point temperature and inputs from three temperature sensors (ambient, discharge and interior air) (Fig. 40).

**NOTE:** The button beneath the snap panel is only to change from °F to °C on the LCD temperature display. This button would not normally be used by the customer or dealer.

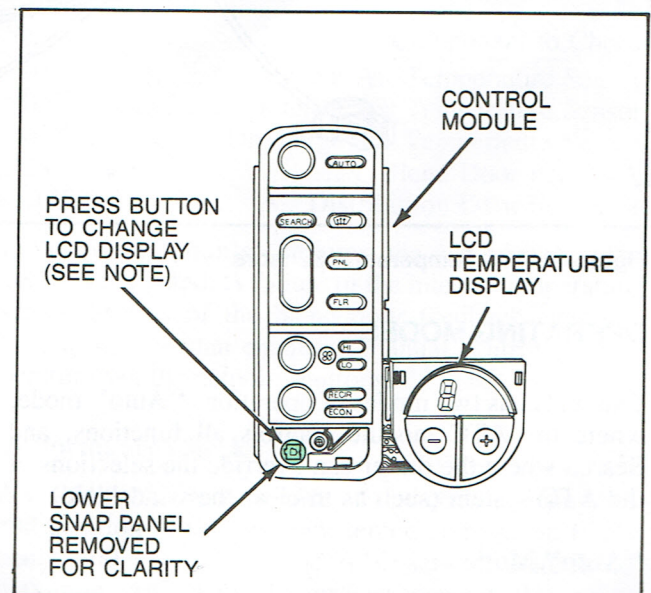


Figure 39, Control Assembly



## HEATING AND AIR CONDITIONING

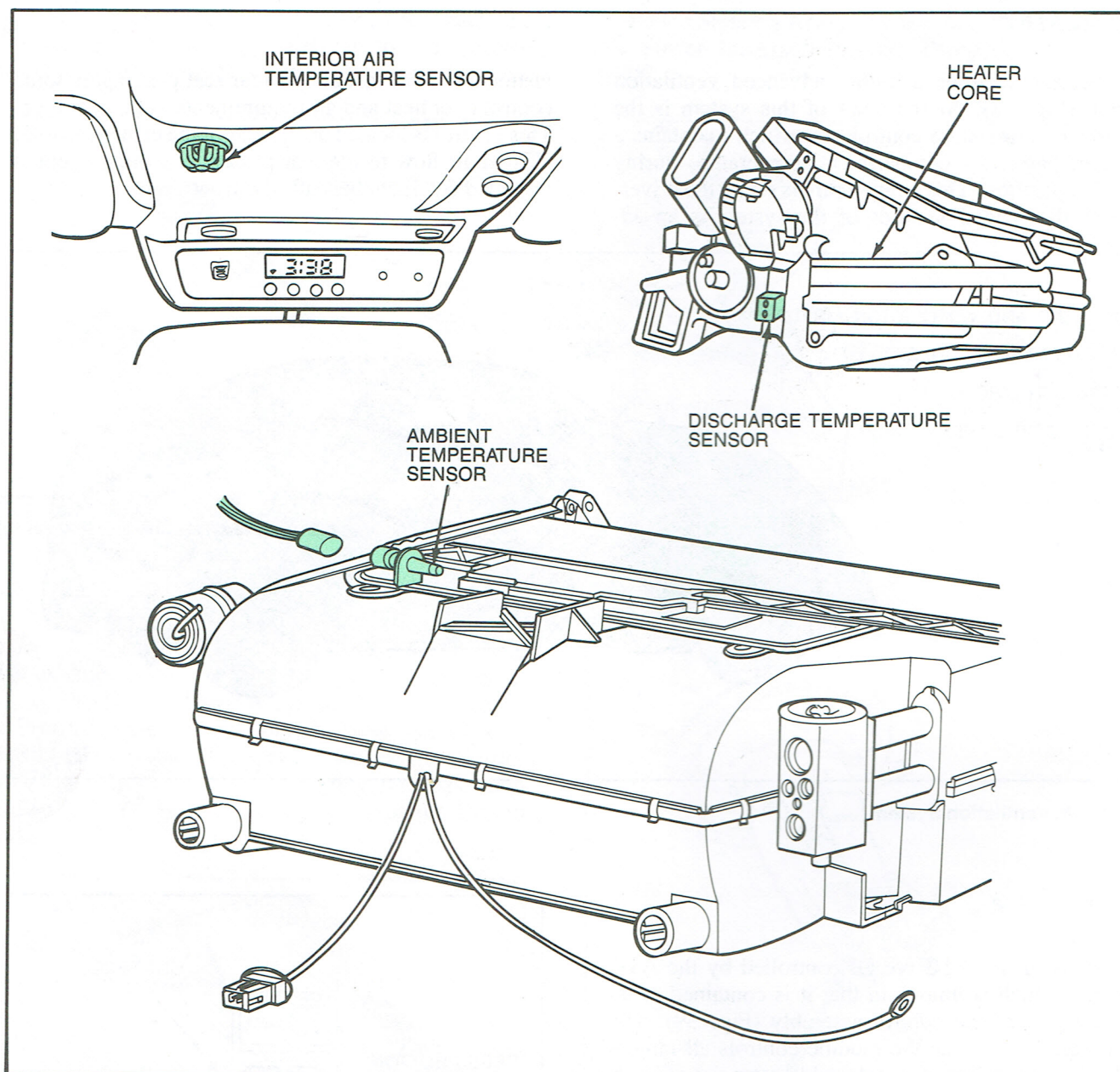


Figure 40, ATC Temperature Sensors

### OPERATING MODES

The ATC has two modes of operation. “Auto” mode, where the ATC module controls all functions, and Search where the driver can override the selections of the ATC system (such as to clear the windshield).

#### “Auto” Mode

If the “Auto” push button is pressed, the system resets to the fully automatic mode and a green LED (light

emitting diode) on the control assembly glows. Normally this setting should satisfy the passenger comfort requirements.

The passenger compartment temperature may be adjusted by the +|- push buttons on the set point control. The setting is memorized during switched ignition periods, except if the battery has been disconnected.



# HEATING AND AIR CONDITIONING

The blower speed is dependent on the required heat flow rate, (I.E. if it is higher, it indicates that the ambient and vehicle interior are differing from the comfortable condition. However, the blower speed will not be increased higher than necessary.

If the discharge temperature is below a comfortable level, during winter conditions, a CALO (Cold Air Lockout) function reduces the blower speed and sets the air distribution to "Defrost."

**NOTE:** During the CALO function the blower motor will blow through the defrost set panel until heated air temperature is 3°F below the set point. Then air will be distributed by the floor ducts.

## Overrides

Manual overrides are available which are concentrated on three override push buttons, whose settings are also memorized during switched off ignition periods, except when the battery has been disconnected. After restarting the vehicle, the LED(s) of the applied overrides flash for a few seconds to remind the driver that the system should be set back to "AUTO." These are the three overrides available:

### • Air Distribution Override (Search Push Button) -

This override enables a manual modification to the air distribution and includes the defrost and a demist (Mix defrost/panel) mode. Both modes cause an early A/C compressor activation to optimize the air dehumidification effect. Beyond that the defrost mode causes an increase of the set point to 32°C (90°F) and maximum blower speed. If uncomfortable head level temperatures occur during a continued usage of this mode, the set point may be reduced.

A repeated pressing of the search button generates a cycled selection of the following settings:

- Defrost
- Mix Defrost/Panel
- Panel
- Mix Panel/Floor
- Floor
- Mix Floor/Defrost
- Auto

The same sequence is cycled automatically by holding the push button in. It stops, when released. The chosen setting is indicated by yellow LED's. In case of mix positions the two adjacent LED's glow.

• **Blower Speed Override Push Button** - A cycle choice of the blower settings "HI" and "LO". "AUTO" is possible by pressing the blower override push button. "HI" causes a doubling of "AUTO" blower speed when possible, otherwise it is set to maximum. "LO" causes a reduction 50%. These two settings are indicated by yellow LED's.

• **Recir/Econ Push Button** - If the lowest override push button is pressed once (starting from "AUTO"), the recirculation mode occurs and prevents air intake from outside the vehicle. For example, this mode could be used when driving on a dusty road to prevent dust from being drawn in the passenger compartment. The AUTO cycle already provides that Recir will be used as condition require so Recir should not be selected unless the operator feels it is necessary (ie. dusty or contaminated air conditions). If this button is pressed twice the A/C system is switched off (sets system to economy). Both settings are indicated by yellow LED's. Pressing this button a third time causes a reset "AUTO."

## Failure Modes

Each time the vehicle is started the control module enters a self test routine. The system parameters are checked and any out of range conditions are displayed. These are the service codes that could flash on the temperature display.

Service Code	Component to Check
"01"	Ambient Air Temperature Sensor
"02"	Interior Air Temperature Sensor
"04"	Discharge Air Temperature Sensor
"08"	Blend Door Feedback
"16"	Air Distribution Door Feedback

In the event of multiple failures, the sum of the service codes is indicated. A failure of the interior temperature sensor or loss of the blend door feedback causes a backup routing that enables a manual control of temperature via the setpoint buttons.

## Performance Check

A/C and heater performance can be checked using the end position of the set point temperature range (indication '00' and '99'). The ATC sets all controls to maximum A/C or maximum heat respectively.



## ELECTRICAL AND BODY FEATURES

### ELECTRICAL SYSTEM FEATURES

Although there are no major differences in the basic operation of the electrical system over other Ford cars, the Scorpio does present some interesting features. This is primarily due to the use of a large number of electrically controlled and electronically monitored systems. Also, the European design of systems varies significantly from those used in domestic cars.

### Headlamp On Safety Feature

Scorpio is equipped with a special headlamp on safety feature. With this feature, the headlamps will stay on for a short period of time, with the switch off, to allow the occupants to exit and use the light from the headlamps to illuminate the area. To operate this feature, turn the vehicle and headlamps off, and actuate the flash-to-pass function. This will turn the headlamps ON. They will go off automatically after a short period of time.

### Battery Replacement

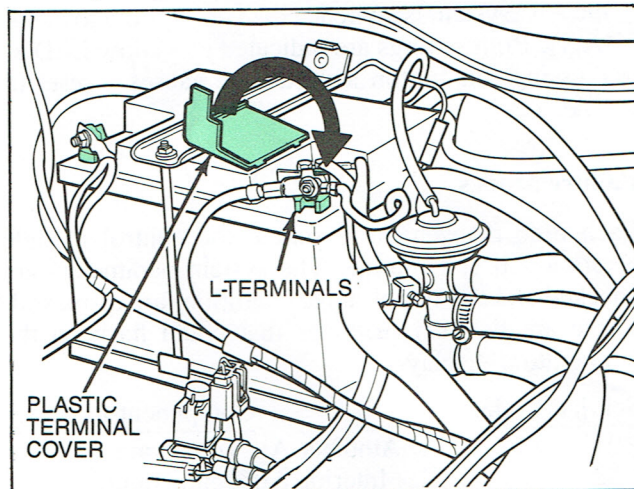


Figure 41, Scorpio Battery

The Scorpio uses an L-terminal battery similar to that used in the XR4Ti (Fig. 41). There is a new replacement battery for both XR4Ti and Scorpio. The replacement battery is available from Motorcraft under Part No. BX-47L.

### Audio System- Rear Defroster Antenna Grid

The rear window defroster grid (Fig. 42), in conjunction with a dedicated electronic module (Fig. 43), also functions as a broadband (AM/FM) radio antenna. Operation of the defroster has no adverse effect on radio reception. A +12 volt (30 ma) feed is provided to the radio antenna isolator/amplifier assembly from the power antenna connection in the back of the radio,

and a separate high current feed is provided isolator assembly for the defroster circuit. The antenna isolator assembly is located behind the trim panel.

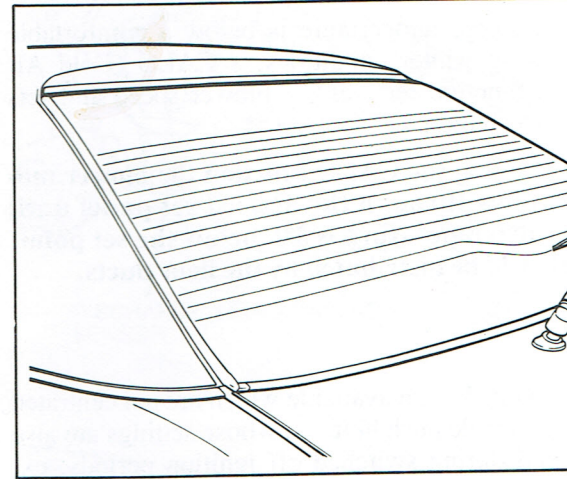


Figure 42, Rear Defroster/Antenna Grid

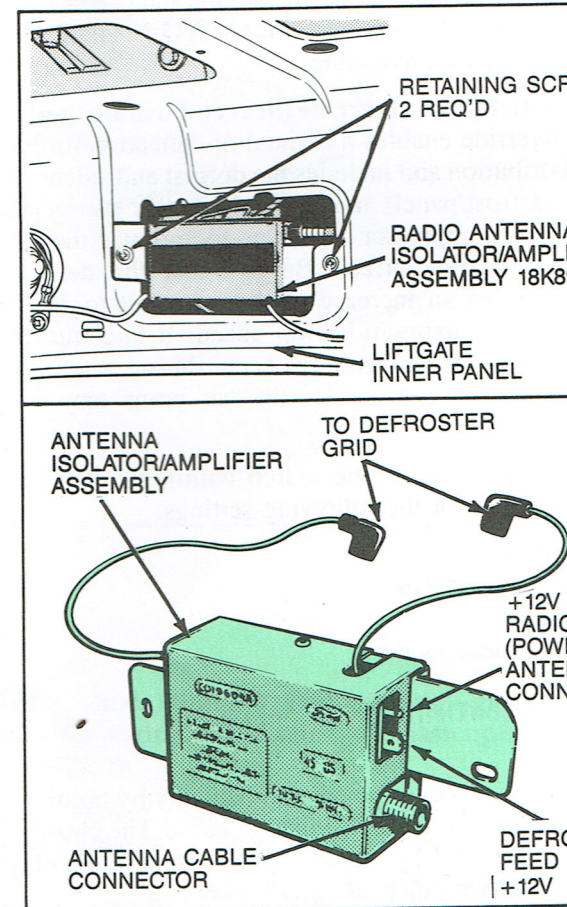


Figure 43, Radio Antenna Isolator/Amplifier Assembly



## ELECTRICAL AND BODY FEATURES

### Audio System — Radio and Amplifier Removal

Removal of the radio and power amplifier (Fig. 44) is done in essentially the same manner as on the XR4Ti radio using special tool T85M-1901-A or equivalent.

The clips used to hold the radio and amplifier are slightly different on the Scorpio but removal procedures have not changed from the XR4Ti.

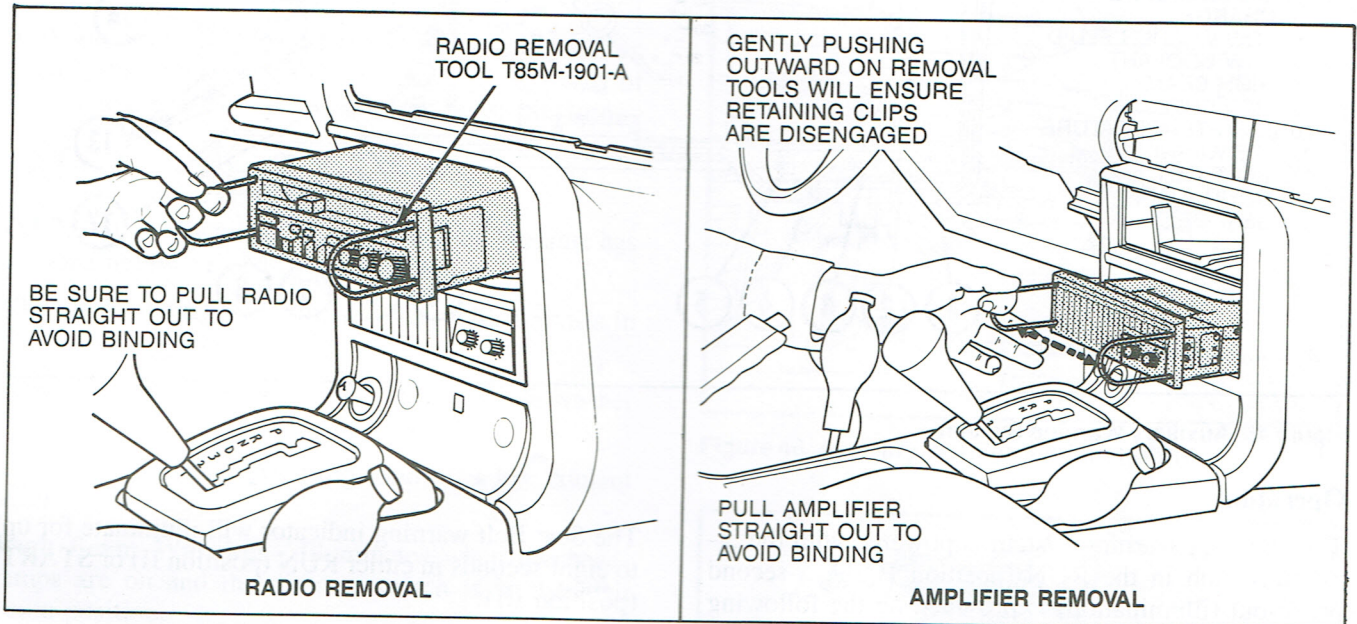


Figure 44, Radio and Amplifier Removal

### Points To Note During Removal

- Pushing outward simultaneously on both radio removal tools will ensure both retaining clips are disengaged.
- Be sure to pull radio straight out to avoid binding.
- To remove the interconnect cable at the rear of the radio and amplifier, pull on body of plug, not cable.

### Auxiliary Warning System

The Scorpio is equipped with a very complete warning indicator system that monitors various functions of the vehicle to provide the driver with a warning if any of the systems develop a problem.

The warning indicators consist of a row of warning lamps along the bottom of the instrument cluster, one LED each in the fuel and temperature gauges, and the graphic display (Fig. 45). The warning lamps along the bottom of the instrument cluster include:

- Anti-lock brake system

- Brake pad wear
- Brake
- \* ● Oil pressure
- \* ● Charge
- Low washer fluid
- Low coolant
- High beam

• The graphic display includes the following warning lamps:

- Lamp out
- \* ● Seat belt
- Door ajar
- Ice

\* These items are not controlled by the auxiliary warning system (AWS) module or bulb outage module.



## ELECTRICAL AND BODY FEATURES

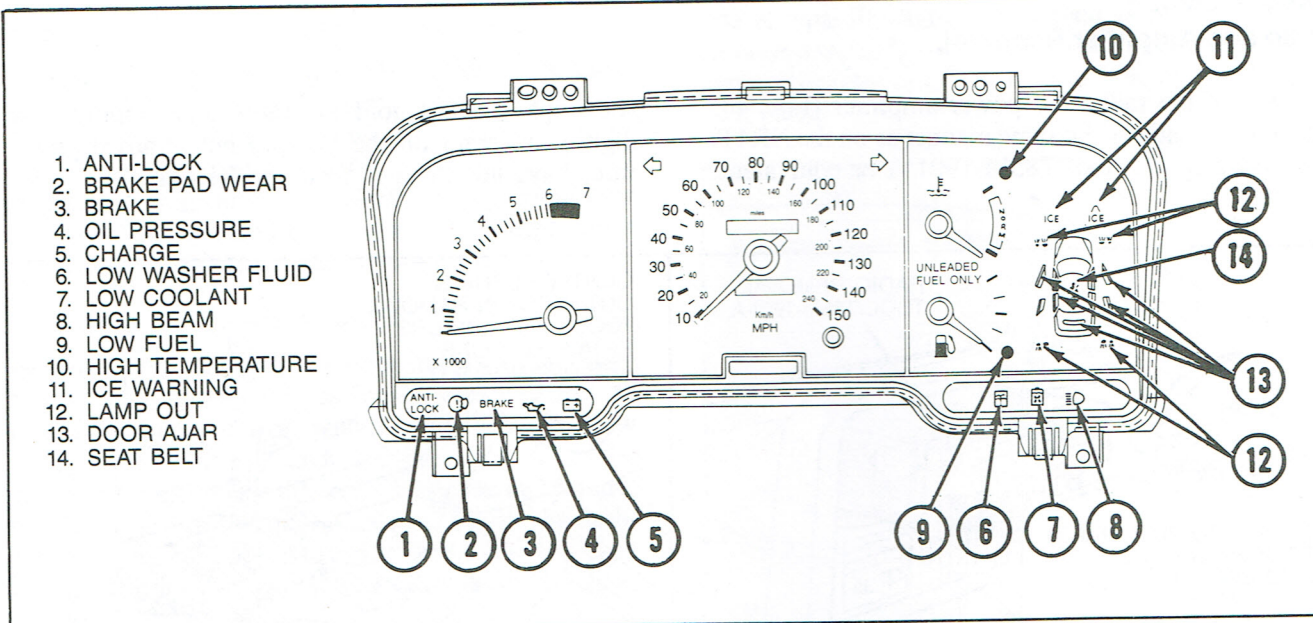


Figure 45, Auxiliary Warning System

### Operation

The auxiliary warning system is powered with the ignition switch in the RUN (position II). A 5-second prove-out (illumination) is provided on the following indicators to inform the driver that the bulbs are good.

- High-Beam
- Lamp Out
- Low Fuel
- High Temp
- Low Washer Fluid
- Low Coolant
- Door Ajar
- Ice
- Brake Pad Wear

**NOTE:** The brake lamp out indicators will stay on until the brake pedal is depressed. This provides a prove-out for the brake lamp switch.

The following warning indicators will stay illuminated until the engine is started:

- Oil pressure
- Charge

The Brake warning indicator will prove-out (illuminate) with the ignition in START (position III).

The Seat Belt warning indicator will illuminate for ten to eight seconds in either RUN (position II) or START (position III).

The remaining warning indicators will only illuminate if the system being monitored activates the indicator.

If a fault (open or short to ground) occurs in the circuitry of the following warning indicators, the lamp will flash for approximately 30 seconds immediately after the ignition is turned to RUN (position II).

- Low Washer Fluid
- Low Coolant
- Door Ajar
- Ice
- Low Fuel
- High Temperature
- Brake Pad Wear

Illumination of a warning light may indicate the following problem:

**Antilock Warning** - Indicates that a problem exists with the anti-lock brake system.

**Brake Pad Wear Warning** - Indicates that a brake pad is worn down to about 1.5mm (0.08 in.).



## ELECTRICAL AND BODY FEATURES

**Brake Warning Light** - This warning light has a triple function:

- As a parking brake warning, indicating that the parking brake is partially or fully applied.
- As a low brake fluid level warning.
- When Brake Warning light is ON in conjunction with the antilock failure warning light it warns of very low brake fluid level or low boost pressure.

**Oil Pressure Warning** - Indicates that oil pressure has dropped below 41 kPa (6 psi).

**Charge Warning** - Illuminates if a problem exists in the charging system.

**Low Washer Fluid Warning** - Indicates low washer fluid level.

**Low Coolant Level Warning** - Indicates low coolant level.

**High Beam Warning** - Illuminates when the headlamps are on and the dimmer switch is in the high beam position.

**Low Fuel Level Warning** - Illuminates when the fuel level in the tank drops below 11 liters (3 gallons).

**Coolant Temperature Warning** - Illuminates when the coolant temperature is above 120°C (248°F).

**Lamp Out Warning** - Lamp out warning segments on the graphic display illuminate if one of the corresponding bulbs is burned out.

**NOTE:** The hi-mount stoplamp is tied into the LH taillamp segment. If the bulb or bulbs burn out the LH taillamp segment will illuminate.

**Seat Belt Warning** - Illuminates when the ignition is first turned to RUN (position II), and will go out after about eight seconds whether or not the engine is started.

**Door Ajar Warning** - Door ajar warning segments of the graphic display will illuminate if one of the doors or the liftgate is not completely closed.

**Ice Warning** - The LH ice warning segment of the graphic display will illuminate if the outside ambient temperature is between 0°C (32°F) and 4°C (39°F). If the temperature drops below 0°C (32°F), the LH segment will go out and the RH segment will illuminate.

There are two modules used in the auxiliary warning system to be aware of. They are the Auxiliary Warning Module (Fig. 46) which controls operation of the auxiliary warning lights and the Bulb Outage Module (Fig. 47) which controls the operation of the lamp out warning system.

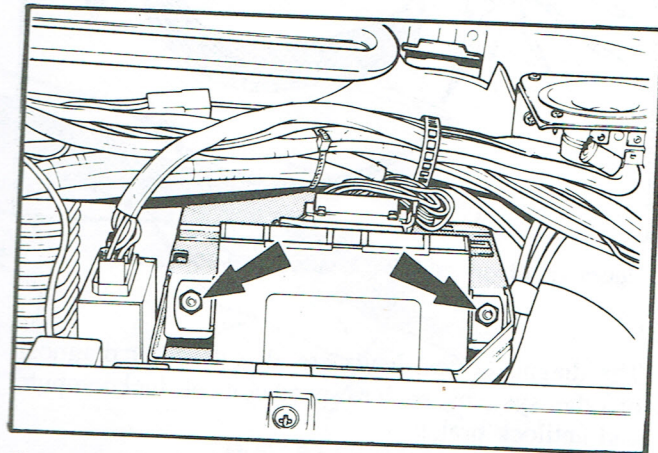


Figure 46, Auxiliary Warning Module 10K910

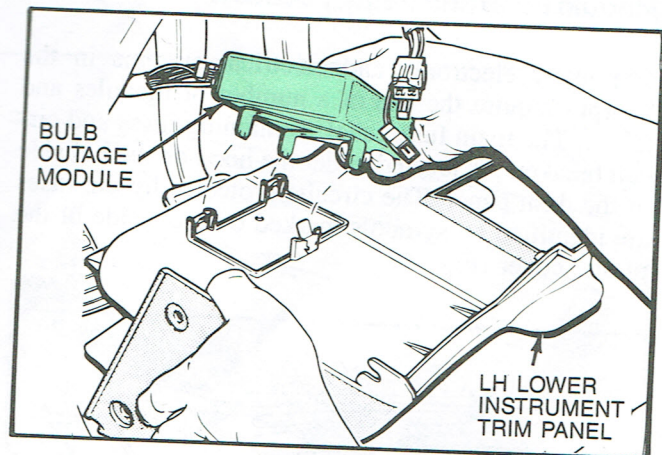


Figure 47, Bulb Outage Module 10C909

### Diagnostics

Auxiliary Warning System diagnostics are covered in section 33-45 of the Scorpio Shop Manual. Diagnostic test leads T88M-50TL (Fig. 48) have been developed for system diagnosis. These test leads are used in conjunction with a meter so that wiring harness connectors can be probed without damaging them. Test leads are used because they are dimensionally correct in relation to the wiring harness terminals and won't damage them.

**WARNING:** Do not probe connectors with regular meter probes. These may damage the terminals.



## ELECTRICAL AND BODY FEATURES

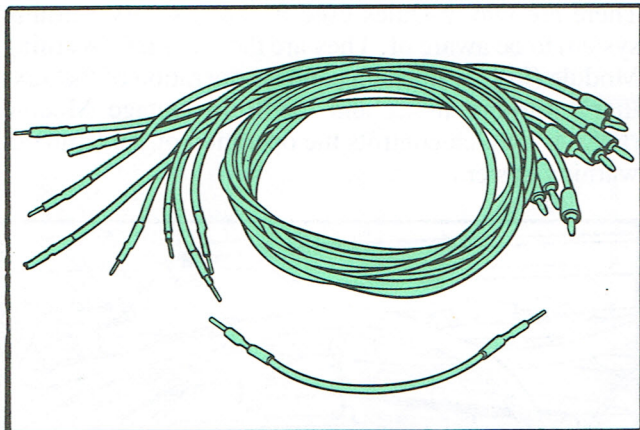


Figure 48, Diagnostic Test Leads T88M-50-TL

The diagnostic test leads are also used for diagnosis on other systems, such as speed control, fuel computer and antilock brakes.

### Module Fuse and Relay Location

The many electronic and electrical systems in the Scorpio require the use of a number of modules and relays. The main fuse panel, containing fuses and circuit breakers, is located under the hood on the LH side of the dash panel. The circuits protected by the fuses are identified by symbols marked on the inside of the plastic cover (Fig. 49).

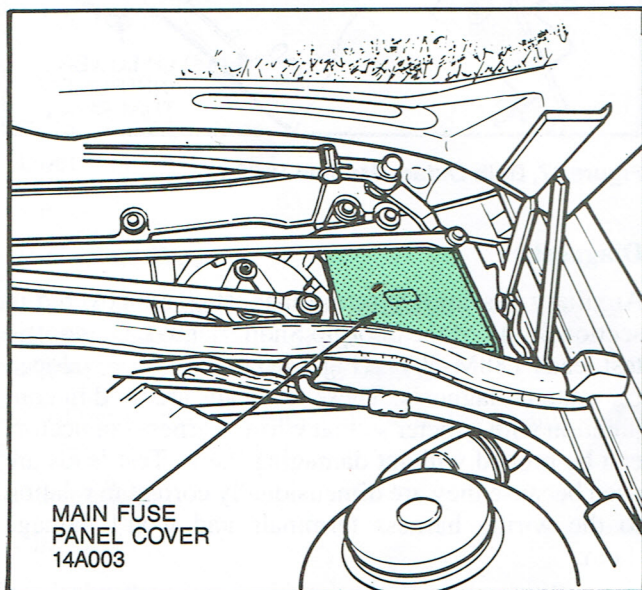


Figure 49, Main Fuse Panel

An auxiliary fuse panel (Fig. 50) is located on the passenger side of the instrument panel in a separate compartment above the glove compartment. To gain access to the auxiliary fuse panel, open the glove compartment, reach into the upper compartment and pull the auxiliary fuse panel down.

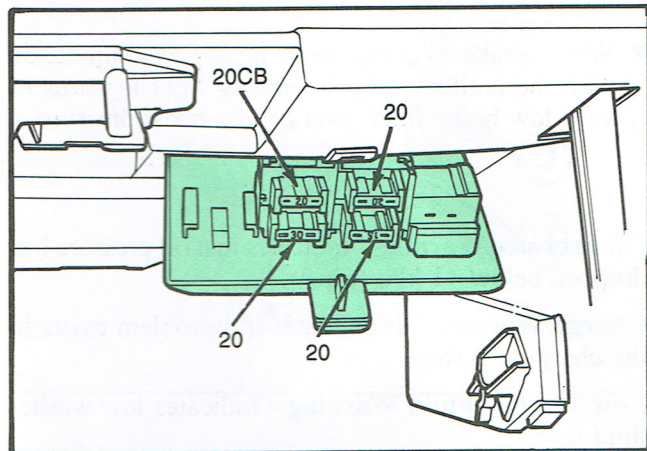


Figure 50, Auxiliary Fuse Panel

An auxiliary relay panel (Fig. 51) is located on a bracket mounted on the instrument panel reinforcement under the RH side of the instrument panel. Access to these relays requires removal of the dash panel (Fig. 52).

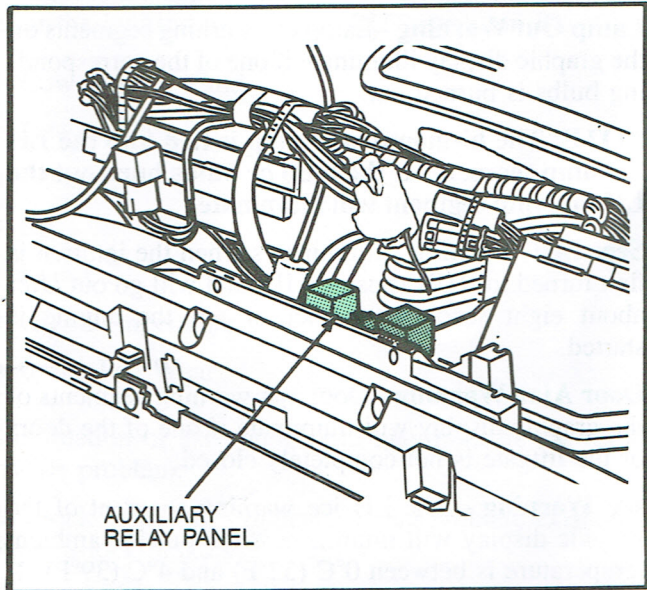


Figure 51, Auxiliary Relay Panel



## ELECTRICAL AND BODY FEATURES

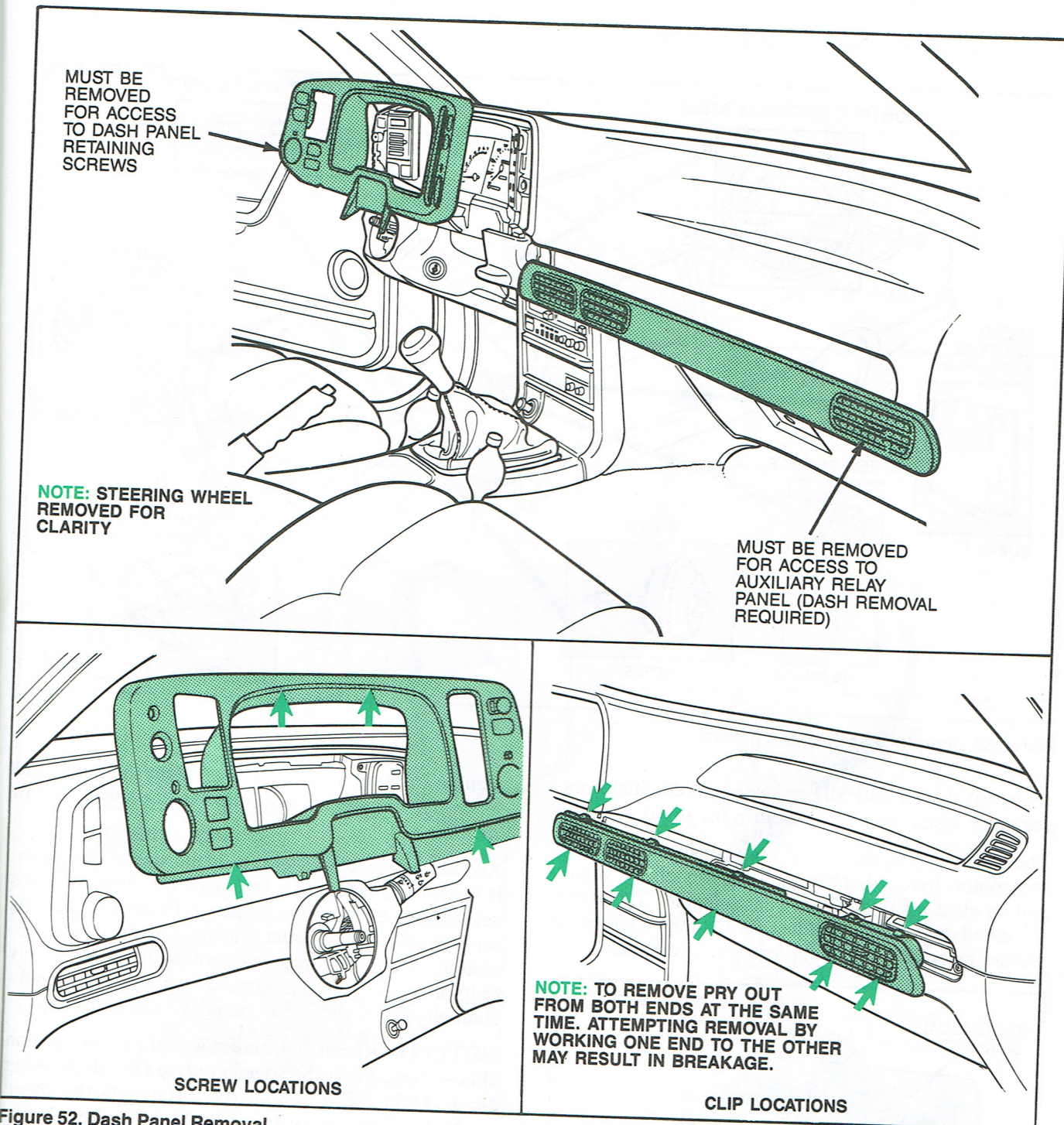


Figure 52, Dash Panel Removal

### SPEED CONTROL

To the operator, the speed control system used on the Scorpio (Fig. 53) has the same features found on the domestic Ford Speed Control With Resume system. From a service standpoint though its primary difference is that it does not rely on engine vacuum

for power. Instead, this system utilizes an electric vacuum pump (Fig. 54) to supply vacuum to the servo assembly.

In addition to supplying vacuum, the vacuum pump contains the regulator assembly (check valves and vent



## ELECTRICAL AND BODY FEATURES

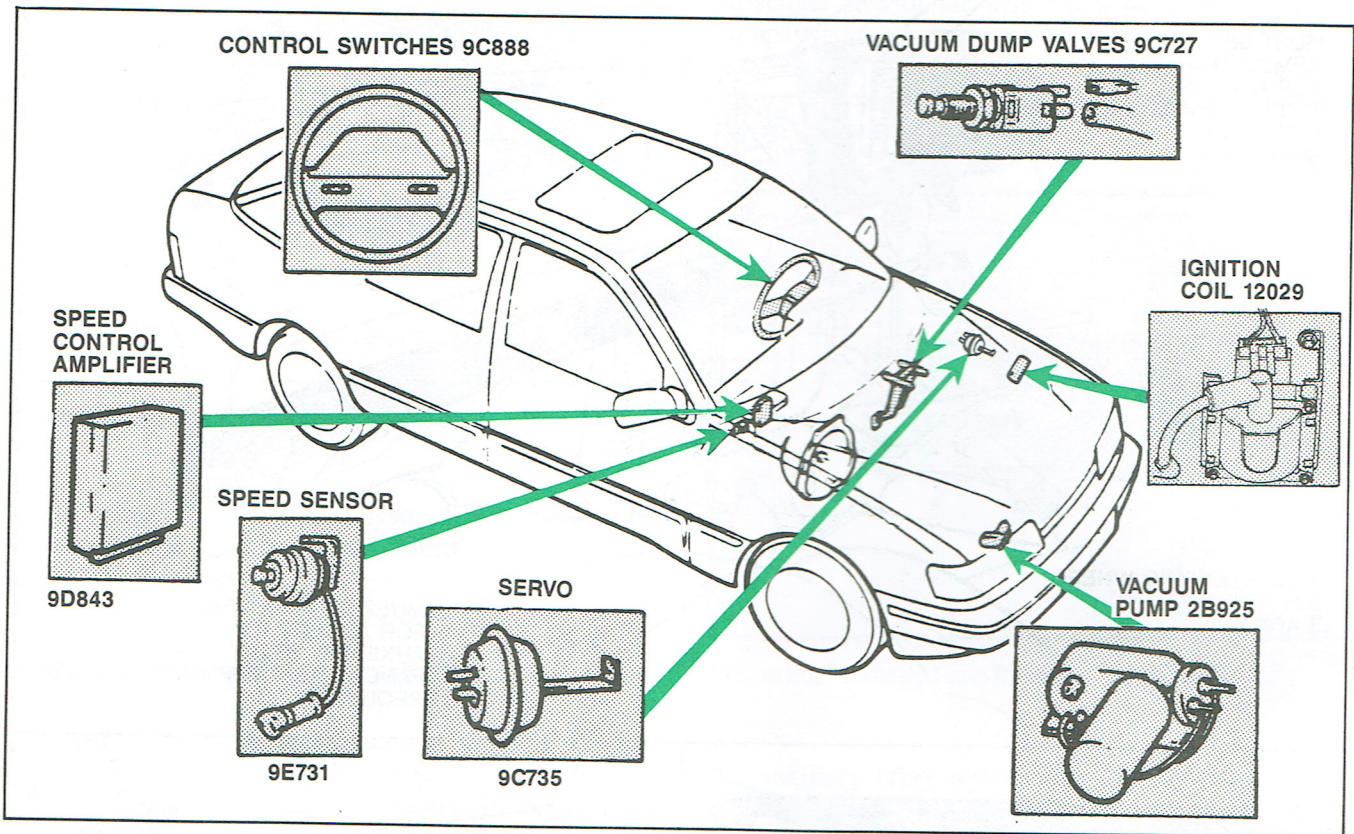


Figure 53, Scorpio Speed Control System

solenoid). In domestically produced Ford vehicles the regulator assembly is contained in the servo.

The pump and regulator assembly consists of an electric motor-driven diaphragm with two check valves and an electrically operated vent solenoid. The pump is located on the frame rail just ahead of the windshield washer reservoir. The pump can produce a maximum

vacuum of 60 kPa (17.7 in. Hg). Both the pump and vent valve circuits are controlled by the speed control module.

Another noticeable difference is the size of the servo. It is much smaller than that used on domestic Ford vehicles. The reason for the size difference is that this servo receives a constant vacuum supply during operation. Domestic speed control systems often rely only on an engine vacuum which can vary substantially under different operating conditions.

**NOTE:** The Resume Function is slightly different on this system. With the speed control ON, depressing the COAST/RESUME switch disengages the speed control system, allowing the vehicle to slow down. To resume previously set speed, the COAST/RESUME switch must be pressed a second time. The system will reengage and the vehicle will accelerate to the previously set speed. The system will also resume previously set speed after a brake application by momentarily pressing the COAST/RESUME switch.

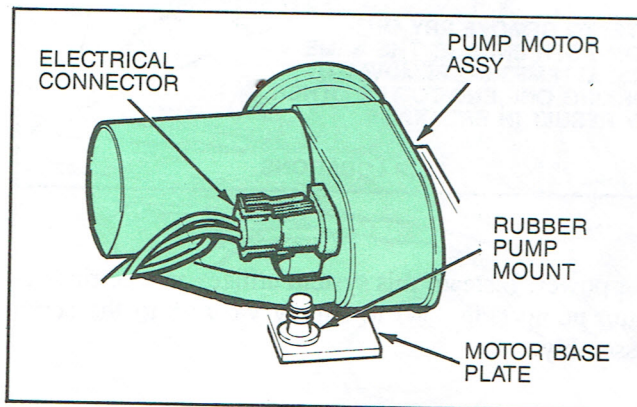


Figure 54, Vacuum Pump



# ELECTRICAL AND BODY FEATURES

## BODY FEATURES

### Power Reclining Rear Seats

A 13° recline on each of the rear seats is a standard feature on the Scorpio (Fig. 55). An electric motor for each seat acts on a wormscrew to tilt the seat backrest. The two buttons which activate the motor are situated to the outside of the bottom of each seat. These buttons can be deactivated by a switch in the front section of the center console. There is no routine service required on the seats.

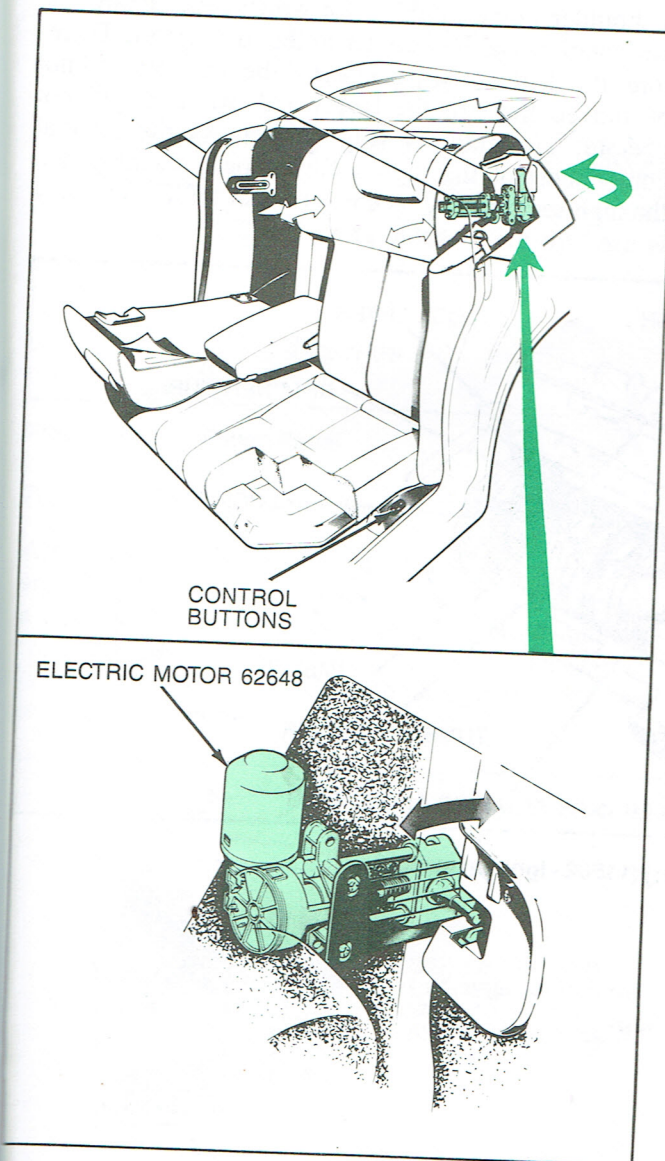


Figure 55, Reclining Rear Seats

### Adjustment-Free Door Removal and Installation

The Scorpio door hinges are each secured by two pinch bolts (Fig. 56), allowing easy removal and installation of the doors.

To remove a door; release the pinch bolt on each hinge, disconnect the check strap and the multiplug connection, then lift the door from its hinges with the door in its fully open position.

The door can be installed without the need for adjustment.

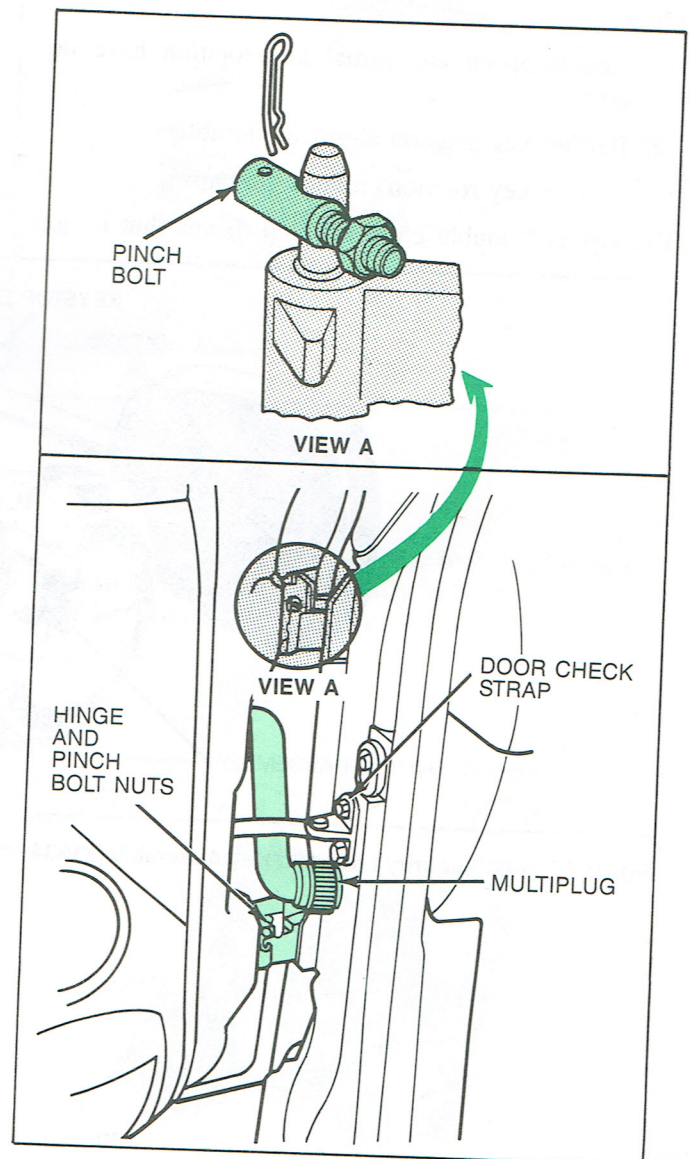


Figure 56, Adjustment-Free Door



## ELECTRICAL AND BODY FEATURES

### High Security Lock System

The high security locks used on the Scorpio ignition, doors and liftgate, are a totally new design of vehicle lock. With a high security lock the insertion of the key does not actuate the tumblers, unlike a TX (Merkur XR4Ti style) series lock where the key's profile edges push and pull the tumblers into alignment, then allow the barrel to rotate. The high security lock key must be turned to actuate/align the tumblers.

The high security lock has three distinct operating phases:

1. Key insertion and initial key rotation have no effect.
2. Further key rotation aligns the tumblers.
3. Further key rotation, rotates the barrel.

The key is "double entry" which means that it can

be inserted either way up. It may be of interest to note that because the key cuts are out of sequence (from side to side) the key will protrude from the lock by a different amount when it is inserted one way when compared to the other way.

Like most locks, the high security key operates the tumblers from a slot near the tumbler center. As mentioned before, the key rotation operates the tumblers and this is achieved in much the same way as a rotating cam moves a lifter up and down in a bore.

Barrel rotation is produced by the key jamming against a shoulder in the tumbler slot which then imparts the key rotation via the tumbler to the lock barrel. Therefore, if a different key is inserted the tumblers will not be moved flush to the barrel and the lock will not operate. The cutaway (Fig. 57) shows the internal components of the high security lock assembly and the high security key. A conventional "TX" form key is used for the lockable glove box.

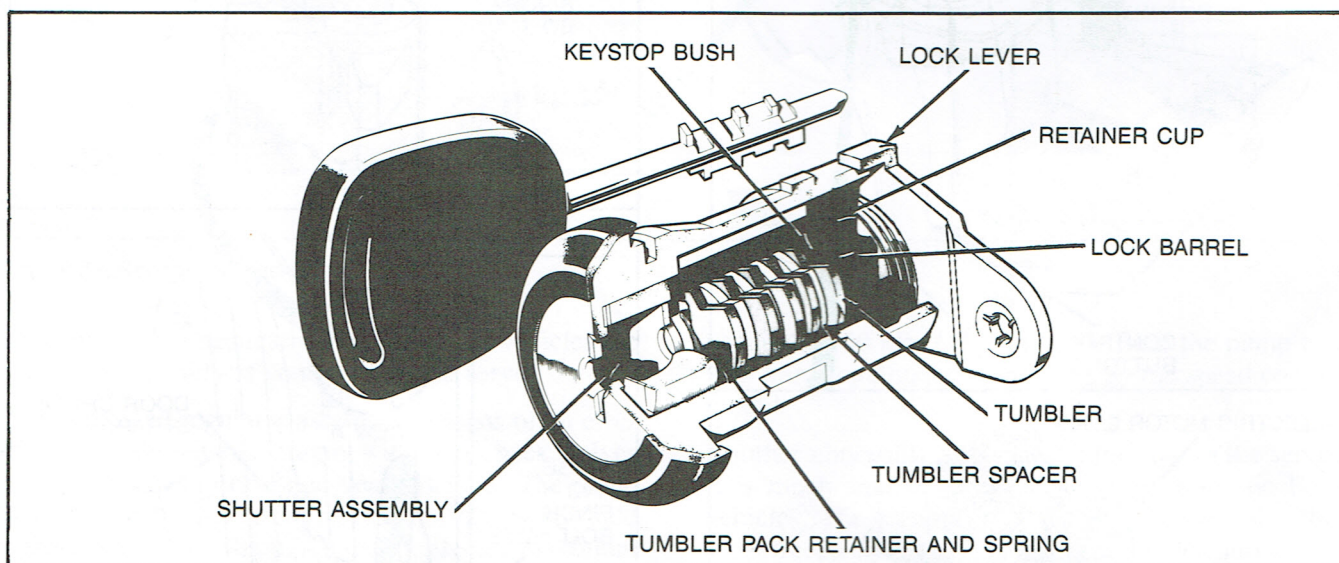


Figure 57, High Security Lock and Key Assembly (21984 - door) (11582 - Ignition switch)



## ELECTRICAL AND BODY FEATURES

### License Plate Rear Finish Panel

The rear finish panel (Fig. 58) contains threaded brass inserts to accept the screws used to hold the license plate. **These brass inserts could be damaged if the proper screw is not used. Use the screws provided with the vehicle in the glove box.**

- 4 required — M5 × 12mm

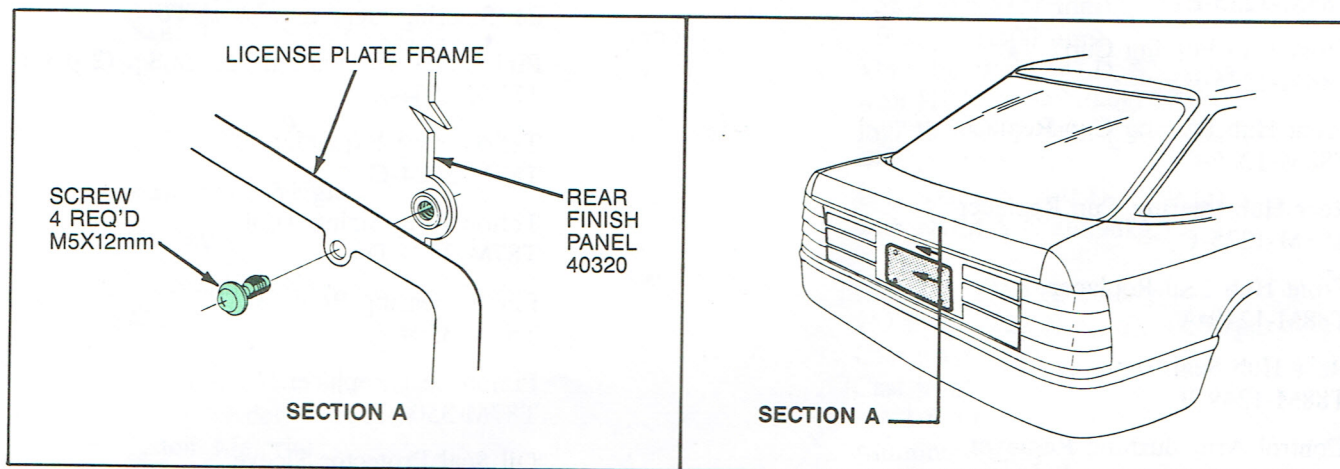


Figure 58, Rear Finish Panel

### Rear Bulb Holder Assembly

All rear lights (including taillight, brake light, turn signal, side marker and backup light) are contained in a bulb holder. Access to the bulb holder assembly is from the inside of the liftgate (Fig. 59). The holder is easily removed by pinching the two plastic retaining tabs and pulling the assembly out.

**NOTE:** The right hand side rear bulb holder assembly can be accessed more easily by first removing the jack from its stored position.

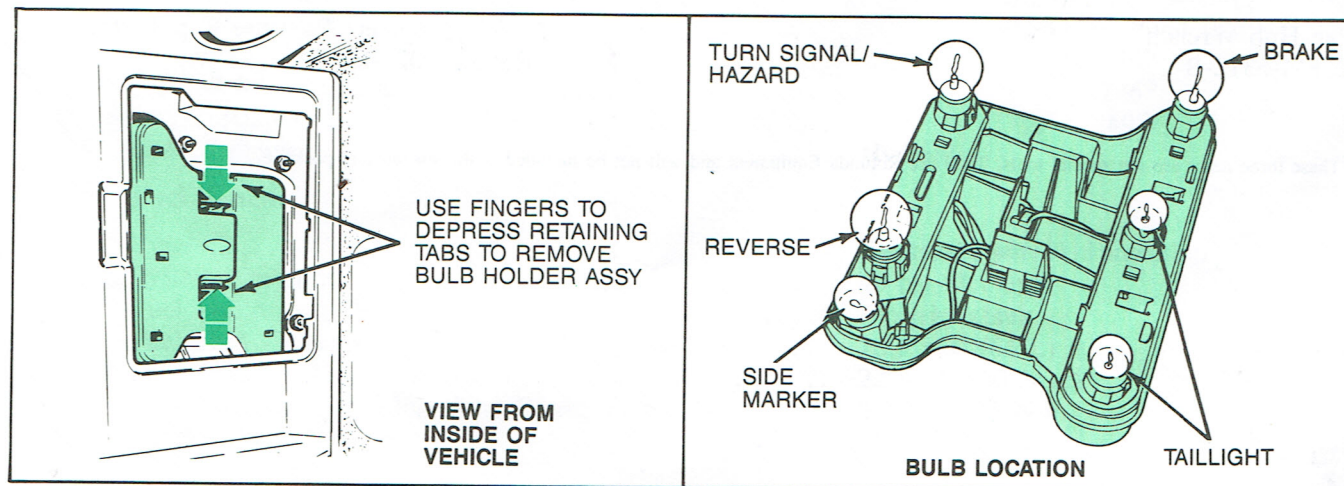


Figure 59, Bulb Holder Assembly Location and Bulb Identification



## APPENDIX

### NEW SPECIAL TOOLS SPECIFIC TO SCORPIO

Rear Hub Bearing Cup Remover  
T88M-1225-A1

Rear Hub Forcing Cup  
T88M-1225-A2

Front Hub Bearing Cup  
T88M-1225-B1

Front Hub Forcing Cup  
T88M-1225-B2

Front Hub Bearing Cup Replacer  
T88M-1225-C

Rear Hub Bearing Cup Replacer  
T88M-1225-D

Front Hub Seal Replacer  
T88M-1249-A

Rear Hub Seal Replacer  
T88M-1249-B

Control Arm Bushing Remover  
T88M-5493-A

Control Arm Bushing Replacer  
T88M-5493-B

Fuel Line Coupling Key  
T88M-9550-A

Fuel Tank Lock Ring Wrench  
T88M-9275-A

Fan Clutch Wrench  
T88M-6312-A

Fan Hub Wrench  
T88M-6312-B

Diagnostic Test Leads  
T88M-50-TL

#### ZF Steering Gear Tools

ZF Steering Gear - Complete Set  
T87M-3504-A

ZF Steering Gear Individual Tools

Pinion Seal Installation Spacer Set (2 pcs.)  
T87M-3504-B

Teflon Ring Expander  
T87M-3504-C

Teflon Ring Sizing Tool  
T87M-3504-D

Pinion Bearing Replacer  
T87M-3504-E

Pinion Seal Replacer  
T87M-3504-F

Oil Seal Protector Sleeve  
T87P-3504-H

Universal Handle  
T87P-3509-D

#### Rotunda Equipment

\*Power Steering Analyzer - Hose Adapter  
Rotunda 014-00208

\*Power Steering Analyzer - Pump Adapter  
Rotunda 014-00209

\*Cooling System Pressure Cap Tester  
Rotunda 021-00052

\*These three items are not special tools. They are Rotunda Equipment and will not be included in the special tool package.



# APPENDIX

## 1988 MERKUR SCORPIO SPECIFICATIONS

### Dimensions

Wheelbase .....	108.7 in. (2762 mm)
Overall Length .....	186.4 in. (4735 mm)
Overall Height .....	54.7 in. (1388 mm)
Overall Width .....	69.5 in. (1766 mm)
Front Tread Width .....	58.2 in. (1477 mm)
Rear Tread Width .....	59.1 in. (1500 mm)
Curb Weight .....	3240 lbs. with A4LD, 3233 lbs. with HUM 5 (1470/1465 kg.)
Front Axle Weight .....	1697 lbs. with A4LD, 1694 lbs. with HUM 5 (770/765 kg.)
Rear Axle Weight .....	1543 lbs. with A4LD, 1539 lbs. with HUM 5 (700/698kg.)

### Engine

Maximum Horsepower @ rpm .....	144 (107 KW) @ 5500 rpm
Maximum Torque @ rpm .....	162 lb.ft. (222 N·m) @ 3000 rpm
Cylinder Head Material .....	Cast iron
Cylinder Block Material .....	Cast iron
Firing Order .....	1-4-2-5-3-6
Piston Material .....	Aluminum alloy
Bore Diameter .....	3.66 in. (93.03 mm)
Stroke Length .....	2.83 in. (72 mm)
Compression Ratio .....	9.0:1
Crankshaft Material .....	Nodular cast iron
Connecting Rod Material .....	Forged steel

### Valve Train

Type .....	Overhead valve
Drive .....	Single chain, roller type
Camshaft .....	Manual                      Automatic
Intake Lift .....	0.257 in. (6.54 mm)
Exhaust Lift .....	0.257 in. (6.54 mm)
Intake Duration .....	276°
Exhaust Duration .....	276°
Overlap Duration .....	49°
Cam Followers .....	Hydraulic

### Fuel System

Type .....	Electronic port fuel injection
System Pressure .....	40 psi (2.7 bar)
Fuel Pump .....	Electric intank
Fuel Tank Capacity .....	16.9 gal. (64 L)
Fuel Tank Locking Ring Torque .....	22 lb.ft. (30 N·m)
Fuel Tank Locking Ring Band Clamp Screw Torque ...	3.7 lb.ft. (5 N·m)



## APPENDIX

### 1988 MERKUR SCORPIO SPECIFICATIONS (Continued)

#### Ignition System

Distributor Type .....	Breakerless thick film ignition system
Spark Plugs .....	AWSF 42C
Control System .....	Ford EEC IV
Emission System .....	Oxygen sensor, three way catalytic converter, exhaust gas recirculation, closed PCV system, evaporative emission carbon canister.

#### Electrical System

Alternator .....	90 amp with integral voltage regulator
Battery .....	12V-500A/70 RC (Manual Transmission) 12V-590A/90 RC (Automatic Transmission)

#### Transmissions

Manual .....	Ford Hummer five-speed with overdrive
Ratios .....	1st 3.36:1 2nd 1.81:1 3rd 1.26:1 4th 1.00:1 5th 0.83:1
Automatic .....	Ford A4LD four speed overdrive transmissions with lockup converter
Ratios .....	1st 2.47:1 2nd 1.47:1 3rd 1.00:1 4th 0.75:1
Torque Converter Stall Speed .....	2900 rpm

#### Axle Ratios

Manual Transmission .....	3.64:1
Automatic Transmission .....	3.36:1

#### Clutch

Type .....	Single disc dry plate/cable
Disc Diameter .....	
Pressure Plate Spring Load .....	1169 lbs. (5200 N)
Flywheel Weight .....	
Driveshaft .....	Straight tube with Guibo Joint and Center Bearing

#### Suspension System

Front .....	MacPherson Strut
Rear .....	Independent

#### Spring Rates

Front .....	108.5 lb./in. (19.0 N·m)
Rear .....	251 lb./in. (44 N·m)



## APPENDIX

### 1988 MERKUR SCORPIO SPECIFICATIONS (Continued)

#### Stabilizer Bars

Front .....	1.06 in. (27.0 mm) diameter
Rear .....	0.63 (16.0 mm) diameter

#### Tires/Wheels

Tire Type .....	Steel-belted Radial
Model .....	Pirelli P6
Size .....	205/60HR15
Speed Rating .....	HR
Inflation Pressure	
Front .....	32 psi (221 kPa)
Rear .....	32 psi (221 kPa)
Wheel Type .....	Cast Aluminum Vented
Wheel Size .....	15 × 6.0 in. J
Spare Tire .....	T115/70D15
Spare Wheel .....	15 × 4 in. Aluminum

#### Steering System

Type .....	Power variable-ratio rack-and-pinion
Gear Ratio .....	11.91-16.16 (12.43 overall)
Turns Lock-to-Lock .....	2.68
Turning Circle (curb to curb) .....	34.1 ft. (10.4 m)

#### Braking System

Type .....	Electronic Integrated Power Boost Anti-Lock Brake System
Front Brakes .....	Hydraulic disc (vented)
Rear Brakes .....	Hydraulic disc (solid)

#### Climate Control System

System Type .....	Automatic Temperature Control
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Fuel Requirements .....	Unleaded
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