GMC
TRUCK

1992

SYCLONE

TYPHOON

SONOMA GT

SERVICE MANUAL SUPPLEMENT

CAUTION

To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed:

Proper service and repair am important to the safety of the service technician and the safe, reliable operation of all motor vehicles. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use a replacement part of lesser quality.

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly, anyone who intends to use a replacement part, service procedure, or tool which is not recommended by the vehicle manufacturer, must first determine that neither his safety nor the safe operation of the vehicle will be jeopardized by the replacement part, service procedure, or tool selected.

It is important to note that this manual contains various Cautions and Notices that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the vehicle or render it unsafe. It is also important to understand that these ‘Cautions’ and ‘Notices’ are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

Special service tools that are shown in this service manual that have tool product numbers beginning with “J” or “ST” are available for worldwide distribution from:

Kent-Moore
SPX Corporation
29784 Little Mack
Roseville, MI 48066-2298
1-800-345-2233
Mon.-Fri. 8:00 p.m. EST
Telex: 244040 KMTR VR
FAX: 313-578-7375

General Motors dealers can purchase TECH 1 scan tools and accessories through Kent-Moore at the above address and phone number. Non-General Motors dealer repair facilities can purchase TECH 1 scan tools and accessories from Kent-Moore at the above address or:

Sun Electric Corporation
One Sun Parkway
Crystal Lake, IL 60014
1-800-CALLSUN (225-5786)
6:45 a.m. - 7:00 p.m. CST

1992
SYCLONE, TYPHOON, AND SONOMA GT SERVICE MANUAL SUPPLEMENT

FOREWORD

This service manual supplement contains diagnosis, on-vehicle maintenance, and light repair for Syclone, Typhoon, and Sonoma GT Models, when used with the 1992 Service Manual for Sonoma and Jimmy Models. Procedures involving disassembly and assembly of major components for these vehicles are published in the Light Duty Truck Unit Repair Manual.

This manual should be kept in a handy place for ready reference. If properly used, it will meet the needs of technicians and vehicle owners.

When reference is made in this manual to a brand name, number, or specific tool, an equivalent product may be used in place of the recommended item.

All information, illustrations, and specifications contained in this manual are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

GMC TRUCK DIVISION
TRUCK & BUS GROUP
General Motors Corporation
Pontiac, Michigan

X-9276

June 1991

TABLE OF CONTENTS

The table of contents on this page indicates the sections covered in this manual. At the beginning of each individual section is a table of contents which gives the page number on which each major subject begins.

X-9276

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Other GMC Truck Service Publications For Your Syclone, Typhoon or Sonoma GT:

Form Description	Form No.	Price Each (U.S. Only)	Qty.	Total
Light Duty Truck Unit Repair Manual	X-9237	$36.00		$
Electrical Diagrams and Diagnosis Manual	X-9244	$31.00		$
Service Manual–Sonoma and Jimmy Models (Includes Fuel & Emissions)	X-9229	58.00		$

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SECTION 0A

GENERAL INFORMATION

CONTENTS

REGULAR PRODUCTION OPTIONS (RPO S)

The following RPOs are standard equipment on the Syclone, Typhoon and Sonoma GT models as indicated. Service procedures on these RPO's that are not found in this manual can be found in the 1992 Service Manual Sonoma and Jimmy Models.

RPO	DESCRIPTION	SONOMA GT	SYCLONE	TYPHOON
AA3	Window, Tinted Deep Tint All Exp. W/S, FD, RD			X
AU3	Lock, SD Power	X	X	X
A31	Window, SD Power	X	X	X
B32	Covering, Front Floor Mats, Aux.		X	
C25	Wiper System, RR Window			X
C80	HVAC, Manual A/C	X	X	X
FF4	Arm, Torsion Bar Spring Adj., LH		X	X
FF5	Arm, Torsion Bar Spring Adj., RH		X	X
G80	Axle, Positraction Limited Slip	X	X	X
KC4	Cooling System, Engine Oil	X	X	X
K34	Cruise Control, Automatic		X	X
LB4	Engine, Gas 4.3L		X	X
L35	Engine, 6-Cyl., 4.3 CPI	X		
MD8	Transmission, Automatic 4L60	X	X	X
NQE	Fuel Tank, PO-Gallon	X	X	X
N40	Steering, Power	X	X	X
PO6	Trim Discs, Wheel	X		
TR6	Lamp Group	X		
T63	Headlamps On Warning System		X	X
VA1	Battery, HD	X	X	X
U73	Antenna, Fixed	X	X	X
VO2	Radiator, HD W/Trans. Oil Cooler	X	X	X
YC2	Convenience Package, Decor Level 2	X	X	X
ZJ7	Wheel, Special Hub Cap and Trim Ring	X		
ZM7	Package Combination, Intermittent Wiper and Tilt Wheel	X	X	
ZM8	Package Combination, Electric Tailgate Release/RR Window Defogger			X

SECTION 0B

MAINTENANCE AND LUBRICATION

SYCLONE AND TYPHOON

CONTENTS

MAINTENANCE SCHEDULE

SECTION A-SCHEDULED MAINTENANCE SERVICES

See chart on page 0B-2 for Scheduled Maintenance Services.

SECTION B-EXPLANATION OF SCHEDULED MAINTENANCE SERVICES

The services listed in the Maintenance Schedule are explained below. After services are completed, fill in the Maintenance Record. When the following maintenance services are performed, make sure all parts are replaced and all necessary repairs are done before operating your vehicle. Be sure to use the proper fluids and lubricants as shown in the Owner's Manual Supplement.

Item No.

1. **ENGINE OIL AND OIL FILTER CHANGE*** - Use Mobil 1 synthetic oil or an equivalent synthetic. The proper viscosity for your vehicle is SAE 10W-30.
2. **CHASSIS LUBRICATION** - Lubricate the front suspension, steering linkage, transmission shift linkage, parking brake cable guides, rear propshaft, front prop rear joint centering ball, universal joints, and brake pedal springs at the intervals specified in Section A or at every engine oil change, whichever comes first.
3. **ENGINE COOLING AND CHARGE AIR COOLER SYSTEM SERVICE*** - Drain, flush and refill system with new coolant. Refer to your Owner's Manual Supplement for further details.
4. **AIR CLEANER ELEMENT REPLACEMENT*** - Replace at specified intervals. Replace more often under dusty conditions. Ask your dealer for the proper replacement intervals for your driving conditions.
5. **TRANSMISSION SERVICE**
   Automatic Transmission - Change the transmission fluid and filter every 15,000 miles (25 000 km).
6. **PCV SYSTEM INSPECTION*** - Check that PCV (Positive Crankcase Ventilation) system works properly. Replace the valves and any worn, plugged or collapsed hoses as necessary.
7. **FUEL FILTER REPLACEMENT*** - Replace the fuel filter at the specified interval or sooner if clogged.
8. **SPARK PLUGS REPLACEMENT* - Replace** spark plugs with the type listed in your Owner's Manual Supplement.
9. **SPARK PLUG WIRE INSPECTION*** - Clean wires and inspect for bums, cracks or other damage. Check the wire boot fit at the distributor and at the spark plugs. Replace wires as needed.

SECTION A-SCHEDULED MAINTENANCE SERVICES

The services shown in this schedule up to 60,000 miles (100 000 km) are to be performed after 60,000 miles (100 000 km) at the same intervals.

Item No.	Service	Miles (000)	2.5	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
		Kilometers (000)	**4**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
1	Engine Oil Change* —Every 3 Months, or		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	Oil Filter Change* —Every 3 Months, or		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2	Chassis Lubrication—Every 3 Months, or		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	Engine Cooling and Charge Air Cooling System Service*—Every 24 Months or											+										+
4	Air Cleaner Element Replacement*											+										+
5	Transmission Service						+					+					+					+
6	PCV System Inspection*																					+
7	Fuel Filter Replacement*											+										+
8	Spark Plugs Replacement*											+										+
9	Spark Plug Wire Inspection*																					+
10	Electronic Vacuum Regulator Valve (EVRV) Inspection*																					+
11	Engine Timing Check*																					+
12	Fuel Tank, Cap and Lines Inspection*											+										+
13	Engine Accessory Drive Belt Inspection*																					+
14	Tire and Wheel Rotation			+					+					+					+			
15	Drive Axle Service						+					+					+					+

FOOTNOTES:
* An Emission Control Service

The maintenance services contained in this Schedule are based on the assumption that your vehicle will be used as designed:

- To carry passengers and cargo within the limits shown on the tire placard located on the edge of the driver's door.
- On reasonable road surfaces within legal driving limits.
- With unleaded fuel.

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10. **ELECTRONIC VACUUM REGULATOR VALVE (EVRV) INSPECTION*** - Inspect filter for excessive contamination or plugging. If required, clean element with a solution of biodegradable soap and water, let dry and reinstall element.
11. **ENGINE TIMING CHECK AND DISTRIBUTOR CHECK*** - Adjust timing to underhood label specifications. Inspect the inside and outside of the distributor cap and rotor for cracks, carbon tracking and corrosion. Clean or replace as needed.
12. **FUEL TANK, CAP AND LINES INSPECTION*** - Inspect the fuel tank, cap and lines for damage or leaks. Remove fuel cap, inspect gasket for an even filler neck imprint, and any damage. Replace parts as needed.
13. **ENGINE ACCESSORY DRIVE BELT INSPECTION*** - Inspect belt. Look for cracks, fraying, wear, and proper tension.
14. **TIRE AND WHEEL ROTATION AND INSPECTION** - For proper wear and maximum tire life, rotate tires at the first 6,000 miles (10 000 km), and then every 15,000 miles (25 000 km) thereafter. Follow the instructions and patterns shown in your Owner's Manual Supplement. Check tires for uneven wear or damage. If irregular or premature wear is apparent, check wheel alignment. Also, check for damaged wheels. While the tires are removed for rotation, perform the brake system inspection described in Section C.

    Inspect tires and wheels for abnormal wear or damage. Refer to your Owner's Manual Supplement for further information.
15. **DRIVE AXLE SERVICE** - Check rear/front axle fluid level and add as needed. Check constant velocity joints and axle seals for leaking.

    Rear locking differential - Drain fluid at first oil change and refill. Check fluid level and add as needed at subsequent oil changes. In dusty areas, drain fluid at every 15,000 miles and refill.†

    Front standard differential - Check fluid level and add as needed at every oil change. In dusty areas, drain fluid every 15,000 miles and refill.†

* An Emission Control Service
† A fluid loss in these systems may indicate a problem. Have them inspected and repaired at once.

SECTION C-OWNER INSPECTIONS AND SERVICES

Listed below are inspections and services which should be made by either you or a qualified technician at the intervals shown to help ensure proper safety, emission performance and dependability of your vehicle. Take any problems promptly to your dealer or another qualified technician for service advice. Whenever repairs are necessary, have them completed at once. For your safety and that of others, any safety-related parts that could have been damaged in an accident should be inspected, and all needed repairs should be done before operating your vehicle. Be sure to use the proper fluids and lubricants as shown in the Owner's Manual Supplement and in the Owner's Manual.

WHILE OPERATING YOUR VEHICLE

Automatic transmission shift Indicator operation - Make sure the indicator points to the gear chosen.

Horn operation - Blow the horn occasionally to make sure it works. Check all button locations.

Brake system operation - Be alert to abnormal sounds, increased brake pedal travel or repeated pulling to one side when braking. Also, if a brake or antilock warning light goes on, something may be wrong with part of the brake system. Have it inspected and repaired at once. Refer to your Owner's Manual Supplement for further details.

Exhaust system operation - Be alert to any changes in the sound of the system or any smell of fumes. These are signs the system may be leaking or overheating. Have it inspected and repaired at once. Also, refer to your Owner's Manual.

Tire and wheel operation - Be alert to a vibration of the steering wheel or seat at normal highway speeds. This may mean a wheel balance is needed. Also, a pull right or left on a straight, level road may show the need for a tire pressure adjustment or wheel alignment.

Steering system operation - Be alert to changes in steering action. An inspection is needed when the steering wheel is harder to turn or has too much free play or if abnormal sounds are noted when turning or parking.

Headlight aim adjustment - Take note of the light pattern occasionally. If beam aim doesn't look right, headlights should be adjusted.

Make a practice of scanning your gages and indicator lights while driving. Refer to your Owner's Manual Supplement for information regarding the operation of the lights and gages.

AT EACH FUEL FILL

Engine oil level check† - Check engine oil level and add if necessary. Refer to your Owner's Manual Supplement for further details.

Engine and charge air cooler coolant level and condition† - Check coolant level in reservoir tank and charge air cooler and add if necessary. Replace if dirty or rusty. Refer to your Owner's Manual Supplement for further details.

Windshield washer fluid level check - Check washer fluid level in container and add if necessary.

Hood latch operation - When opening hood, note the operation of secondary latch. It should keep hood from opening all the way when primary latch is released. Make sure that hood closes firmly.

Visual tire inflation check - Visually check tires for adequate inflation. If they appear low, inflate as needed.

AT LEAST MONTHLY

Tire and wheel inspection and pressure check - Check tires for abnormal wear or damage. Also check for damaged wheels. Keep pressures as shown on Tire Placard on the driver's door (include spare). Pressure should be checked when tires are "cold." Refer to your Owner's Manual Supplement for further information.

Light operation check - Check operation of license plate light, sidemarker light, headlights including high beams, fog lights, parking lights, taillights, brake lights, turn signals, backup lights, instrument panel illumination and hazard warning flashers.

Fluid leak check - After the vehicle has been parked for a while, inspect the surface beneath the vehicle for water, oil, fuel or other fluids. Water dripping from the air conditioning system after use is normal. If you notice fuel leaks or fumes, the cause should be found and corrected at once.

AT LEAST TWICE A YEAR (FOR EXAMPLE, EVERY SPRING AND FALL)

Power steering pump fluid level check† - Check power steering pump fluid in accordance with the instructions in your Owner's Manual Supplement and add fluid if necessary.

Brake master cylinder reservoir fluid level check† - Check fluid level in accordance with the instructions in your Owner's Manual, and add fluid if necessary. A low fluid level can indicate that there is a leak or worn disc brake pads may need to be serviced.

If the vehicle is equipped with antilock brakes, refer to your Owner's Manual Supplement for additional important information.

Key lock cylinder lubrication-Lubricate key lock cylinders with one of the lubricants recommended in your Owner's Manual. Lock deicers which contain alcohol may wash away lubricants. It is recommended that you lubricate the lock cylinder after you have used a deicer of this type.

Weatherstrip lubrication - Clean surface and then apply a thin film of silicone grease with a clean cloth.

EACH TIME ENGINE OIL IS CHANGED

Automatic transmission fluid level check† - Check transmission fluid level and add as required. Refer to your Owner's Manual Supplement for further details.

Steering and suspension Inspection† - Inspect front and rear suspension and steering system for damaged, loose or missing parts, signs of wear or lack of lubrication. Inspect power steering lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc. Lubricate the steering linkage.

Brake systems Inspection - for convenience the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc. Inspect disc brake pads for wear and rotors for surface condition. Also inspect drum brake linings for wear and cracks. Inspect other brake parts, including drums, wheel cylinders, parking brake, etc. at the same time. Check parking brake adjustment. **Inspect brakes more often if driving habits or conditions result in frequent braking.**

Exhaust system inspection* - Inspect complete system including catalytic converter. Inspect body near the exhaust system. Look for broken, damaged, missing or out-of-position parts, as well as, open seams, holes, loose connections or other conditions which could cause a heat buildup in the floor pan or could let exhaust fumes seep into the passenger compartments.

Engine drive belt Inspection - Inspect belt for cracks, fraying and wear. Replace as needed.

Drive axle service - Check rear/front axle fluid level and add as needed. Check constant velocity joints and axle seals for leaking.

Transfer case (all-wheel-drive) inspection† - Every 12 months or at oil change intervals, check front axle and transfer case and add lubricant when necessary. Check vent hose at transfer case for kinks and proper installation.

Rear propeller shaft and front prop rear joint centering ball - Lubricate all propeller shaft slip joints and universal joints through the lubrication fitting when equipped.

AT LEAST ONCE A YEAR

Transmission neutral start switch operation

CAUTION: Before performing the following safety switch check, be sure to have enough room around the vehicle. Then, firmly apply both the parking brake (see your Owner's Manual for procedure) and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition (engine control switch) promptly. Take these precautions because the vehicle could move without warning and possibly cause personal injury and property damage.

- On automatic transmission vehicles, try to start the engine in each gear. The starter should crank only in "P" (PARK) or "N" (NEUTRAL).

Steering column lock operation - While parked, try to turn key to "Lock" position in each gear range. The key should turn to "Lock" only when gear is in "P" (PARK), and the key release lever is depressed. Try to turn the key to "Lock" without depressing the key release lever. The key should turn to "Lock" only with the key lever depressed. The key should come out only in "Lock."

Parking brake and transmission "P" (PARK) mechanism operation

- Apply the regular brake and hold, then apply the parking brake.

CAUTION: Before checking the holding ability of the parking brake and automatic transmission "P" (PARK) mechanism, park on a fairly steep hill with enough room for movement in the downhill direction; to reduce the risk of personal injury or property damage, be prepared to apply the regular brakes promptly if the vehicle begins to move.

- To check the parking brake with the engine running and transmission shift lever in "N" (NEUTRAL), slowly remove foot pressure from the regular brake pedal until the vehicle is held by only the parking brake.
- To check the automatic transmission "P" (PARK) mechanism holding ability, shift the transmission to "P" (PARK), and release the parking brake, then the regular brakes.
  If the hill is too steep, or the vehicle is heavily loaded, it may be difficult to shift the transmission out of "P" (PARK) after the check is complete. Refer to your Owner's Manual.

Lap and shoulder belts condition and operation - Inspect belt system, including: webbing, buckles, latch plates, retractors, guide loops and anchors. Have a belt assembly replaced if the webbing has been cut or otherwise damaged.

Spare tire and jack storage - Be alert to rattles in the vehicle. Make sure the spare tire, all jacking equipment, and any covers or doors are securely stowed at all times. Oil the jack ratchet or screw mechanism after each use.

Underbody flushing - At least every spring, flush the underbody with plain water to remove any corrosive materials used for ice and snow removal, and dust control. Take care to thoroughly clean any areas where mud and other debris can collect. Sediment packed in closed areas of the vehicle should be loosened before being flushed.

Engine cooling and charge air cooler system service*† - Inspect coolant and freeze protection. If dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture as specified in your Owner's Manual Supplement. This provides proper freeze protection, corrosion inhibitor level and engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten hose clamps. Clean outside of radiator, charge air cooler radiator and air conditioning condenser. Wash radiator filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and cap is also recommended. See the maintenance schedule chart in Section A for the recommended coolant change interval.

Body lubrication service - Lubricate all body door hinges including the tailgate. Lubricate the body hood, fuel door and rear compartment hinges, latches and locks including interior glove box and console doors, and any folding seat hardware. Lubricate the hood safety lever pivot and prop rod pivot. More frequent lubrication may be required when exposed to a corrosive environment.

Accelerator control system - lubricate all pivot points with engine oil, except the throttle shaft. Do not oil any accelerator or cruise control cables. Replace any cables that have high effort or excessive wear.

* An Emission Control Service
† A fluid loss in these systems may indicate a problem. Have them inspected and repaired at once.

SECTION D - RECOMMENDED FLUIDS AND LUBRICANTS

Note: Fluids and lubricants identified below by name, part number or specification may be obtained from your GM Truck dealer:

USAGE	FLUID/LUBRICANT
Engine Oil	Mobil 1 synthetic, or equivalent synthetic, with a viscosity of SAE 10W-30.
Engine Coolant and Charge Air Cooler	Mixture of water and a good quality ethylene glycol base antifreeze conforming to GM-6038-M (GM Part No. 1052103).
Front Prop Rear Joint Centering Ball	Chassis grease meeting requirements of GM-6031-M (GM Part No. 1052497).
Automatic Transmission	DEXRON®-IIE Automatic Transmission Fluid (GM Part No. 12345881).
Transfer Case	DEXRON®-IIE Automatic Transmission Fluid (GM Part No. 12345881).

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FLUID CAPACITIES

CRANKCASE

ENGINE	VIN CODE	QUANTITY	
		Without Filter	With Filter
4.3L	Z	4 Quarts (3.8 Liters)	4.5 Quarts (4.3 Liters)
*All quantities are approximate. *After refill, the level MUST be checked as outlined under "Engine Oil And Filter Recommendations" in Section 6 of the owner's manual.			

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SERVICE REPLACEMENT PART AND FILTER RECOMMENDATIONS

Engine (VIN)	Air Cleaner	Spark Plugs	Charge Cooler Cap	PCV Valves
4.3L (Z)	A 1163C	CR42TS	15637803**	8995909**

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**GM Part Number.

WHEEL NUT TORQUE

DESCRIPTION	TORQUE
All-Wheel Drive	100 ft. lbs. (140 N•m)

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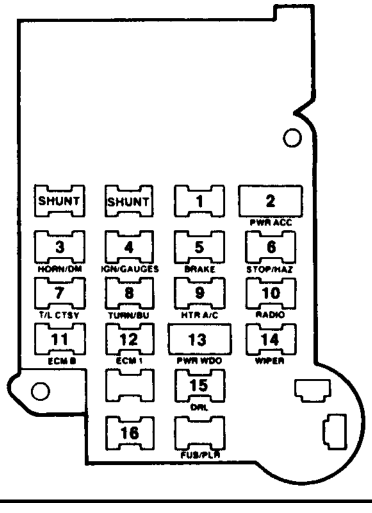
FUSES AND CIRCUIT BREAKERS

Do not use fuses of higher amperage than those recommended.

Following is a list of amperages of the fuses and circuit breakers:

1. Inst Lps. 5-Amp Fuse
2. 30-Amp Circuit Breaker
3. 20-Amp Fuse
4. 20-Amp Fuse
5. 15-Amp Fuse
6. 15-Amp Fuse
7. 20-Amp Fuse
8. 15-Amp Fuse
9. 25-Amp Fuse
10. 15-Amp Fuse
11. 10-Amp Fuse
12. 10-Amp Fuse
13. 30-Amp Circuit Breaker
14. 25-Amp Fuse
15. Not used
16. ELC (Typhoon) 20-Amp Fuse



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LAMP BULB DATA

AC type guide lamps are recommended when replacement becomes necessary.

Lamp Usage	Quantity	C/P	Trade No.
PRNDL	2	1	161
Fog Lamps	2	55W	H3
I/P Illum. Lamps	6	2	194

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SECTION 1A

HEATING AND VENTILATION

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

HEATER HOSE ROUTING

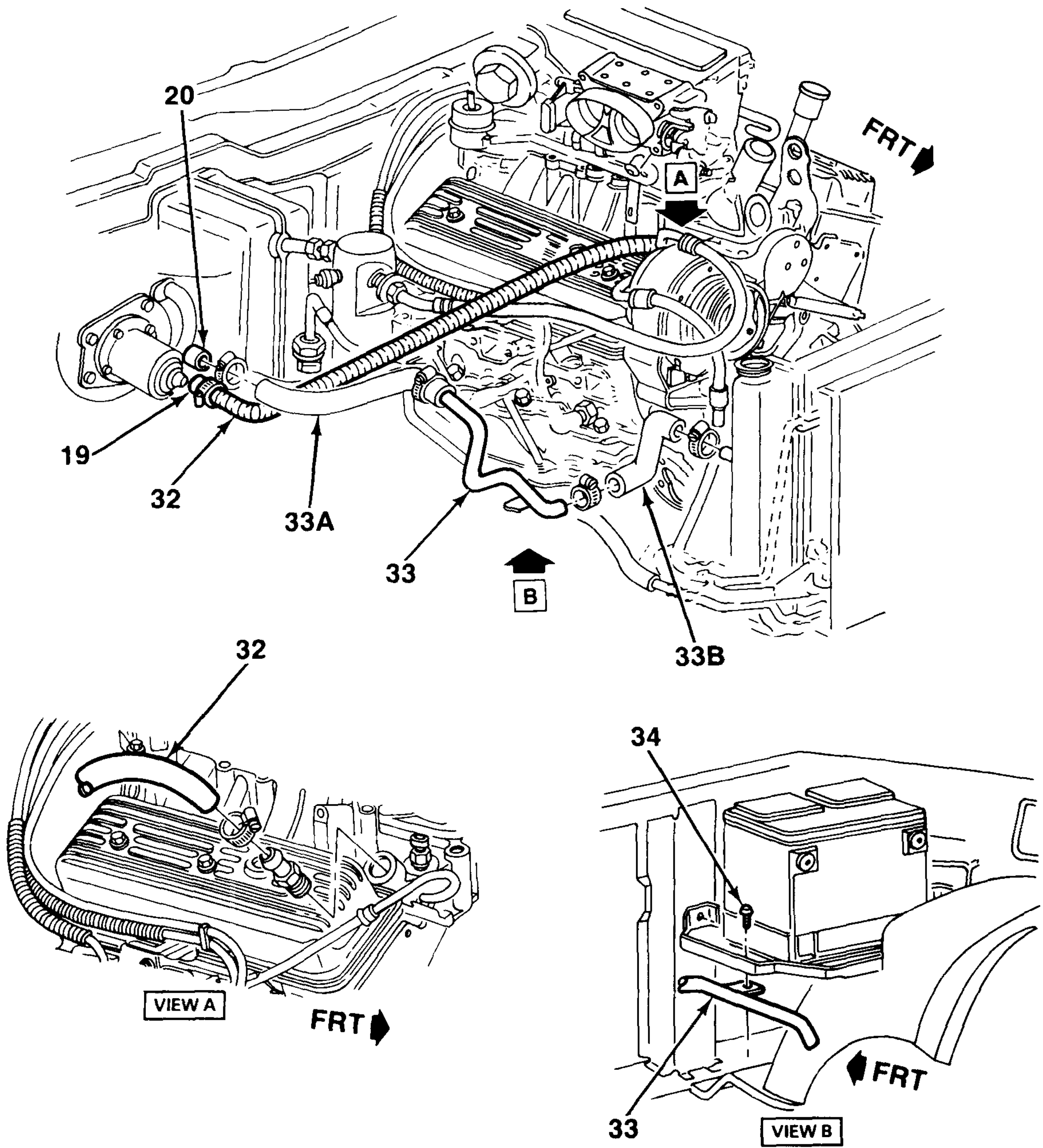
The inlet heater hose (32) attaches from the engine to the core inlet tube (19). The outlet heater tube (33) attaches from the core outlet tube (20) which is directly above the core inlet tube (19), to the radiator. The outlet heater tube (33) is attached to the battery tray by a small bracket. A screw (34) must first be removed to remove the outlet heater tube (33). Hoses (33A and 33B) are attached at each end of the outlet heater tube (33) with screw-type clamps. Refer to Figure 1.

HEATER HOSE REPLACEMENT

The heater core can be damaged near the tube attachment seams if force is applied on them. If the heater hoses do not come off, cut the hoses forward of the core tubes. Cut the hose on core tubes to remove.

Important

- Draw hoses tight to prevent sagging or rubbing against other components. Route hoses through all clamps as installed originally.



19. Core Inlet Tube
20. Core Outlet Tube
32. Inlet Heater Hose
33. Outlet Heater Tube
33A. Hose
33B. Molded Hose
34. Screw

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Figure 1–Engine Heater Hose Assembly

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	In. Lbs.
Outlet Hose Clamp	1.7	15
Inlet Hose Clamp	2.0	18
Battery Tray Screw	6.5	58

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SECTION 1B

AIR CONDITIONING

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener/s not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

COMPRESSOR REPLACEMENT

Remove or Disconnect (Figures 1 and 2)

1. Negative (-) battery cable.
   - Drain radiator as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Refrigerant from the system as described in AIR CONDITIONING (SEC. 1B) in the 1992 Service Manual Sonoma and Jimmy Models.
3. Charge air cooler. Refer to TURBOCHARGER (SEC. 6J) in this manual.
4. Bolt (5).
5. Washer (4).
6. Hose manifold (1).
   - Discard O-rings (23).
7. Electrical connector (3).
8. Drive belt from compressor as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.
9. Nuts (18) holding turbo water return pipe clip (22) and compressor bracket (19) to upper compressor mounting bolts (6).
10. Nut (21).
11. Bolt(20).
12. Compressor bracket (19) from upper compressor mounting bolt (6).
   - Loosen turbo water return pipe fitting at turbocharger (8) and pull turbo water return pipe clip (22) off upper compressor mounting bolt (6).
13. Nuts (10) from upper and lower compressor mounting bolts (6 and 9).
14. Upper and lower compressor mounting bolts (6 and 9).
15. Compressor (2).

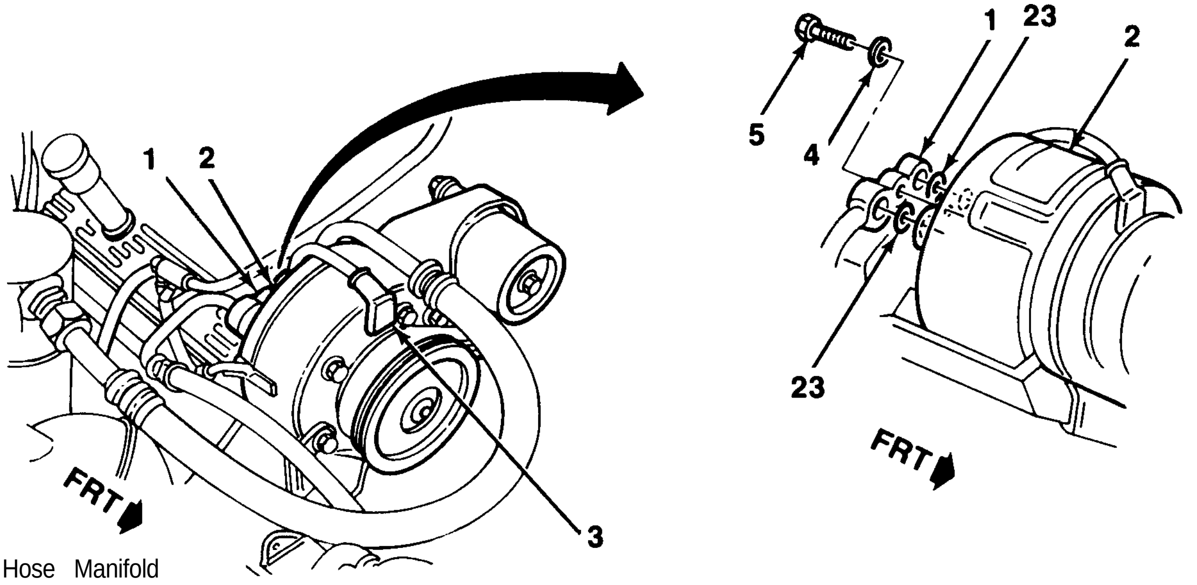
Install or Connect (Figures 1 and 2)

NOTICE: For steps 3, 5 and 15 see "Notice" on page 1B-1 of this section.

1. Compressor (2) in mounting bracket (11).
2. Upper and lower compressor mounting bolts (6 and 9).
   - To install upper compressor mounting bolts (6) the flat on the "D" shaped bolt head flange must first be positioned to clear the compressor clutch and then be repositioned to index against the anti-rotation lug on mounting bracket (11) so that bolt head will seat flush and not spin when nut (10) is driven.
3. Nuts (10) to upper and lower compressor mounting bolts (6 and 9).

Tighten

- Nuts (10) to 33 N•m (24 ft. lbs.).



1. Hose Manifold
2. Compressor
3. Electrical Connector
4. Washer
5. Bolt
23. O-Ring

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Figure 1 – Compressor Mounting

4. Turbo water return pipe clip (22) onto upper compressor mounting bolt (6).
5. Turbo water return pipe fitting at turbocharger (8).

Tighten

- Turbo water return pipe fitting at turbocharger (8) to 22 N•m (16 ft. lbs.).

6. Compressor bracket (19) to upper compressor mounting bolt (6).
7. Bolt (20).
8. Nut (21).
9. Nuts (18) holding turbo water return pipe clip (22) and compressor bracket (19) to upper compressor mounting bolts (6).
10. Drive belt to compressor as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.
11. Electrical connector (3).
12. O-rings (23) to hose manifold (1).

Important

- Oval cross-section O-rings (23) have been released to provide more effective sealing of the refrigerant line connections at the compressor rear head. New oval cross-section O-rings (23) should be used when installing the refrigerant hose manifold (1) to the compressor (2). The cavities for the O-rings (23) should be lubricated with clean refrigerant oil and the O-rings (23) should be pressed into place with a tool that will not damage the O-ring (23). A thin, smooth plastic rod with no sharp edges or points is an ideal tool for this purpose.

13. Hose manifold (1).
14. Washer (4).
15. Bolt (5).

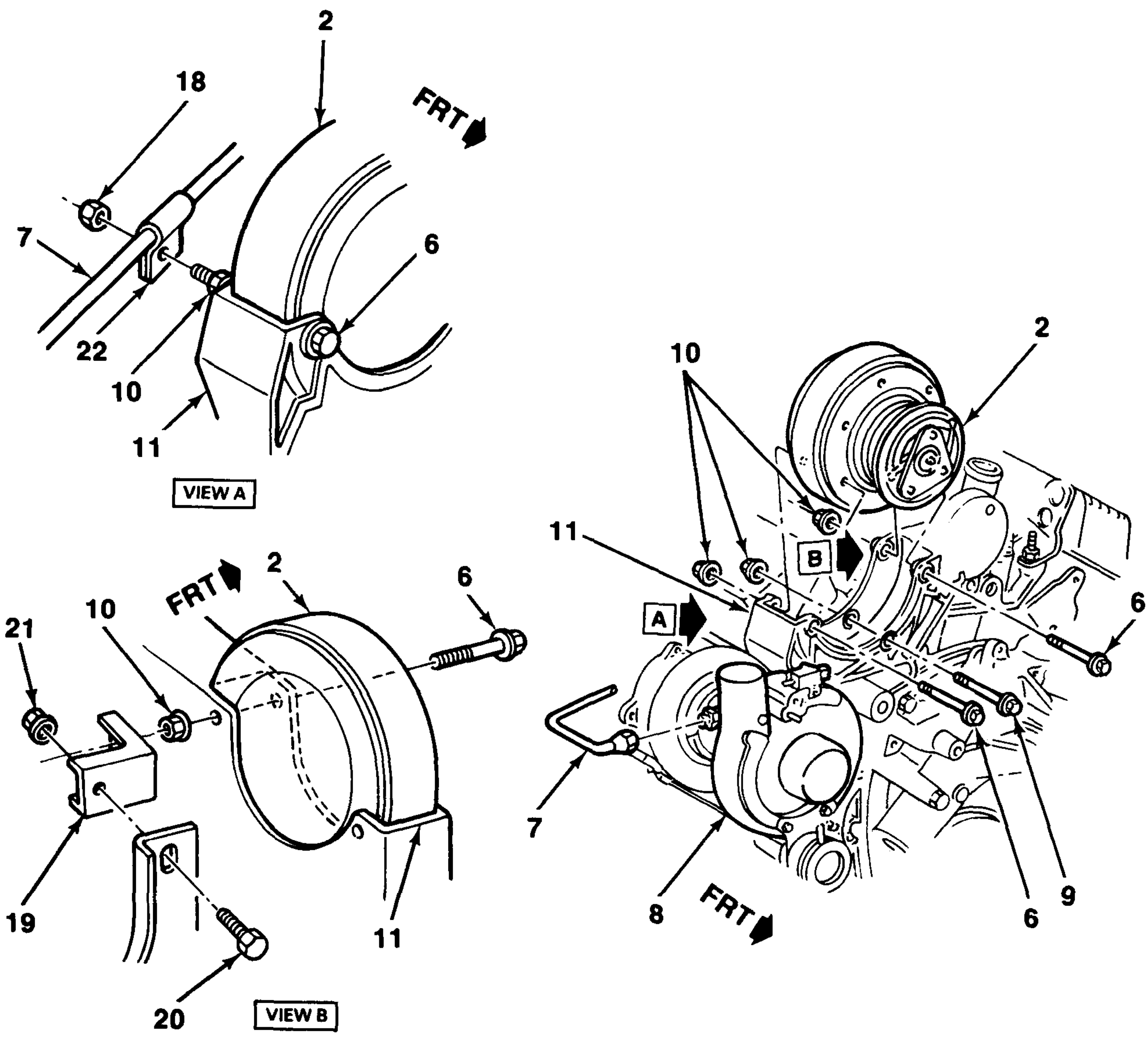
Tighten

- Bolt (5) to 34 N•m (25 ft. lbs.).

16. Charge air cooler. Refer to TURBOCHARGER (SEC. 6J) in this manual.
17. Refrigerant to the system and perform a leak test as described in AIR CONDITIONING (SEC. 1B) in the 1992 Service Manual Sonoma and Jimmy Models.
    - Fill radiator as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.
18. Negative (-) battery cable.

EVAPORATOR AND BLOWER ASSEMBLY REPLACEMENT

The procedure for removing the evaporator and blower assembly is the same as in the 1992 Service Manual Sonoma and Jimmy Models with the exception that the charge air cooler must first be removed. Refer to TURBOCHARGER (SEC. 6J) in this manual.



2. Compressor
6. Upper Compressor Mounting Bolt
7. Turbo Water Return Pipe
8. Turbocharger
9. Lower Compressor Mounting Bolt
10. Nut
11. Mounting Bracket
18. Nut
19. Compressor Bracket
20. Bolt
21. Nut
22. Turbo Water Return Pipe Clip

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Figure 2 - Compressor Replacement

EVAPORATOR TUBE ASSEMBLY REPLACEMENT

The procedure for removing the evaporator tube is the same as in the 1992 Service Manual Sonoma and Jimmy Models with the exception of first removing the battery tray. Refer to BATTERY (SEC. 6D1) in this manual.

VACUUM TANK REPLACEMENT

Remove or Disconnect (Figure 3)

1. Battery tray. Refer to BATTERY (SEC. 6D1) in this manual.
2. Vacuum tank hose (16) from tank (12).
3. Bolts (13).

Install or Connect (Figure 3)

NOTICE: See "Notice" on page 1B-1 of this section.

1. Bolts (13).

Tighten

- Bolts (13) to 11 N•m (97 in. lbs.).

2. Vacuum tank hose (16) to tank (12).
3. Battery tray. Refer to BATTERY (SEC. 6D1) in this manual.

VACUUM LINES - ENGINE COMPARTMENT

For vacuum line routing, refer to Figure 3. The vacuum tank hose (16) is routed along the right side of engine to vacuum tank (12) under battery tray (15). The vacuum hose (17) is routed into cowling with wiring harness.

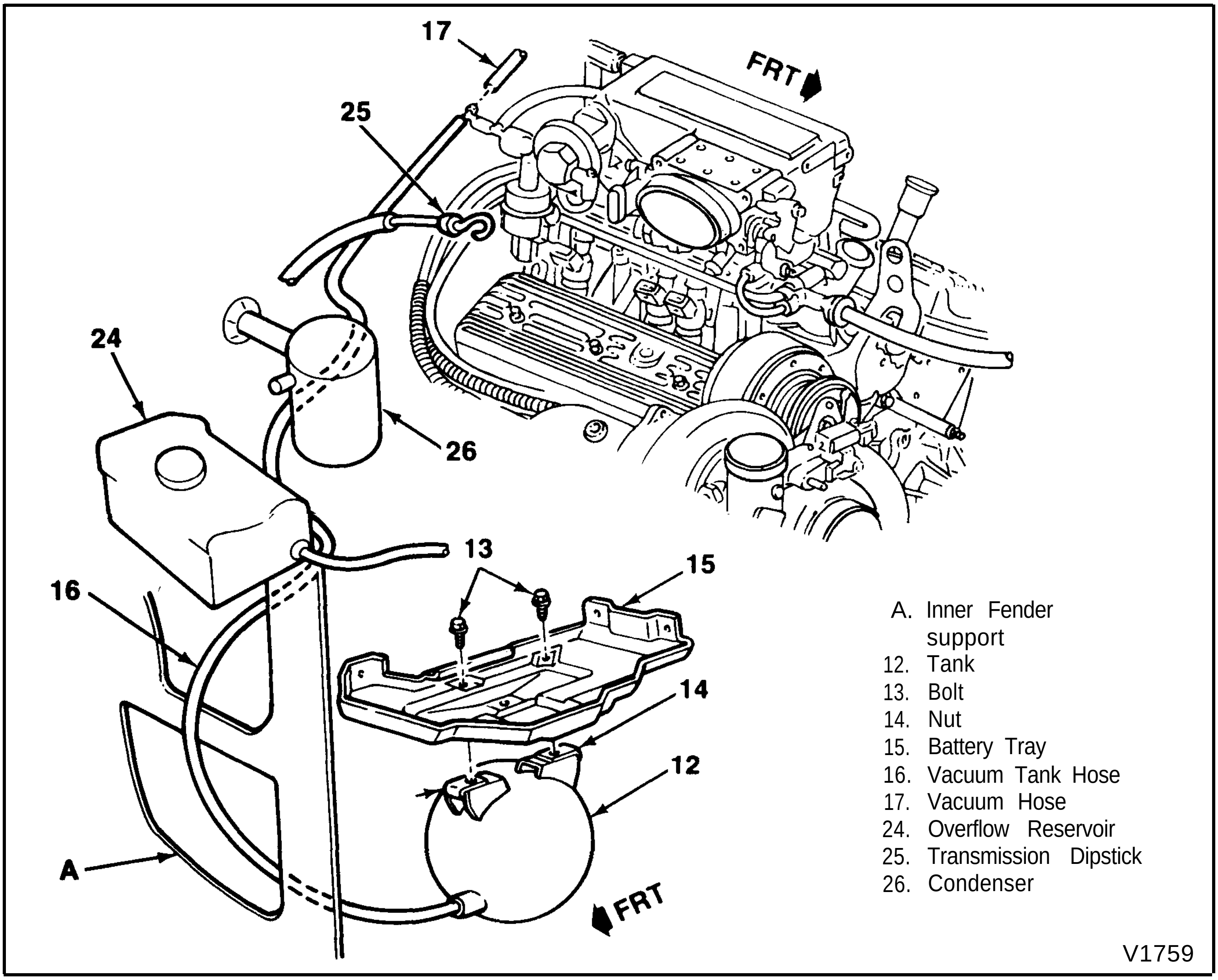

Figure 3 - Vacuum Tank and Lines

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N-m	Ft. Lbs.	In. Lbs.
Compressor Mounting Nut	33	24	-
Hose Manifold Bolt	34	25	-
Turbo Water Return Pipe Fitting	22	10	-
Vacuum Tank Bolt	11	-	97

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SECTION 2A

FRAME AND BUMPERS

NOTICE: When fasteners are removed, a/ways reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

FRONT BUMPER REPLACEMENT

Remove or Disconnect (Figure 1)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Bulb socket from turn signal/parking lamp (12).
2. Fog lamp electrical connectors (11).
3. Nuts (5) and washers (9 and 10) from bolts (3).
4. Bolts (7).
5. Nuts (8) and washers (20 and 30).
6. Front bumper.
7. Nuts (2) and washers (31) from bolts (6).
8. Braces (4) from bolts (6), if necessary.
9. Fascia brackets (27), if necessary, by removing bolts (26), washers (34) and braces (24).
10. Braces (13), if necessary, by removing bolts (25).

Install or Connect (Figure 1)

1. Fascia brackets (27), if removed, by installing braces (24), washers (34) and bolts (26).
2. Braces (13), if removed, by installing bolts (25).
3. Braces (4) to bolts(S), if removed.
4. Nuts (2) and washers (31) to bolts (6).
5. Front bumper, making sure to get bolts (3) into brackets (13).
6. Washers (20 and 30) and nuts (8).
7. Bolts (7).
8. Nuts (5) and washers (9 and 10) to bolts (3).
9. Fog lamp electrical connectors (11).
10. Bulb socket to turn signal/parking lamp (12).
    - Lower vehicle.

FRONT FASCIA REPLACEMENT

Remove or Disconnect (Figure 1)

1. Front bumper as explained previously in this section.
2. Fascia (14) from front support (15).
    - Drill out plastic rivets (16), using an 1/8-inch drill bit.

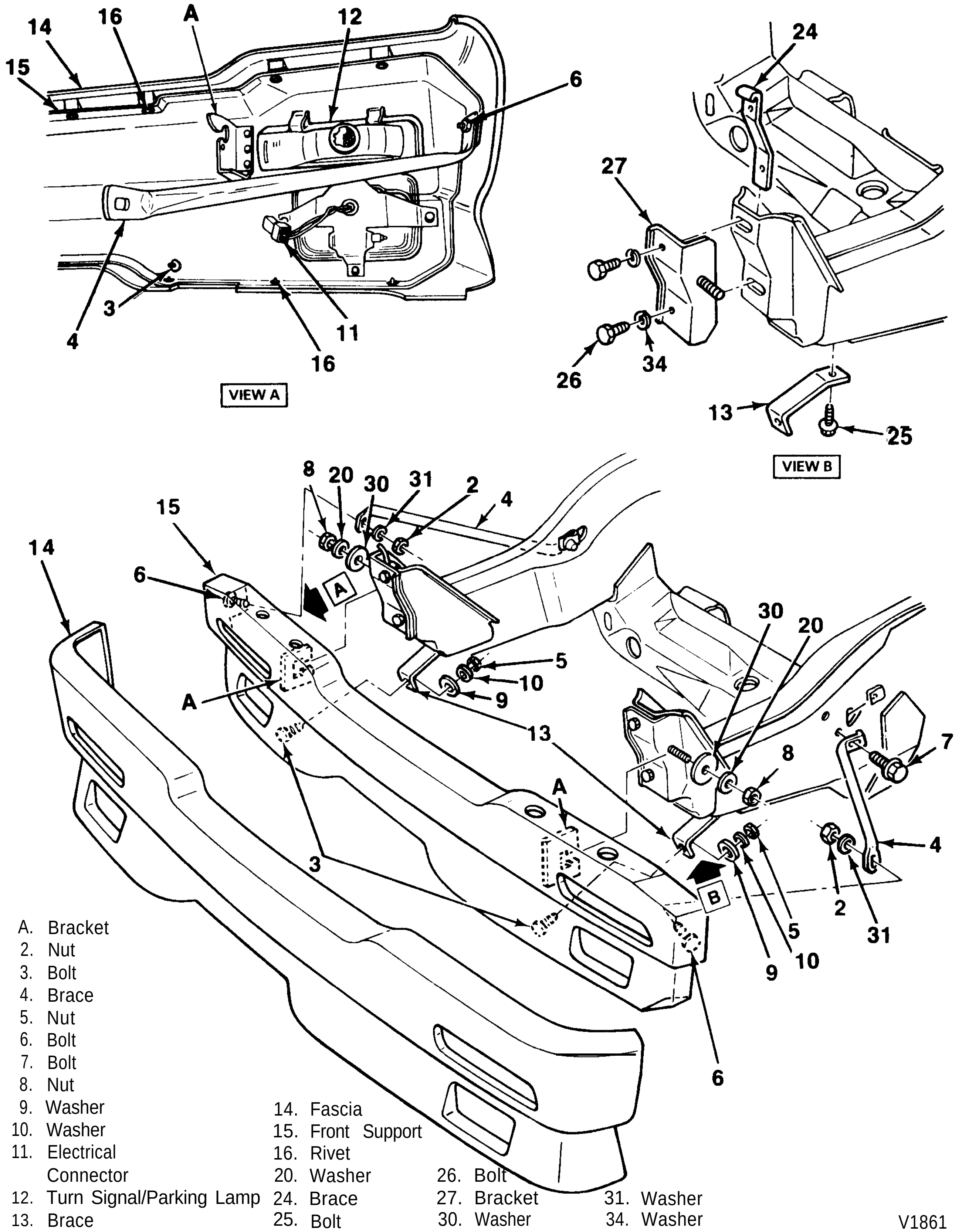
Install or Connect (Figure 1)

1. Fascia (14) to front support (15).
    - Install new plastic rivets (16).
2. Front bumper as explained previously in this section.

REAR BUMPER REPLACEMENT

Remove or Disconnect (Figure 2)

1. Rear license lamps as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Nuts (17) and washers (18).
3. Bolts (19) and washers (21).
4. Rear bumper from frame.
5. Brackets (28), if necessary, by removing bolts (29) and washers (32 and 33).



A. Bracket
2. Nut
3. Bolt
4. Brace
5. Nut
6. Bolt
7. Bolt
8. Nut
9. Washer
10. Washer
11. Electrical Connector
12. Turn Signal/Parking Lamp
13. Brace
14. Fascia
15. Front Support
16. Rivet
20. Washer
24. Brace
25. Bolt
26. Bolt
27. Bracket
30. Washer
31. Washer
34. Washer

Figure 1 - Front Bumper

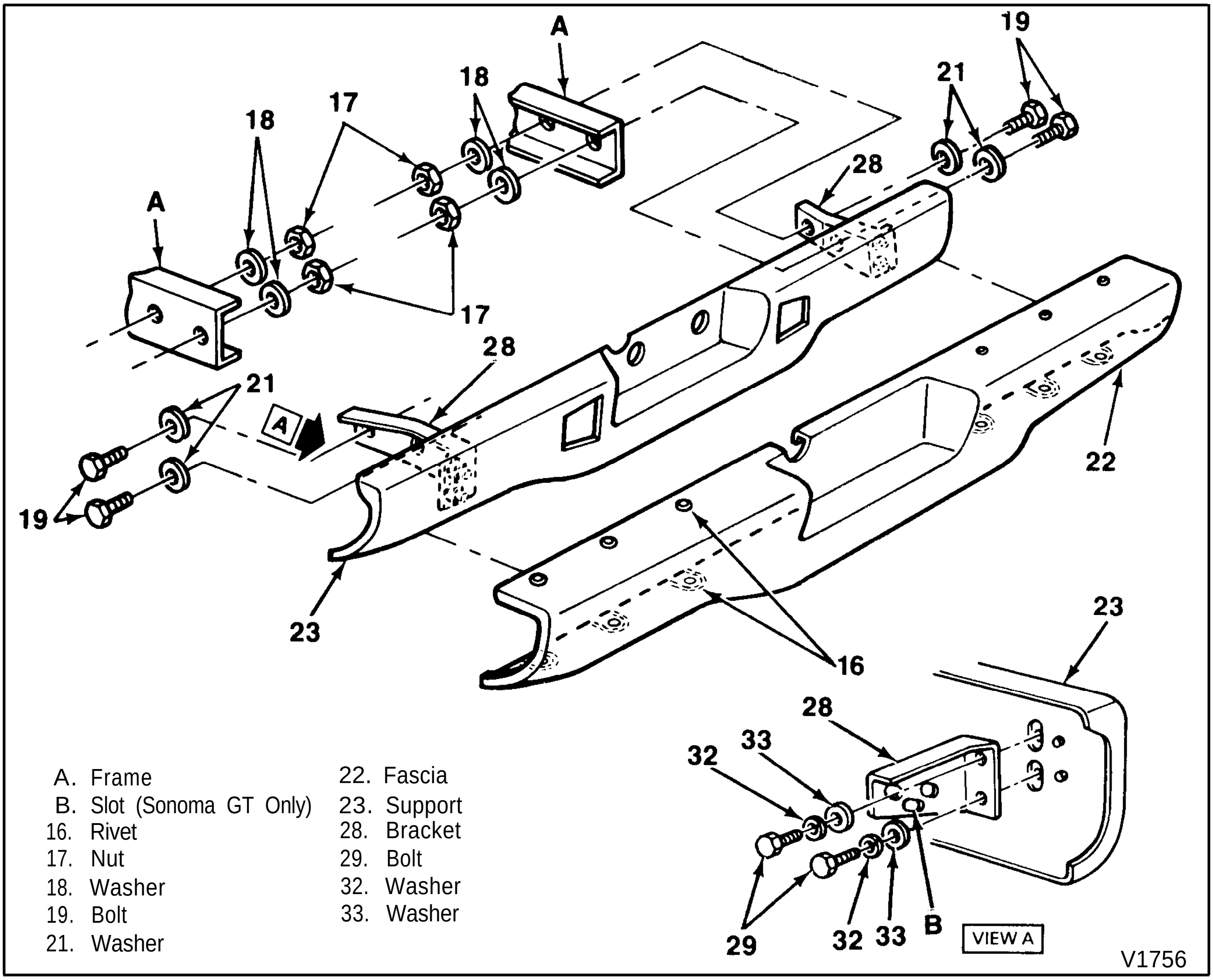


Figure 2-Rear Bumper

Install or Connect (Figure 2)

1. Brackets (28) if removed, by installing bolts (29) and washers (32 and 33).
2. Rear bumper to frame.
3. Bolts (19) and washers (21).
4. Washers (18) and nuts (17).
5. Rear license lamps as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.

REAR FASCIA REPLACEMENT

Remove or Disconnect (Figure 2)

1. Rear bumper as explained previously in this section.
2. Fascia (22) from support (23).
   - Drill out plastic rivets (16) using an 1/8-inch drill bit.

Install or Connect (Figure 2)

1. Fascia (22) to support (23).
   - Install new plastic rivets (16).
2. Rear bumper as explained previously in this section.

SECTION 2B

SHEET METAL

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

ROCKER MOLDING BRACKET

SYCLONE AND TYPHOON

Remove or Disconnect (Figure 1)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A). in the 1992 Service Manual Sonoma and Jimmy Models.

1. Rocker molding as explained later in this section.
2. Brackets (22) by drilling out rivets (31) using a drill and a 15/64-inch drill bit.

Install or Connect (Figure 1)

NOTICE: See "Notice" on page 2B-1 of this section.

1. Brackets (22) by installing rivets (31).
2. Rocker molding as explained later in this section.

- Lower vehicle.

ROCKER MOLDING

SYCLONE AND TYPHOON

Remove or Disconnect (Figure 1)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Rocker molding (21 or 28).
   - On Syclone, drill out rivets (2 and 23) using a drill and a 15/64-inch drill bit and lift rocker molding (21) over clips (1) and brackets (22).
   - On Typhoon, drill out rivets (2 and 23) using a drill and a 15/64-inch drill bit and remove rocker molding (28) from brackets (22).
2. Brackets, if damaged, as explained earlier in this section.
3. Clip (1) on Syclone, if damaged, by drilling out rivet (24) using a drill and a 15/64-inch drill bit.

Install or Connect (Figure 1)

1. Clip (1) on Syclone, if removed, using rivet (24).
2. Brackets, if removed, as explained earlier in this section.
3. Rocker molding (21 or 28).
   - On Syclone, position rocker molding (21) over clip (1) and brackets (22), and install rivets (2 and 23).
   - On Typhoon, position rocker molding (28) over brackets (22), and install rivets (2 and 23).

Important

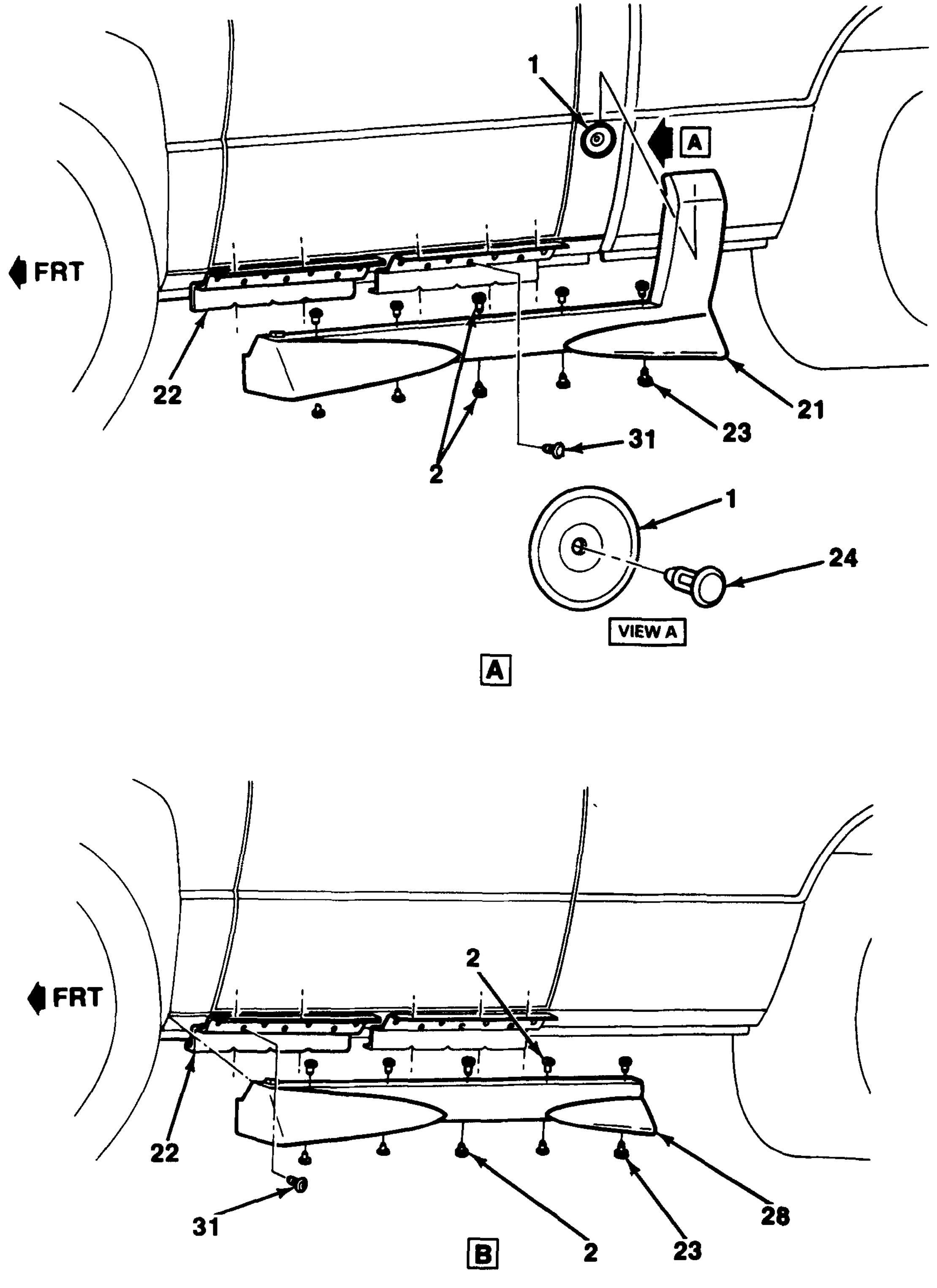
- Install rearmost rivet (23) first.

- Lower vehicle.

SONOMA GT

Remove or Disconnect (Figure 2)

- Raise and suitably support vehicle as described in



A. Syclone
B. Typhoon
1. Clip
2. Rivet
21. Rocker Molding
22. Bracket
23. Rivet
24. Rivet
28. Rocker Molding
31. Rivet

Figure 1 - Rocker Molding and Brackets (Syclone and Typhoon)

GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

- Loosen bolt (36) on clamp (35) (5 places).
- Rocker molding (32) from vehicle.

Disassemble (Figure 2)

- Clamp assembly from rocker molding (32) by removing bolt (36) and washer (37).

Assemble (Figure 2)

- Clamp assembly to rocker molding (32) by sliding clamp (35) onto bracket (34) and loosely installing washer (37) and bolt (36).

Install or Connect (Figure 2)

- Rocker molding (32) to vehicle and tighten bolt (36) on clamp (35).
- Lower vehicle.

FRONT WHEELHOUSE/ FENDER MOLDING

SYCLONE AND TYPHOON

Remove or Disconnect (Figure 3)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Bolts (20) from nuts (16) on front wheelhouse molding (13).
2. Bolts (15) and brace (16) from front fender.
3. Bolt (17) from front wheelhouse molding (13).
4. Bolts (14) from front wheelhouse molding (13).
5. Front wheelhouse molding (13).
6. Tape (19) from front wheelhouse molding (13).

Install or Connect (Figure 3)

NOTICE: For steps 3, 5 and 6, see "Notice" on page 2B-1 of this section.

1. Tape (19) to front wheelhouse molding (13).
2. Position front wheelhousing molding (13) to front fender.
3. Bolts (14) to front wheelhouse molding (13).

   Tighten

   - Bolts (14) to 1.4 N•m (12 in. lbs.).
4. Bolts (17) to front wheelhouse molding (13).
5. Bolts (15) through brace (16) to front fender.

   Tighten

   - Bolts (15) to 9.5 N•m (84 in. lbs.).
6. Bolts (20) through nuts (18) on front wheelhouse molding (13).

   Tighten

   - Bolts (20) to 6.5 N•m (58 in. lbs.).

- Lower vehicle.

SONOMA GT

Remove or Disconnect (Figure 3)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Front parking lamp as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Bolt (17) from front fender molding (39).
3. Bolts (15) and brace (16) from front fender.
4. Bolt (14) from front fender molding (39).
5. Front fender molding (39).
6. Tape (19) from front fender molding (39).

Install or Connect (Figure 3)

1. Tape (19) to front fender molding (39).
2. Front fender molding (39) to front fender.
3. Bolt (14) to front fender molding (39).

   Tighten

   - Bolt (14) to 1.4 N•m (12 in. lbs.).
4. Bolts (15) and brace (16) to front fender.

   Tighten

   - Bolts (15) to 9.5 N•m (84 in. tbs.).
5. Bolt (17) to front fender molding (39).
6. Front parking lamp as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.

- Lower vehicle.

REAR WHEEL OPENING MOLDING

SYCLONE AND TYPHOON

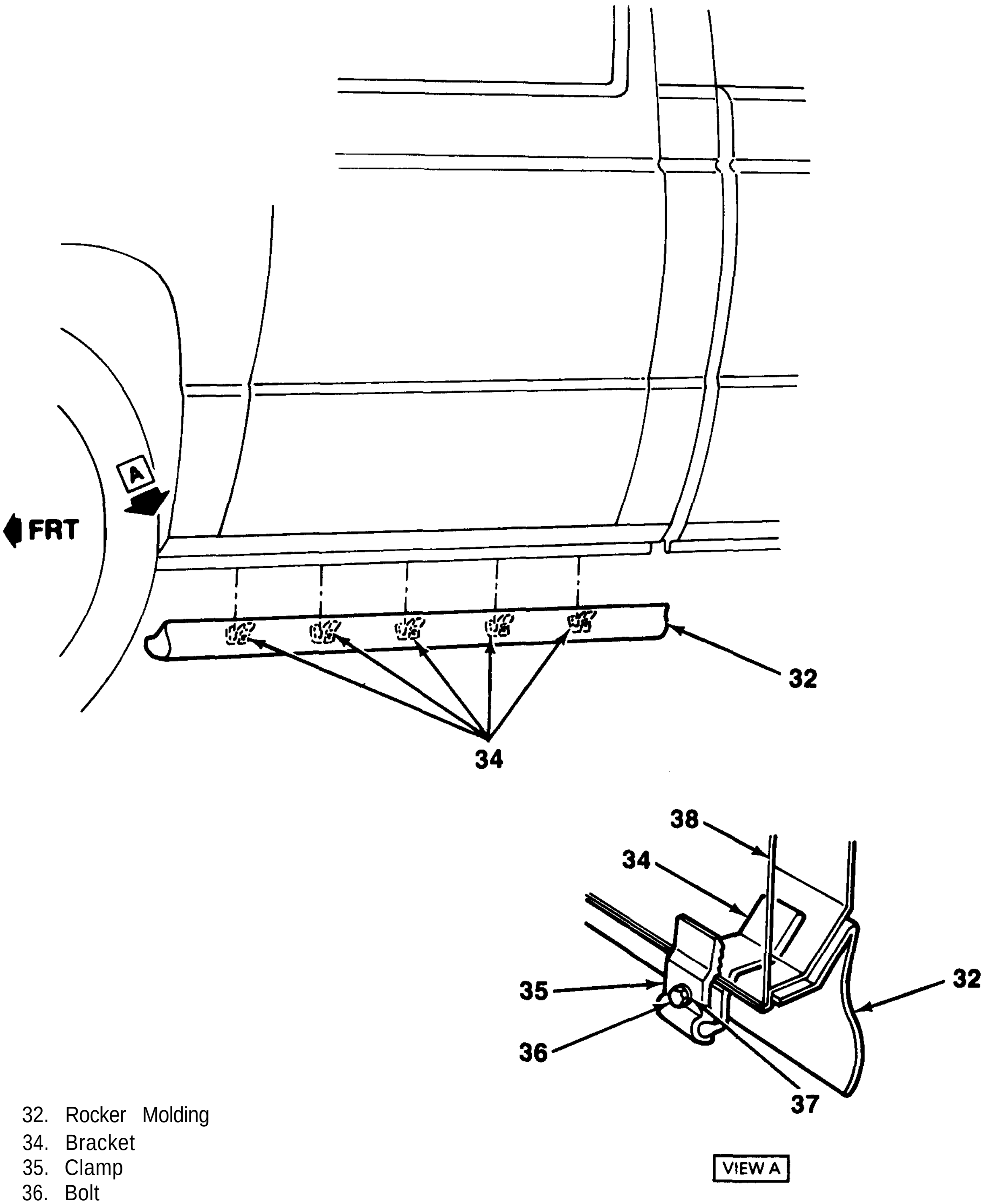
Remove or Disconnect (Figure 4)

1. Screws (4) from rear wheel opening molding (3).
2. Bolts (6) from rear wheel opening molding (3).
3. Rear wheel opening molding (3).

Install or Connect (Figure 4)

NOTICE: For steps 2 and 3, see "Notice" on page 2B-1 of this section.

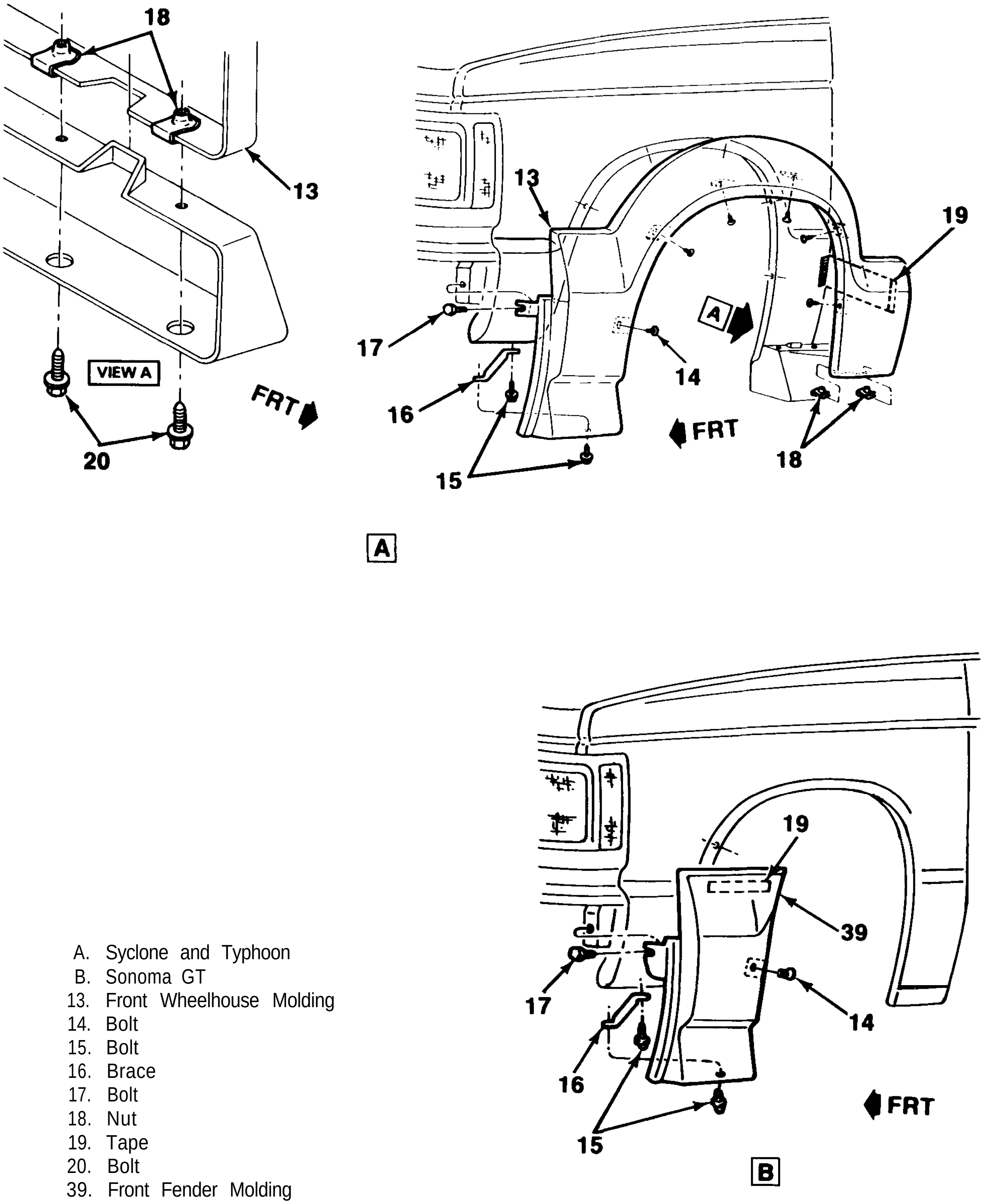
1. Rear wheel opening molding (3).
2. Bolts (6) to rear wheel opening molding (3).



32. Rocker Molding
34. Bracket
35. Clamp
36. Bolt
37. Washer
38. Rocker Panel

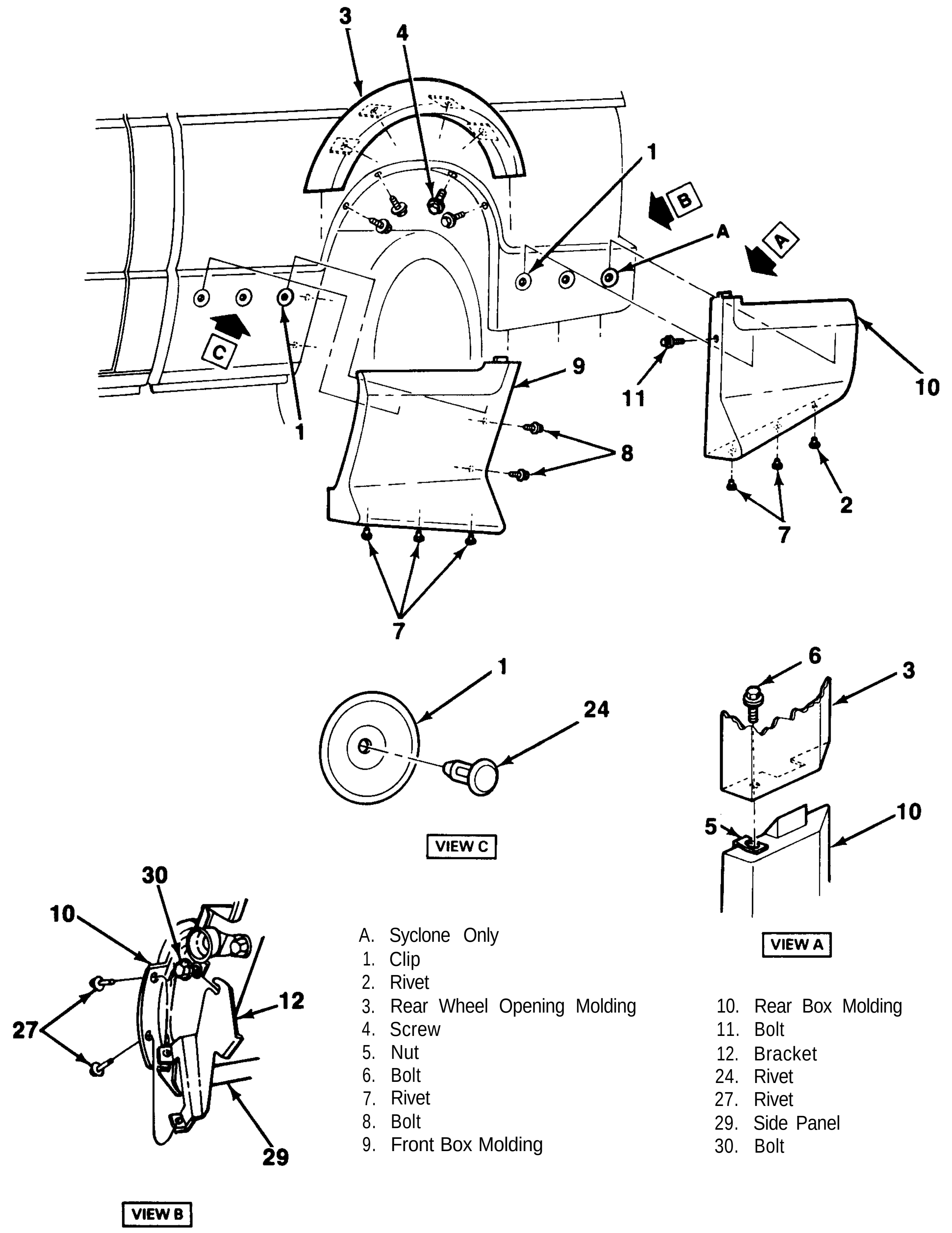
V1738

Figure 2 - Rocker Panel Molding (Sonoma GT)



A. Syclone and Typhoon
B. Sonoma GT
13. Front Wheelhouse Molding
14. Bolt
15. Bolt
16. Brace
17. Bolt
18. Nut
19. Tape
20. Bolt
39. Front Fender Molding

Figure 3 - Front Wheelhouse/Fender Moldings



A. Syclone Only
1. Clip
2. Rivet
3. Rear Wheel Opening Molding
4. Screw
5. Nut
6. Bolt
7. Rivet
8. Bolt
9. Front Box Molding
10. Rear Box Molding
11. Bolt
12. Bracket
24. Rivet
27. Rivet
29. Side Panel
30. Bolt

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Figure 4 - Rear Wheel Opening and Front and Rear Box Moldings (Syclone and Typhoon)

Tighten

- Bolts (6) to 1.4 N•m (12 in. lbs.).

3. Screws (4) to rear wheel opening molding (3).

Tighten

- Screws (4) to 1.4 N•m (12 in. lbs.).

BOX MOLDINGS

SYCLONE AND TYPHOON

Remove or Disconnect (Figure 4)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Bracket (12) from rear fender by drilling out rivets (27) using a drill and a 15/64-inch drill bit, and loosening bolt (30).
2. Bolts (6 and 11) from the front box molding (9) and rear box molding (10).
3. Rivets (7) using a drill and a 15/64-inch drill bit.
4. Rear wheel opening molding as explained previously in this section.
5. Rivet (2) from the rear box molding (10) using a drill and a 15/64-inch drill bit.
6. Rear box molding (10) from clips (1).
7. Front box molding (9) from clips (1).
8. Clips (1), if damaged.
   - Drill out rivets (24) using a drill and a 15/64-inch drill bit.

Install or Connect (Figure 4)

1. Clips (1), if removed, using rivets (24).
2. Front box molding (9) to clips (1).
3. Rear box molding (10) to clips (1).
4. Rivet (2) in the rearmost hole in the rear box molding (10).
5. Rear wheel opening molding as explained previously in this section.
6. Rivets (7) to the front box molding (9) and the rear box molding (10).

NOTICE: See "Notice" on page 2B-1 of this section.

7. Bolts (6 and 11) to the front box molding (9) and the rear box molding (10).

Tighten

- Bolts (8 and 11) to 1.4 N•m (12 in. lbs.).

8. Bracket (12) to rear fender by tightening bolt (30) and installing rivets (27).

- Lower vehicle.

SONOMA GT

Rear Box Molding

Remove or Disconnect (Figure 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Rear bumper. Refer to FRAME AND BUMPERS (SEC. 2A) in this manual.
2. Bolt (30) from rear box molding bracket (12).

- Loosen clamp bolt (43).

3. Rear box molding bracket (12), if necessary, by drilling out rivets (27).
4. Bolts (41) from rear box molding (42).
5. Rear box molding (42).
6. Tape (19) from rear box molding (42).

Install or Connect (Figure 5)

1. Tape (19) to rear box molding (42).
2. Rear box molding (42) to vehicle.
3. Bolts (41) to rear box molding (42).
4. Rear box molding bracket (12), if removed, by installing rivets (27).

- Tighten clamp bolt (43).

5. Bolt (30) to rear box molding bracket (12).
6. Rear bumper. Refer to FRAME AND BUMPERS (SEC. 2A) in this manual.

- Lower vehicle.

Front Box Molding

Remove or Disconnect (Figure 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Loosen bolt (36) on clamp (44) (5 places).
- Front box molding (40) from vehicle.

Assemble (Figure 5)

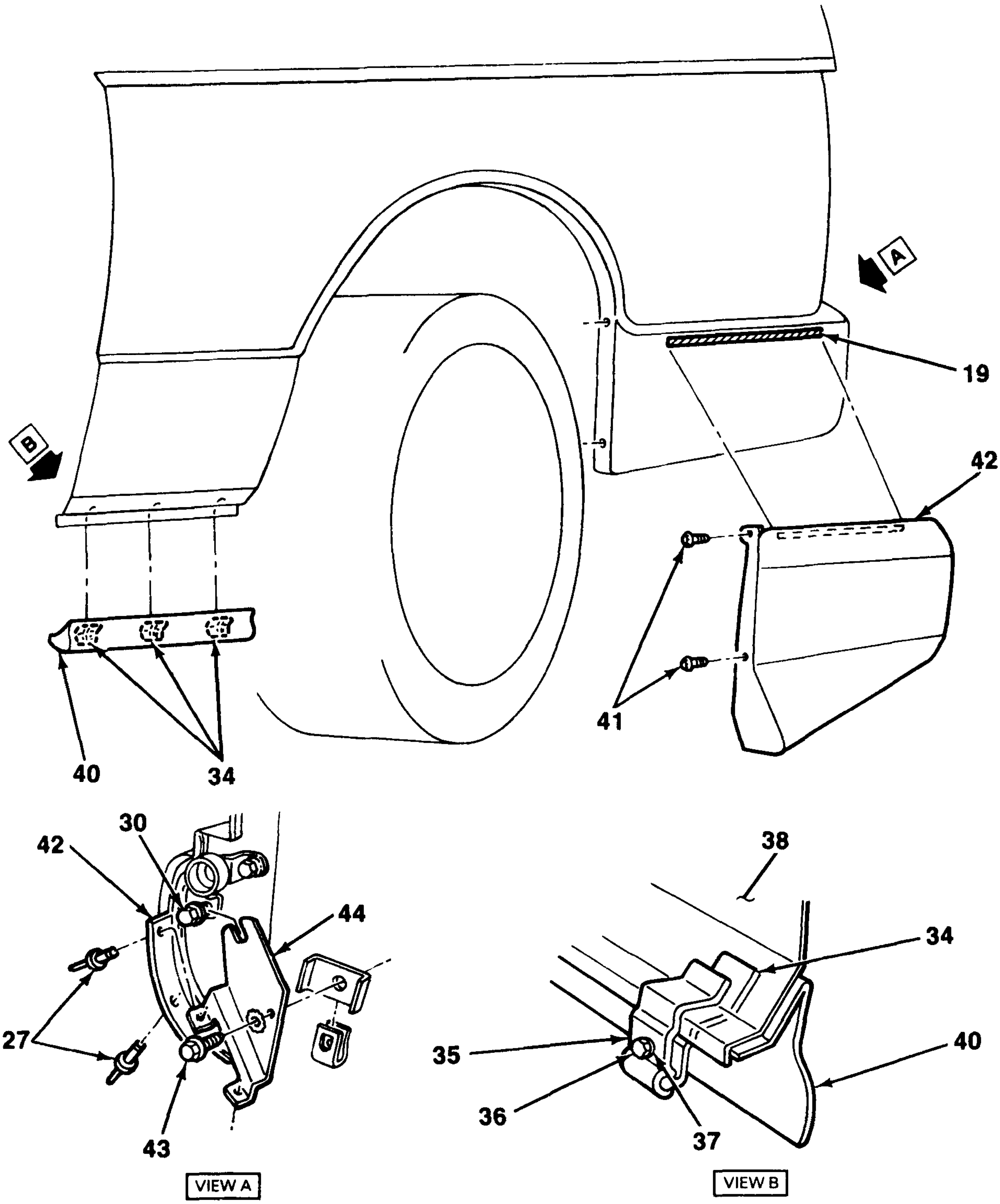
- Clamp assembly to front box molding (40) by sliding clamp (44) onto bracket (34) and loosely installing washer (37) and bolt (36).

Assemble (Figure 5)

- Clamp assembly to front box molding (40) by sliding clamp (44) onto bracket (34) and loosely installing washer (37) and bolt (36).

Install or Connect (Figure 5)

- Front box molding (40) to vehicle and tighten bolt (36) on clamp (44).
- Lower vehicle.



19. Tape
27. Rivet
30. Bolt
34. Bracket
35. Clamp
36. Bolt
37. Washer
38. Rocker Panel
40. Front Box Molding
41. Bolt
42. Rear Box Molding
43. Bolt
44. Bracket

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Figure 5 - Front and Rear Box Moldings (Sonoma GT)

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	In. Lbs.
Front Wheelhouse Molding Bolt	1.4	12
Brace-to-Fender Bolt	9.5	84
Front Wheelhouse-to-Fender Bolt	6.5	58
Rear Wheel Opening Molding-to-Box Molding Bolt	1.4	12
Rear Wheel Opening Molding-to-Fender Screw	1.4	12
Front Box Molding-to-Fender Bolt	1.4	12
Rear Box Molding-to-Fender Bolt	1.4	12

V3218

SECTION 3A

FRONT END ALIGNMENT

SYCLONE AND TYPHOON

CONTENTS

ON-VEHICLE SERVICE

TRIM HEIGHT SPECIFICATIONS

VEHICLE HEIGHTS (Figures 1 through 3)

1. Lift the front bumper of the vehicle up about 38 mm (1.5 inch). Let the vehicle settle. Do this three times. Measure “Z” dimension.
2. Push the front bumper down 38 mm (1.5 inch). Let the vehicle settle. Do this three times. Measure “Z” dimension.

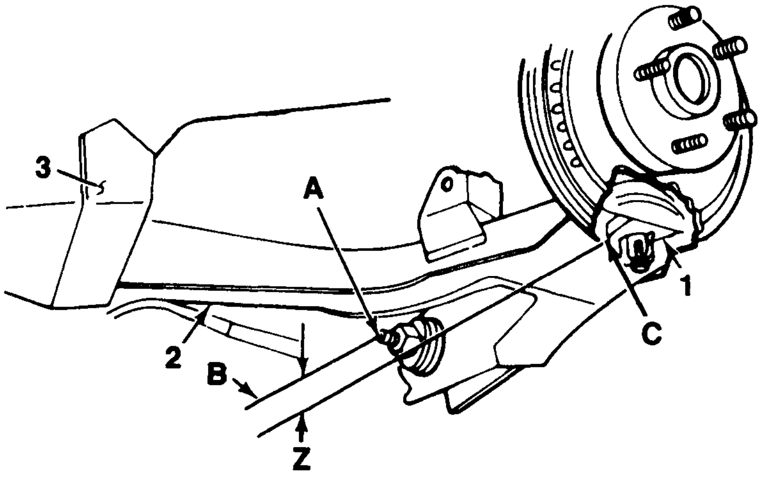
Important

- True height is the average of the high and low measurements.

3. Lift the rear bumper of the vehicle up about 38 mm (1.5 inch). Let the vehicle settle on its own. Do this three times. Measure “D” dimension.
4. Push the rear bumper of the vehicle down about 38 mm (1.5 inch). Let the vehicle rise on its own. Do this three times. Measure “D” dimension.

Important

- True height is the average of the high and low measurements.



A. Center Line of Pivot Bolt
B. Parallel to Ground
C. Lowest Inboard Edge of Knuckle
Z. All Curb “Z” Heights to be Trimmed at 63.6 ± 6.0 mm (2.5 ± 0.2”)
1. Knuckle and Hub Assembly
2. Lower Control Arm
3. Frame

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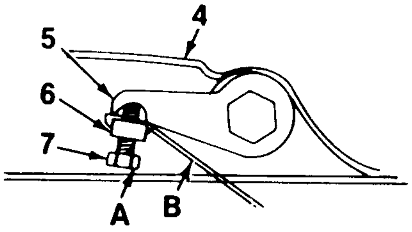
Figure 1 - “Z” Height



A. One revolution of bolt into nut increases front "Z" height by 6.0 mm (0.2").
B. 1 mm (0.04") clearance must be provided between adjuster arm and nut after adjustment.
4. Torsion Bar Support
5. Torsion Arm
6. Nut
7. Bolt

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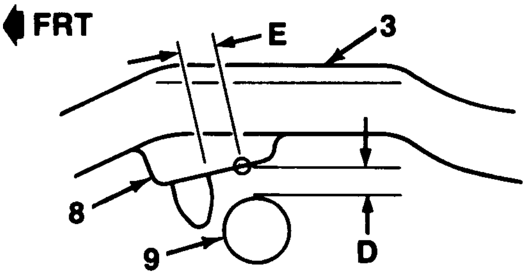
Figure 2 - "Z" Trim Height Adjustment



D. "D" Height Average. "D" Heights to be Trimmed at 100.2 ± 6.0 mm (3.9 ± 0.2")
E. 50 mm (2")
3. Frame
8. Bumper Bracket
9. Rear Axle

V1764

Figure 3 - "D" Height

SPECIFICATIONS

TO ALIGN (A)	SERVICE CHECKING	SERVICE SETTING
CASTER	+3.5° ± 1.0° (C)	+3.5° ± 0.50° (B)
CAMBER	0.0° ± 0.80° (C)	0.0° ± 0.50° (B)
TOE-IN (DEGREES PER WHEEL)	+0.15° ± 0.10° (D)	+0.15° ± 0.05° (D)

NOTE: Vehicle must be jounced three times before checking alignment to eliminate false geometry readings.

(A) Front suspension (Z) dimension and rear suspension (D) dimension are held as explained under "Trim Height Specifications." Front end alignment specifications are indicated on this chart.
(B) Left and right side to be equal within 0.50 degree.
(C) Left and right side to be equal within 1.0 degree.
(D) Toe-in left and right side to be set separately per wheel and steering wheel must be held in straight ahead position within ±5.0 degree.

V1408

SECTION 3B1

POWER STEERING

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. ifs fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

POWER STEERING PUMP REPLACEMENT

Remove or Disconnect (Figures 1 and 2)

Tool Required:
J 25034-B Power Steering Pump Pulley Remover

1. Air cleaner and duct.
2. Upper fan shroud screws.
3. Upper fan shroud.
- Loosen fan nuts.
4. Serpentine belt.
5. Fan-to-water pump pulley nuts.
6. Fan and pulley.
7. Pump pulley.
    - Install J 25034-B. Ensure that pilot bolt bottoms in pump shaft by turning nut to top of pilot bolt.
    - Hold pilot bolt.
    - Turn nut counterclockwise.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
8. Left wheel assembly. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.
9. Left wheelhouse panel screws.
10. Left wheelhouse panel.
11. Bolt from hose bracket.
- Place a drain pan below pump (3).
12. Return hose assembly (7) from pump (3).
13. Pressure hose assembly (6) from pump (3).
- Cap return hose assembly (7) and pressure hose assembly (6).
14. Mounting bolts (4) from bracket (1).
- Lower vehicle.
15. Bolts (19) from rear bracket (2) at alternator.
16. Pump (3) and rear bracket (2).
17. Nuts (5) from rear bracket (2).
18. Pump (3) from rear bracket (2).

Install or Connect (Figures 1 and 2)

Tool Required:
J 25033-B Power Steering Pump Pulley Installer

NOTICE: For steps 2, 4, 5, 6, 7, 14 and 17, see "Notice" on page 3B1-1 of this section.

1. Pump (3) to rear bracket (2).
2. Nuts (5) to rear bracket (2).

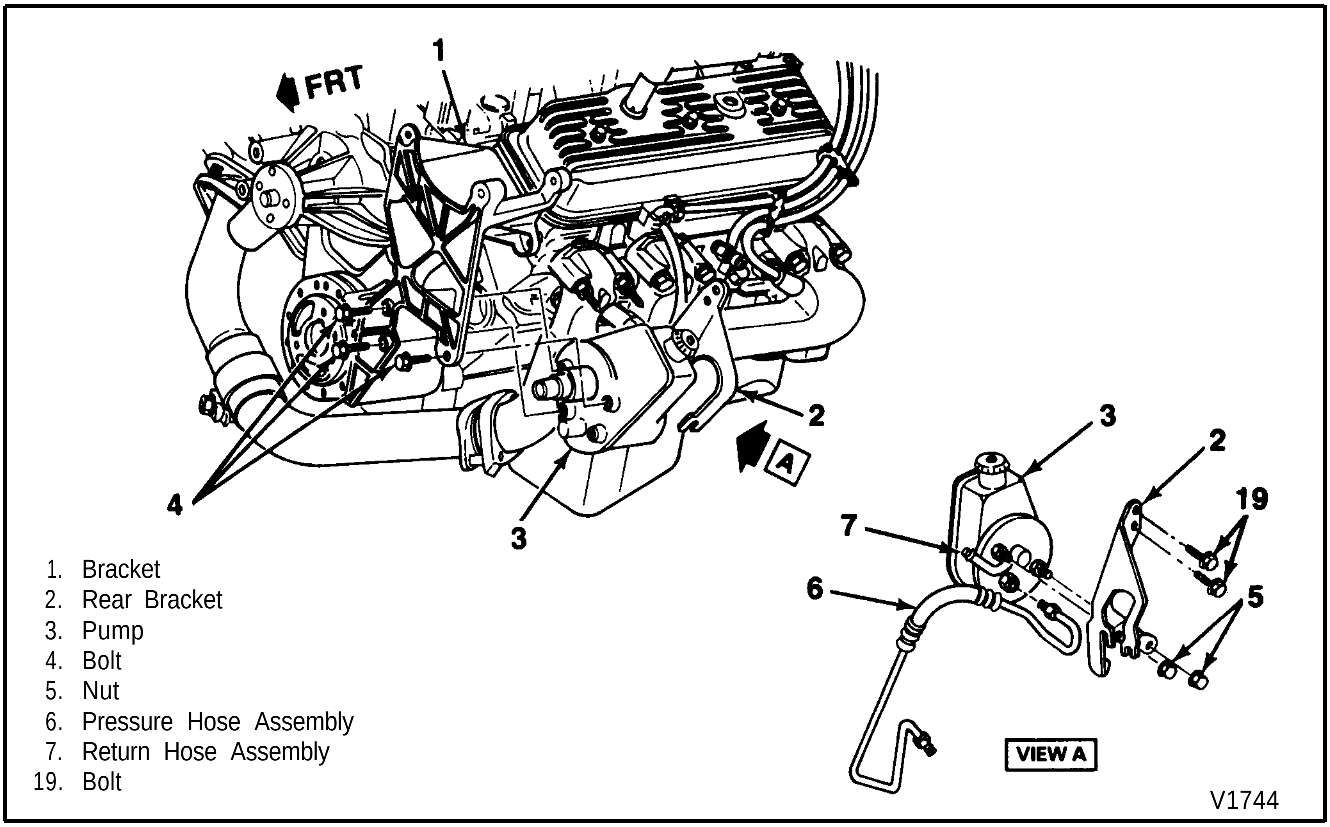


Figure 1 - Replacing Power Steering Pump

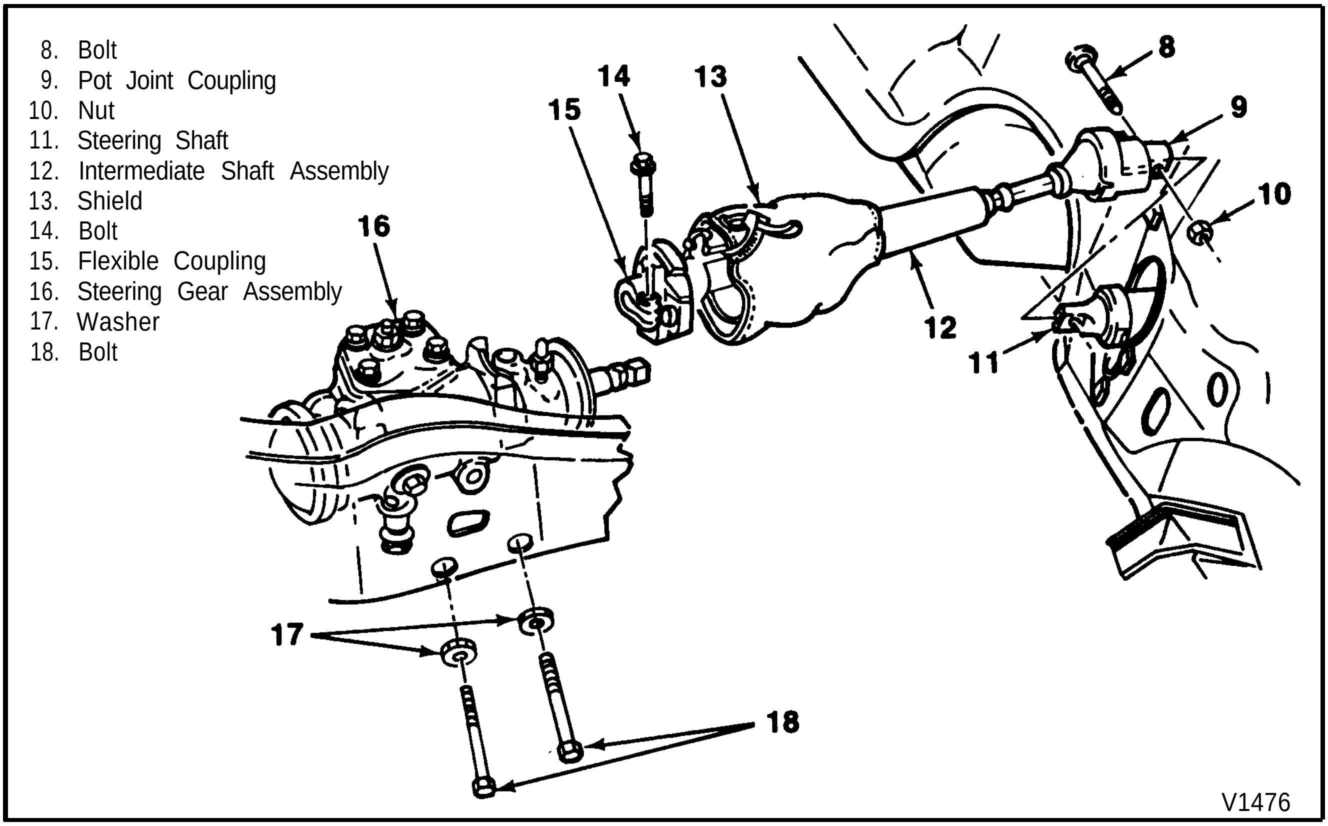


Figure 2 - Steering Gear Assembly

Tighten

- Nuts (5) to 45 N•m (33 ft. lbs.).

3. Pump (3) and rear bracket (2) to vehicle.
4. Mounting bolts (4) to bracket (1).

Tighten

- Bolt (4) to 50 N•m (37 ft. lbs.).

5. Bolts (19) to rear bracket (2) at alternator.

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

6. Pressure hose assembly (6) to pump (3).

Tighten

- Pressure hose assembly fitting to 27 N•m (20 ft. lbs.).

7. Return hose assembly (7) to pump (3).

Tighten

- Return hose assembly fitting to 27 N•m (20 ft. lbs.).

8. Bolt to hose bracket.
9. Left wheelhouse panel to vehicle.
10. Screws to left wheelhouse panel.
11. Left wheel assembly. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

- Lower vehicle.

12. Pump pulley.
    - Place pulley on end of pump shaft.
    - Install J 25033-B. Be sure pilot bolt bottoms in pump shaft by turning nut to top of pilot bolt.
    - Hold pilot bolt.
    - Turn nut clockwise.
13. Fan and pulley.
14. Fan-to-water pump pulley nuts.

Tighten

- Nuts to 24 N•m (18 ft. lbs.).

15. Serpentine belt.
16. Upper fan shroud.
17. Upper fan shroud screws.

Tighten

- Screws to 10 N•m (89 in. lbs.).

18. Air cleaner and duct.

- Fill and bleed power steering system as described in POWER STEERING (SEC. 3B1) in the 1992 Service Manual Sonoma and Jimmy Models.

Inspect

- Power steering system for leaks.

STEERING GEAR REPLACEMENT

Remove or Disconnect (Figures 1 and 2)

- Place a drain pan below steering gear.
- Place a drain pan below charge air cooler radiator.

1. Pressure and return hose assemblies (6 and 7) from steering gear assembly (16).
    - Cap or tape ends of pressure and return hose assemblies (6 and 7) and gear fittings to prevent the entrance of dirt.
2. Shield (13).
3. Bolt (14) from flexible coupling (15).
    - Draw alignment marks on flexible coupling (15) and power steering gear shaft before removing flexible coupling (15).
4. Bolt (6) and nut (10) from pot joint coupling (9).
5. Intermediate shaft assembly (12) at steering gear assembly (16).

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

6. Charge air cooler radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.
7. Pitman arm as described in STEERING LINKAGE (SEC. 3B3) in the 1992 Service Manual Sonoma and Jimmy Models.
8. Mounting bolts (16) and washers (17) from steering gear assembly (16).
9. Steering gear assembly (16).

Install or Connect (Figures 1 and 2)

NOTICE: For steps 2, 6, 7 and 9 see "Notice" on page 3B1-1 of this section.

1. Steering gear assembly (16).
2. Washers (17) and mounting bolts (18).

Tighten

- Mounting bolts (18) to 75 N•m (55 ft. lbs.).

3. Pitman arm as described in STEERING LINKAGE (SEC. 3B3) in the 1992 Service Manual Sonoma and Jimmy Models.
4. Charge air cooler radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.

- Lower vehicle.

5. Intermediate shaft assembly (12) at steering gear assembly (16).
6. Bolt (8) and nut (10) to pot joint coupling (9).

Tighten

- Nut (10) to 62 N•m (46 ft. lbs.).

7. Bolt (14) to flexible coupling (15).
    - Make sure the alignment marks line up.

Tighten

- Bolt (14) to 36 N•m (27 ft. lbs.).

8. Shield (13).
9. Pressure and return hose assemblies (6 and 7) to steering gear assembly (16).

Tighten

- Hose fittings to 27 N•m (20 ft. lbs.).

- Refill charge air cooler radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.
- Bleed power steering system as described in POWER STEERING (SEC. 3B1) in the 1992 Service Manual Sonoma and Jimmy Models.

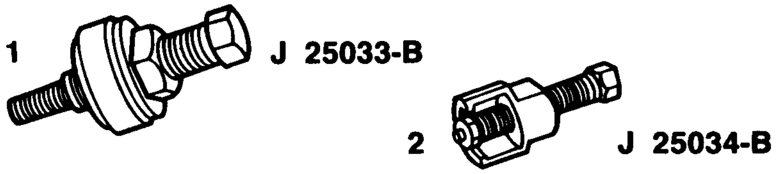
SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Rear Bracket-to-Pump Nut	45	33	
Pump Mounting Bolt	50	37	
Hose-to-Pump Fitting	27	20	
Fan-to-Water Pump Pulley Nut	24	18	
Upper Fan Shroud Screw	10		89
Steering Gear-to-Frame Bolt	75	55	
Flexible Coupling Bolt	36	27	
Pot Joint Coupling Nut	62	46	

V1745

SPECIAL TOOLS



1. Power Steering Pump Pulley Installer
2. Power Steering Pump Pulley Remover

V1767

SECTION 3D1

ELECTRONIC LEVEL CONTROL

TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

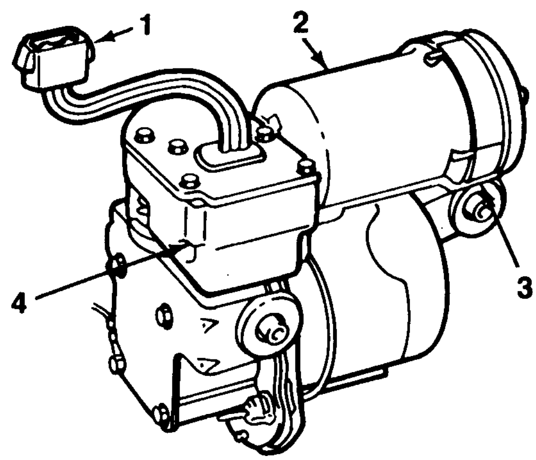
DESCRIPTION

Electronic Level Control (ELC) system adjusts the rear trim height in response to changes in vehicle loading. The system consists of an air compressor assembly, air dryer, exhaust solenoid, compressor relay, height sensor, air adjustable shocks and air tubing. The exhaust solenoid is connected directly to battery (+), but controlled by the height sensor, allowing the system to exhaust with the ignition off when excess weight is removed.

SYSTEM COMPONENTS

COMPRESSOR

The compressor assembly is a single piston and pump powered by a 12v DC permanent magnet motor. The compressor head casting contains intake and exhaust valves plus a solenoid operated exhaust valve which releases air from the system when energized. The compressor is located at the left rear of the vehicle under body. The compressor assembly is also coated with a weather sealant and covered with a shield for protection (figure 1).



1. Exhaust Solenoid Connector
2. Air Dryer
3. Dryer Cover
4. Air Compressor

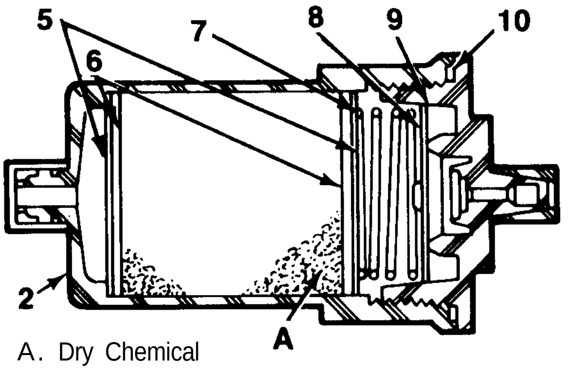
V1789

Figure 1 - ELC Compressor

AIR DRYER

The air dryer is attached to the compressor output and provides a dual function (figure 2):

1. It contains a dry chemical that absorbs moisture from the air before it is delivered to the shocks/strut. Moisture is removed from the chemical and returned to the air when it is being exhausted.
2. The air dryer also contains a valving arrangement that maintains minimum air pressure of 48-97 kPa (7-14 psi) in the shocks/struts for improved ride characteristics.



A. Dry Chemical
2. Air Dryer
5. Retainer
6. Filter
7. Spring
8. Valve Seat
9. Minimum Air Pressure Valve
10. Gasket

V1790

Figure 2 - ELC Air Dryer

EXHAUST SOLENOID

The exhaust solenoid is located in the compressor head assembly and provides two functions (figure 1):

1. It exhausts air from the system when energized by the height sensor.
2. It acts as a blow off valve to limit maximum pressure output of the compressor.

COMPRESSOR RELAY

The relay completes the 12v (+) circuit to the compressor motor when energized. The height sensor controls this function.

HEIGHT SENSOR

The height sensor controls two basic circuits (figure 3):

1. Compressor relay coil ground circuit.
2. Exhaust solenoid coil ground circuit.

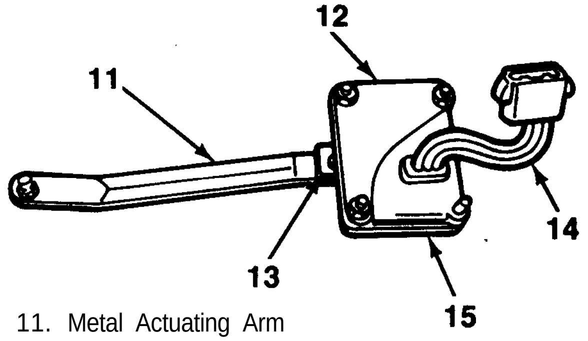
To prevent falsely energizing the compressor relay or exhaust solenoid circuits during normal ride motions, the sensor circuit provides a predetermined delay before ground is completed to either circuit.

In addition, the sensor electronically limits compressor run time and exhaust solenoid energized time. This time limit function is necessary to prevent continuous compressor operation in case of a severe system leak or continuous exhaust solenoid operation.

The electronic timer is reset whenever:

1. The ignition is cycled “OFF and ON”.
2. Height sensor exhaust or compressor signal changes.

The height sensor is mounted to the frame in the rear. The height sensor actuator arm is attached to the rear axle by a short link.



11. Metal Actuating Arm
12. Height Sensor Bracket
13. Plastic Actuating Arm
14. Pigtail Harness
15. ELC Height Sensor

V1791

Figure 3 - ELC Height Sensor

AIR ADJUSTABLE SHOCKS AND STRUTS

The air adjustable shock is similar to the conventional type which is enclosed in an air chamber. It is constructed with a rubber-like sleeve attached to the dust tube and reservoir. This sleeve forms a flexible chamber which will extend the shock/strut when the air pressure in the chamber is increased. In order to maintain proper operation and reliability of the air adjustable shocks/struts, a minimum pressure of 48-97 kPa (7-14 psi) must be maintained in the system at all times.

AIR LINES AND FITTINGS

Flexible air lines are used throughout the system. The line is 3.2 mm (1/8-inch) diameter tubing. "Snap on" connectors are used to attach the air lines to system components and must be used for a proper seal. While the lines are flexible for easy routing and handling, care should be taken not to kink them and to keep them from coming in contact with the exhaust system.

SYSTEM OPERATION

When a load is added to the vehicle, the vehicle body is moved down causing the height sensor arm to rotate upward. The upward movement of the height sensor arm activates the internal timing circuit. After an initial predetermined time delay (8-15 seconds) the sensor grounds pin 3 which in turn completes the compressor relay circuit to ground. With the relay energized, the 12v (+) circuit to the compressor is complete and the compressor runs, sending pressurized air to the shocks/struts through the plastic tubing.

As the air-adjustable shocks/struts inflate, the vehicle body moves upward, rotating the height sensor towards its original position. Once the body reaches it's original height (1 1/4 inch ± 1 inch), the sensor opens the compressor relay circuit and shuts off the compressor.

When an excess load is removed from the rear of the vehicle, the body is forced upward, causing the height sensor arm to rotate down. The downward movement of the arm causes the internal timing circuit to activate. After an initial predetermined time delay (8-15 seconds), the sensor completes the exhaust solenoid circuit to ground. With the exhaust solenoid energized, air starts exhausting out of the shocks/struts back through the air dryer and exhaust sole noid valve into the atmosphere.

As the vehicle body lowers, the height sensor arm is rotated to its original unloaded position. When the vehicle body reaches its original unloaded height (± 1 inch), the sensor opens the exhaust solenoid circuit which prevents air from escaping.

A minimum air pressure of 48-97 kPa (7-14 psi) is maintained in the shocks/struts by the air dryer valve. This residual pressure provides improved ride characteristics when the vehicle is carrying a minimum load.

Height sensor position is checked when the ignition is turned on. If the height sensor indicates that it is not necessary to raise or lower the vehicle, an internal timer circuit is activated. After 40 seconds, the compressor is turned on for 4 seconds. This ensures that the air adjustable shocks/struts are filled with the proper residual pressure.

If weight is added to or removed from the vehicle during the 40 second delay, the air replenishment cycle will be overridden and the vehicle will raise or lower after the normal delay.

DIAGNOSIS OF ELECTRONIC LEVEL CONTROL SYSTEM

NOTICE: For circuit operation and diagnostic procedures, refer to the Sonoma GT/Syclone/ Typhoon Electrical Diagrams and Diagnosis Manual at the end of this manual. When diagnosis or repair requires raising the vehicle on a hoist, it is important that the rear axle assembly remains in the normal trim height position at all times, therefore, the hoist should support the rear wheels or axle housing. When a frame contact hoist is used, two additional jack stands should be used to support the rear axle or control arms in the normal trim height position.

WIRING SCHEMATICS

For wiring schematics, refer to the Sonoma GT/Syclone/ Typhoon Electrical Diagrams and Diagnosis Manual at the end of this manual.

SYSTEM OPERATION CHECK

For system operation check, refer to the Sonoma GT/ Syclone/Typhoon Electrical Diagrams and Diagnosis Manual at the end of this manual.

RESIDUAL AIR CHECK

As explained previously, the air dryer has a valving arrangement that maintains 48-97 kPa (7-14 psi) in the shocks/struts to improve the ride characteristics under light load conditions. To test this function, proceed as follows (figure 4):

Tool Required
J 22124-A Pressure Gage

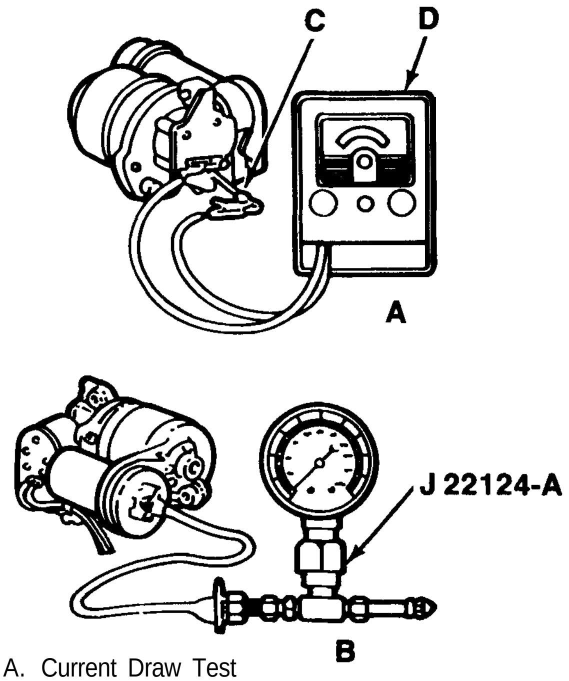
1. Remove air line from dryer fitting and attach it to J 22124-A, then attach gage air line to dryer fitting.

2. Disconnect electrical connection to pump from vehicle harness. Jump 12 volts to terminal "F" (green wire) at connector on pump side. 12 volts can be obtained at any of the three terminals with orange wires ("A," "C," "E") at connector on vehicle harness. Ground terminal "G" (black wire) at connector on pump side to run compressor, pump should run until 690 kPa (100 psi) is reached.

3. To exhaust the system, jump 12 volts from vehicle harness connector to terminal "C" (orange wire) at

connector on pump side and ground terminal "B" (white wire) at same connector.

4. When no more air can be exhausted, the gage should indicate 48-97 kPa (7-14 psi).



A. Current Draw Test
B. Pressure Output Test
C. Motor Ground Lead
D. Ammeter

V1792

Figure 4 - Compressor Test/Residual Air Check

COMPRESSOR/DRYER PERFORMANCE TEST

- This test may be performed on the vehicle or bench and tests Compressor Current Draw, Pressure Output and Leak Down (figures 5 and 6).

Tool Required
J 22124-A Pressure Gage

1. Disconnect wiring from compressor motor and exhaust solenoid terminals.
2. Disconnect existing pressure line from dryer and attach J 22124-A to dryer fitting.
3. Connect ammeter to 12v source and to compressor.
4. Operate the compressor and note the following:
   a. Current draw should NOT exceed 14 amps.
   b. When gage reads at least 690 kPa (100 psi) SHUT COMPRESSOR OFF by disconnecting power supply and observe if pressure leaks down. It should not leak down below 620 kPa (90 psi). If compressor is permitted to run until it reaches its maximum output pressure 1,240 kPa (180 psi), the solenoid exhaust valve will act as a relief valve. The resulting leak down when compressor is shut off will indicate a false leak.
   c. Refer to compressor/dryer trouble chart (figure 5) if compressor fails to meet specification.
   d. If ok, reinstall compressor and reconnect wiring and air lines.

ELC SYSTEM LEAK TEST

Tool Required
J 22124-A Pressure Gage

1. Tee J 22124-A into ELC system between the dryer assembly and the pressure regulator valve. Install so that the shut-off valve is on the compressor side of the gage (figure 6).
2. With the shut-off valve open (up), apply service air pressure through the service valve on the gage until the gage reads 690 kPa (100 psi).
3. If a leak is indicated, close the shut-off valve (down) and continue to observe for pressure drop. Closing the valve isolates the compressor from the remainder of the system.

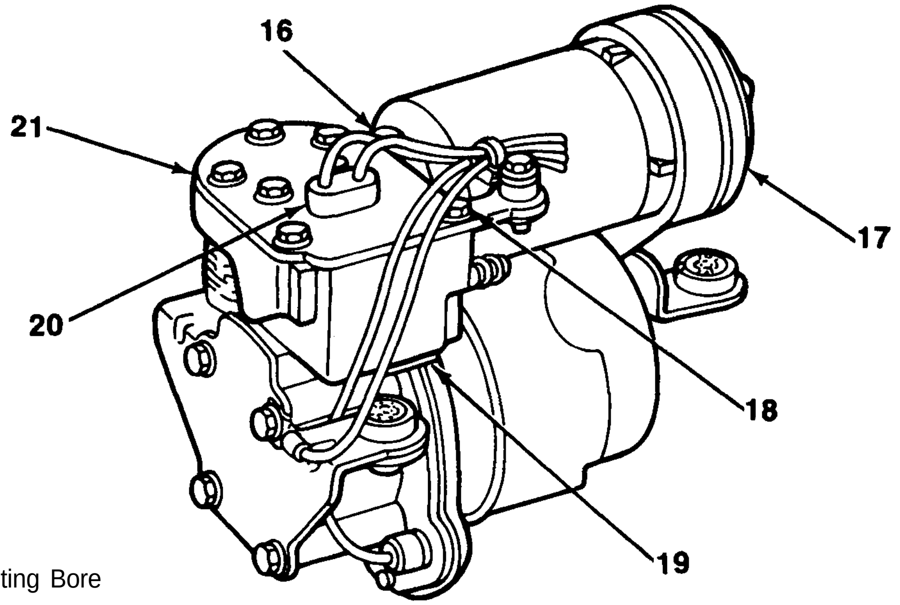
- If the gage pressure continues to drop, the leak is external to the compressor. Leak test all connections with a soap and water or leak test solution. If a leak is

COMPRESSOR/DRYER TROUBLE CHART

MALFUNCTION	CORRECTION
1. Compressor runs but current draw exceeds 14 amps.	1. Replace compressor
2. Compressor inoperative.	2. Replace compressor
3. Compressor output less than 758 kPa (110 psi).	3. Perform compressor/dryer leak test; if no leak is found, replace compressor.
4. Pressure leaks down to 0 kPa (0 psi).	4. Perform compressor/dryer leak test, and make corrections as required.
5. Pressure build up ok, but leaks down below 620 kPa (90 psi) before holding steady. (Does not go to 0 psi.)	5. Replace head assembly.

V1794

Figure 5 - Compressor/Dryer Trouble Chart



16. Dryer "O" Ring Casting Bore
17. Dryer Cover
18. Cover Bolts
19. Head Casting Air Intake and Exhaust Opening
20. Solenoid Valve Terminal Housing
21. Cover Gasket

V1795

Figure 6 - Compressor Leak Test

found in one of the connections, follow the procedure listed below:

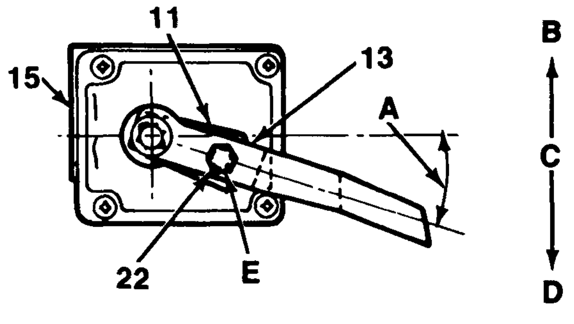
- Dryer cover: replace dryer/exhaust/blocker valve assembly.
- Cover bolts: tighten bolts as required to 4 N•m (36 in. lbs.).
- Head casting air intake and exhaust opening: replace head assembly.
- Edge of solenoid valve terminal housing: replace head assembly.
- Edge of cover gasket: check torque of cover bolts before replacing gasket.

- If the gage pressure does not continue to drop, the leak is in the compressor. Check compressor for leaks.

4. If pressure builds up rapidly but vehicle does not raise, check for pinched air lines and stuck air binding shocks/struts.

Height Sensor Operational Check

1. Turn ignition "OFF", then "ON". This will reset the height sensor timer circuits (figure 7).
2. Raise vehicle on hoist. Be sure rear wheels or axle housing are supported. Be sure vehicle is at proper trim height. Refer to GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
3. Disconnect link from height sensor arm.
4. Check that wiring is properly and securely connected to height sensor and that harness ground wire is securely connected.
5. Move metal sensor arm up. There should be a delay (8-15 seconds) before compressor turns "ON" and shocks/struts start to inflate. As soon as shocks/struts fill, stop compressor by moving sensor arm down.
6. Move sensor arm down below position where compressor stopped. There should be a delay (815 seconds) before shocks/struts start to deflate and vehicle lowers.



A. Arm Angle
B. Up-Shocks Inflate
C. Arm Travel
D. Down-Shocks Deflate
E. Lock Bolt Adjustment of 5° Total
11. Metal Actuating Arm
13. Plastic Actuating Arm
15. ELC Height Sensor
22. Lock Bolt

V1796

Figure 7 - Height Sensor Adjustment

ON-VEHICLE SERVICE

HEIGHT SENSOR ADJUSTMENT

The link should be properly attached to the sensor arm and rear axle when making the adjustment (figure 7).

1. Loosen lock bolt (22) that secures metal actuating arm (11) to height sensor plastic actuating arm (13).
2. To raise vehicle trim height move plastic actuating arm (13) upward and tighten lock bolt (22). If no adjustment remains, check trim height (figure 8).
3. To lower vehicle trim height, follow step 1 and move plastic actuating arm (13) down.
4. If adjustment cannot be made, check for correct ELC height sensor (15).

SHIELD, COMPRESSOR AND BRACKET

Remove or Disconnect (Figures 9 and 10)

1. Negative (-) battery cable.
   - Raise vehicle and suitably support as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Compressor shield (51) by removing bolts (50).
   - Deflate system.
3. High pressure line at air dryer by revolving spring clip 90° while holding connector end and removing tube assembly.
4. Electrical connections at compressor pigtail harness and relay (54 and 55).
5. Compressor mounting bolts (27 and 53) washers (23) and nuts (24 and 25) and remove compressor (4).
6. Three compressor mounting bracket bolts (49) and remove bracket (52).
   - If replacing compressor assembly, remove air dryer (34) and dryer bracket (33).

Install or Connect (Figures 9 and 10)

- If compressor (4) was replaced, install air dryer (34) and dryer bracket (33).

1. Mounting bracket bolts (49) connecting bracket (52) to air compressor (4).

   Tighten

   - Bolts (49) to 5 N•m (44 in. lbs.).

2. Air compressor and bracket assembly to vehicle by installing washers (23) nuts (24 and 25) and bolts (27 and 53).

   Tighten

   - Bolt (27) to 25 N•m (18 ft. lbs.).
   - Nut (24) to 95 N•m (70 ft. lbs.).

3. Electrical connections at compressor pigtail harness and relay (54 and 55).
   - Rotate clip on high pressure line until clip snaps in groove, reconnect high pressure line at air dryer (34).
4. Compressor shield (51) by installing bolts (50).

   Tighten

   - Bolts (50) to 9.5 N•m (84 in. lbs.).

- Lower vehicle.
- Negative (-) battery cable.
- Cycle ignition switch and test for system operation and leaks at air dryer (34).

SUSP	TIRE SIZE	Z		D		J		K	
		SHIPPED	CURB	SHIPPED	CURB	SHIPPED	CURB	SHIPPED	CURB
TYPHOON	P245/50 R18 96V	62.0	66.5	127.5	111.3	193.68	193.68	246.3	335.0

V3223

Figure 8 - Trim Heights

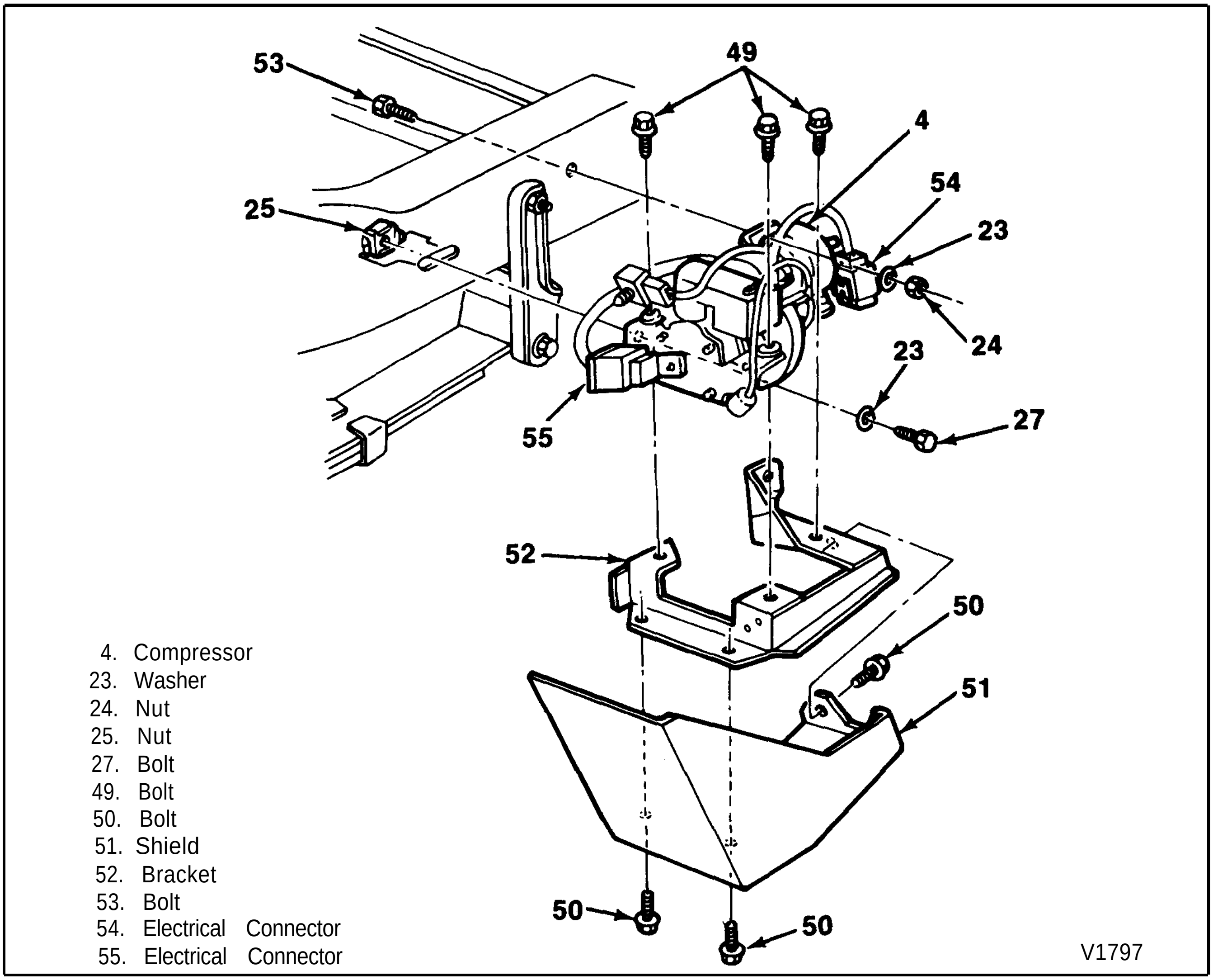


Figure 9 - Compressor Mounting

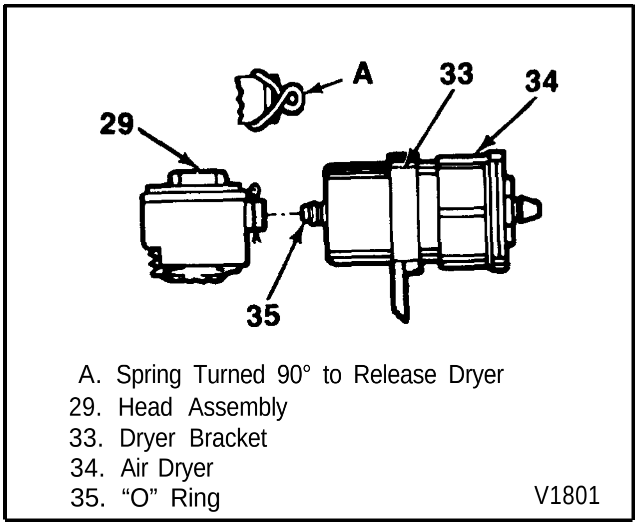


Figure 10 - Removing and Installing Air Dryer

COMPRESSOR HEAD ASSEMBLY

Remove or Disconnect (Figure 11)

1. Dryer assembly as explained later in this section.
2. Seven head mounting bolts (32).
3. Head assembly (29).

Install or Connect (Figure 11)

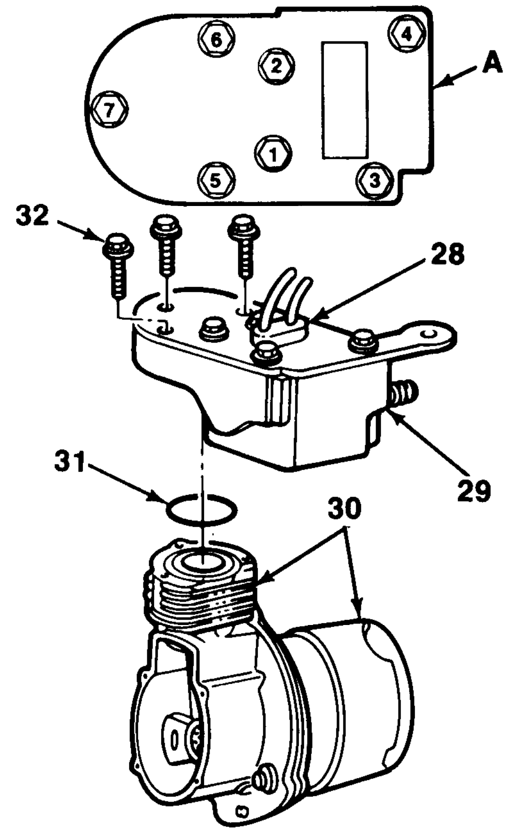
1. Seven head mounting bolts (32).

Tighten

- Head mounting bolts (32) to 4 N•m (35 in. lbs.).

2. New "O" ring (31) and lubricate with petroleum jelly or equivalent.

3. Head assembly (29).
4. Dryer assembly as explained later in this section.



A. Bolt Tightening Sequence
28. Exhaust Valve Solenoid Connector
29. Head Assembly
30. Cylinder and Motor Assembly
31. "O" Ring
32. Bolt

V1800

Figure 11 - Compressor Head, Motor and Cylinder Assembly

SOLENOID VALVE ASSEMBLY

If the solenoid valve requires replacement, it should be replaced with the complete compressor head assembly as explained previously in this section.

AIR DRYER

Remove or Disconnect (Figure 10)

1. Bolts connecting dryer bracket to compressor mounting.
2. Bolts connecting air dryer (34) to motor.
- Rotate retainer spring 90° and pull air dryer (34) out of compressor head assembly (29).

Install or Connect (Figure 10)

- Return retainer spring to its original position.
1. Air dryer (34) on compressor head assembly (29).
- If difficulty is experienced when installing air dryer (34) in compressor head assembly (29), rotate it slightly while applying pressure.
2. Two bolts connecting air dryer (34) to motor.
3. Bolts connecting dryer bracket (33) to compressor mounting.

HEIGHT SENSOR CONNECTOR

An oval connector lock is used at the wiring connector on the height sensor.

To disconnect the harness, squeeze the oval sides of the connector lock to release the two locking tabs and pull the harness connector from the height sensor plug.

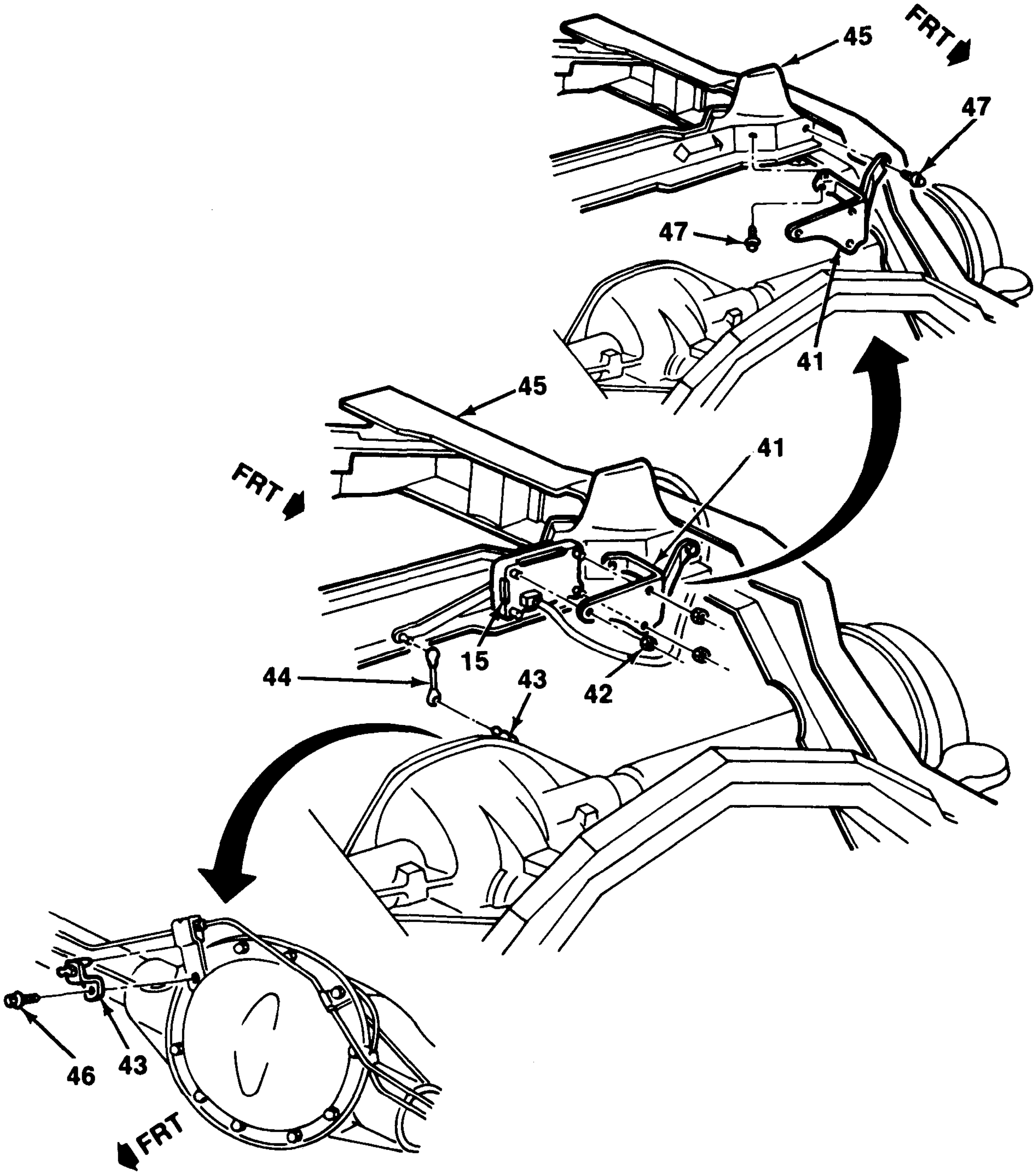
For proper circuit connection, the height sensor plug has an indexing slot and a matching boss molded into the outer diameter of the connector.

When connecting the harness to the height sensor, push the connector into the sensor plug until the sloped shoulder on the rear edge of the boss is visible in the plug slot. Then push the oval connector lock onto the plug until its two locking tabs snap over the shoulder of the sensor plug.

HEIGHT SENSOR AND BRACKET

Remove or Disconnect (Figure 12)

1. Negative (-) battery cable.
- Raise vehicle and suitably support as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Electrical connection at ELC height sensor (15).
3. Sensor link (44) from height sensor arm.
4. Sensor-to-mounting bracket nuts (42) and remove ELC height sensor (15).
5. Sensor mounting bracket-to-frame bolts (47) and remove sensor bracket (41).



15. ELC Height Sensor
41. Sensor Bracket
42. Nut
43. Sensor Link Bracket
44. Sensor Link
45. Frame
46. Bolt
47. Bolt

V1804

Figure 12 - Height Sensor Mounting

Install or Connect (Figure 12)

1. Height sensor bracket (41) to frame and install bolts **(47).**

   Tighten

   - Bolts (47) to 17 N•m (13 ft. lbs.).

2. ELC height sensor (15) to sensor bracket (41) and install nuts (42).

   Tighten

   - Nuts (42) to 3.5 N•m (31 in. lbs.).

3. Electrical connector at ELC height sensor (15).

- Lower vehicle.

4. Negative (-) battery cable.

- Perform height sensor operational check/adjustment procedure as explained previously in this section.

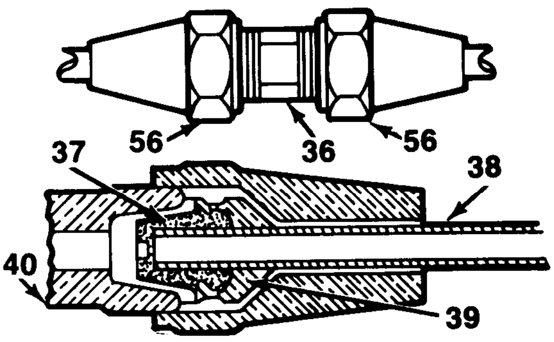
DISCONNECTING AIR LINES

The ELC system air lines use spring clip connections with molded sealing shoulders in the retainer and on the end of the air line with double O-ring seals. Before disconnecting any air line, clean the connector and surrounding area. Squeeze the spring clip to release the connector. To reassemble, lubricate the O-rings with petroleum jelly or equivalent lubricant and push the air line and connector fully into the fitting.

REPAIRING AIR LINES

The air lines used on the ELC can be repaired by splicing in a coupling at the leaking area using the procedure below (figure 13).

1. Inflate system to 690 kPa (100 psi).
2. Locate the leaking area using a soap-water solution or a stethoscope.



36. Service Coupling
37. Rubber Seal
38. Air Line
39. Internal Metal Sleeve
40. Coupling Sleeve
56. Nut

V1805

Figure 13 - Air Line Repair

3. Deflate system.
4. Cut and remove the leaking line section.
5. Splice the replacement line to the existing line.
   a. Remove the plastic retainer pin from one of the nuts (56) and slide the replacement air line (38) into the nut (56) until it bottoms in the rubber seal (37).
   b. While holding the air line (38) in position described in step (a), tighten the nut (56) to 8 N•m (70 in. lbs.).
   c. Attach original air line (38) to other end of service coupling (36) as described in steps (a) and (b).
   d. Using a tie strap, secure the air line (38) to the vehicle in a location where it will not be pinched or contact the exhaust system.
6. Reinflate system and check for leaks.

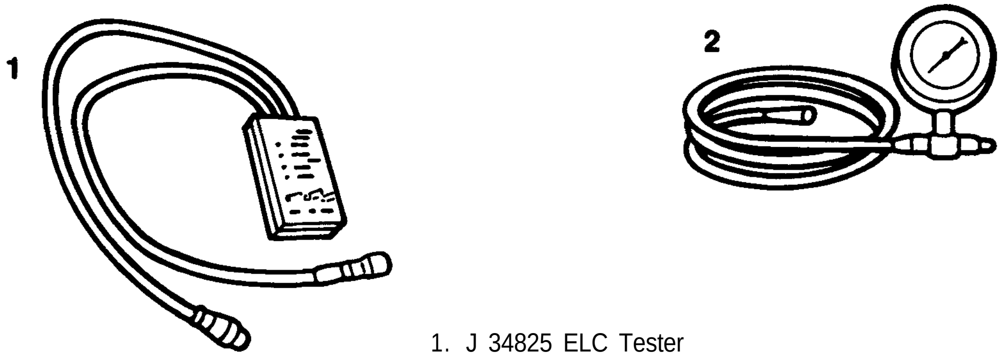
SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Compressor Head Bolt	4	—	35
Bracket-to-Compressor Bolt	5	—	44
Compressor-to-Frame Bolt	25	18	—
Compressor-to-Frame Nut	95	70	—
Compressor Shield Bolt	99.5	—	84
Height Sensor Bracket-to-Frame Bolt	17	13	—
Height Sensor-to-Bracket Nut	3.5	—	31
Air Line Nut	8	—	70

V1807

SPECIAL TOOLS



1. J 34825 ELC Tester
2. J 22124-A Pressure Gage

V1808

SECTION 3E

TIRES AND WHEELS

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

TIRE ROTATION

The tires on the Syclone and Typhoon are directional, and the front and rear wheels have different offsets, so the tires must be dismounted from the wheels for rotation. Remove the tires from the wheels, rotate the tire to the appropriate wheel and mount the tire. Be sure the arrows on the tires point in the direction the tires roll. Balance the tire and wheel assemblies using nylon-coated weights. Adjust tire pressures, and tighten wheel nuts to specified torque.

WHEEL REMOVAL

Remove or Disconnect

- Raise vehicle and suitably support as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Wheel nut caps.
    - Using the special tool provided with the vehicle, remove the lock bolt on the wheel nut cap, then remove cap.
2. Wheel lug nuts.
3. Tire and wheel assembly.

CAUTION: Before installing a wheel, remove any buildup of corrosion on the wheel mounting surface or rotor by scraping and wire brushing. Installing wheels without good metal-to-metal contact at the mounting surfaces can cause wheel nuts to loosen, which may later allow the wheel to come off while the vehicle is in motion.

Clean

- Wheel nuts, studs and the wheel and rotor mounting surfaces.

Install or Connect

1. Tire and wheel assembly.

NOTICE: See "Notice" on page 3E-1 of this section.

2. Wheel lug nuts.

Tighten

- Wheel lug nuts in sequence to 140 N•m (100 ft. lbs.).

3. Wheel nut caps.
    - Using the special tool provided with the vehicle, install the lock bolt on the wheel nut cap.

- Lower vehicle.

SPECIFICATIONS

WHEEL AND TIRE SPECIFICATIONS

Wheel Size	Bolt Holes	Bolt Circle Diameter (in.)	Bolt Size (in.)	Rim Type	Rim Width (in.)	Wheel Rating		Tire Size
						kg/lbs	kPa/psi	
16 x 8.00	5	4.75	0.437	1 - piece	8	659/1453	240/35	P245/50R 16 96V

V1856

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Lug Nut	140	100

V1430

SECTION 4A

PROPELLER SHAFT

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

CONSTANT VELOCITY JOINT

A CV (Constant Velocity) joint propeller shaft is used to transmit power from the transfer case to the front differential. The front propeller shaft is attached to the transfer case flange and front axle companion flange by the flanges on the outer bearing retainers. A metal shroud protects and retains the dust boot to the bearing retainer and flange assembly.

The constant velocity joint allows the front propeller shaft to run at an angle without disturbing the power flow. It is composed of an outer bearing retainer (and flange), spring, cap, circlip, inner bearing assembly and wire ring. The inner bearing assembly includes a bearing cage, six ball bearings and an inner race.

If a vehicle is to be undercoated, the front propeller shaft must be kept completely free of undercoating material. Undercoating material or any other foreign material will upset the front propeller shaft balance, and produce serious vibration.

ON-VEHICLE SERVICE

FRONT PROPELLER SHAFT REPLACEMENT

Remove or Disconnect (Figure 1)

- Raise the vehicle on a hoist as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they wereremoved to maintain the factory balance.

1. Bolts (4) from flange at transfer case (3).

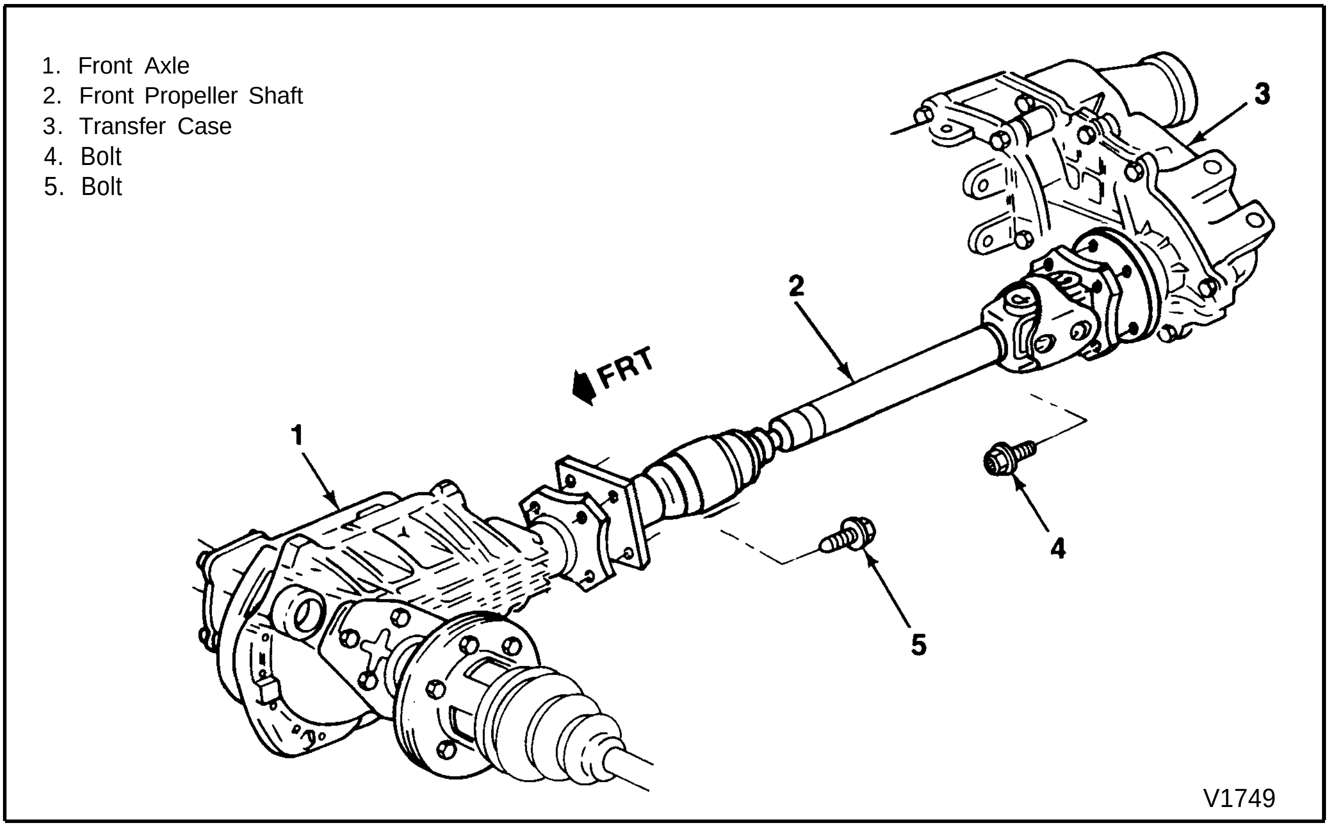


Figure 1 - Front Propeller Shaft

2. Bolts (5) from flange at front axle (1).
3. Front propeller shaft (2).
   - Pull forward and down.

Inspect (Figure 1)

- Shroud and boot for cracking or deterioration. Replace the entire assembly if evidence of damage is found.
- Front propeller shaft (2) for dents or bending.

Install or Connect (Figure 1)

NOTICE: For steps 2 and 3 see "Notice" on page 4A-1 of this section.

1. Front propeller shaft (2).
   - Align the reference marks made previously. Components must be reassembled in the same relationship to maintain proper balance.
2. Bolts (4) to flange at transfer case (3).

Tighten

- Bolts (4) to 70 N•m (52 ft. lbs.).

3. Bolts (5) to flange at front axle (1).

Tighten

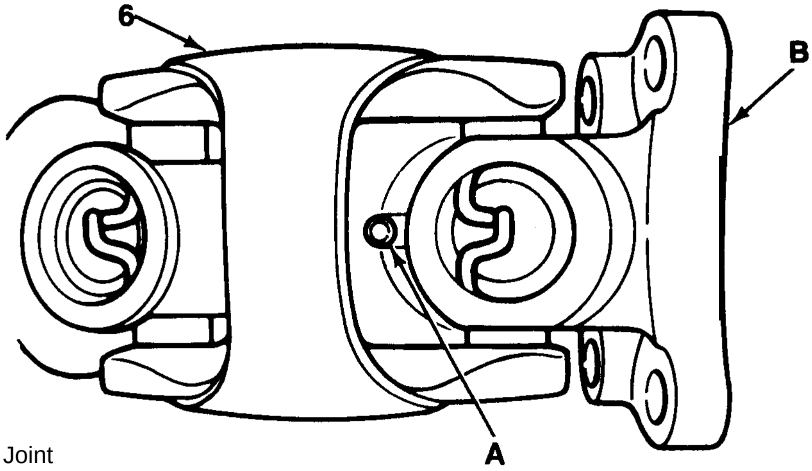
- Bolts (5) to 70 N•m (52 ft. lbs.).

- Lower the vehicle.

LUBRICATION

Double Cardan Joint

The pilot bearing of the double cardan joint, located at the transfer case end of the front propshaft, must be lubricated periodically with chassis grease, GM part number 1052497 or equivalent, using a universal joint lube gun and attachment J 25512-2. The pilot bearing of the joint is accessed by inserting needle point lube fitting through the space between the rear flange and the center housing of the joint (Figure 2). Refer to MAINTENANCE AND LUBRICATION (SEC. 0B) for lubrication interval.



A. Fitting
B. Rear Flange
6. Double Cardan Joint

V3219

Figure 2 - Lubricating Double Cardan Joint

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Flange-to-Transfer Case Bolt	70	52
Flange-to-Front Axle Bolt	70	52

V1429

SPECIAL TOOLS

J 25512-2

1. Needle Point

V3221

SECTION 4C

FRONT DRIVING AXLE

SYCLONE AND TYPHOON

CAUTION: Do not allow the vehicle's weight to load the front wheels or attempt to operate the vehicle when the drive axle(s) or hub nut(s) are removed. To do so may cause the front wheel bearing inner races to separate, resulting In damage to front brake and suspension components and/or personal injury.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The front axle on the Syclone and Typhoon uses a full-time four-wheel drive system with no disengagement feature. The front axle is designed to remain constantly engaged making possible the front half of the all-wheel drive system.

The differential is used to allow the wheels to turn at different rates of speed while the front axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using threaded adjusters. The ring gear is bolted to the differential case with left-hand thread bolts.

The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the pinion bearings in the axle housing.

The axle identification code is stamped on the top of the carrier case, along the edge of the machined face of the left half.

The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) joints connected by an axle shaft. The inner CV joint is a "tri-pot" design, which is completely flexible, and also can move in and out. The outer CV joint is a "Rzeppa" design which is also flexible, but cannot move in and out.

ON-VEHICLE SERVICE

DIFFERENTIAL FLUID FILL AND CHECK

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Keep vehicle level.
- Clean dirt or foreign material from around fill plug opening before removing fill plug (25) (figures 3 and 4).
- Remove fill plug (25) and washer (26).

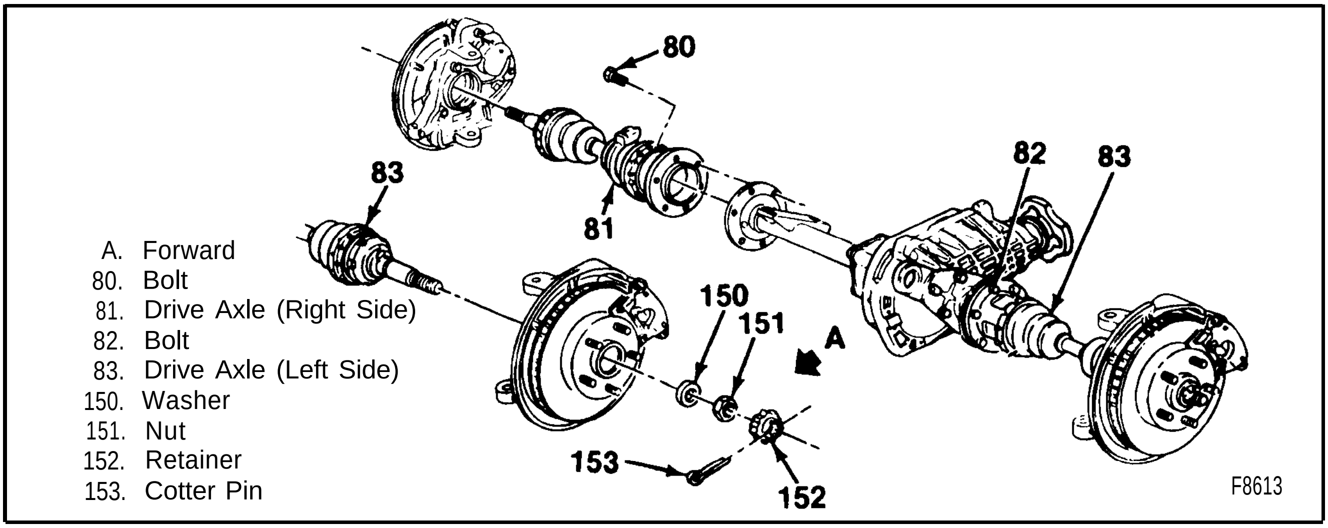


Figure 1 - Drive Axles and Components

Inspect

- Washer (26). Replace if damaged.
- Add or replace fluid using SAE-80W-90 GL-5, GM part number 1052271, or equivalent.
  - Maintain fluid level flush with the bottom of the fill plug opening.
- Install washer (26) and fill plug (25) and tighten to 33 N•m (24 ft. lbs.).
- Lower vehicle.

DRIVE AXLE REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

Remove or Disconnect (Figures 1 and 2)

1. Negative (-) battery cable.
- Unlock steering column so the linkage is free to move.
- Raise the vehicle and suitably support as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Tire and wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

CAUTION: See "Caution" on page 4C-1 of this section.

3. Cotter pin (153) and retainer (152).
4. Axle nut (151) and washer (150).
- Support lower control arm.
5. Lower shock absorber nut and bolt as described in FRONT SUSPENSION (SEC. 3C) in the 1992 Service Manual Sonoma and Jimmy Models.
6. Output shaft flange-to-drive axle bolts (60 or 82).
   - Insert a drift through the opening in the top of the brake caliper into the vanes of the brake rotor. This will keep the axle from turning.
- Use a Posilock Puller Model 110 or equivalent to push the drive axle through the hub (figure 2).
7. Drive axle (61 or 63).

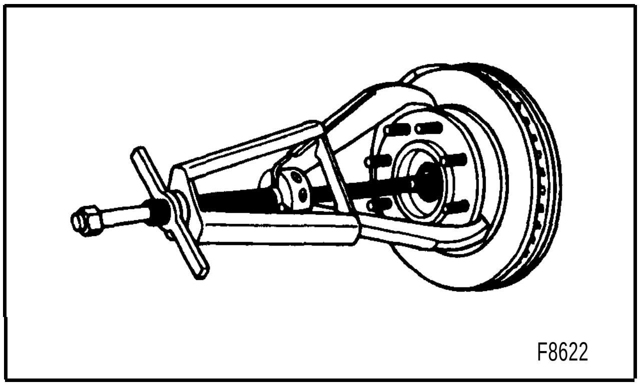


Figure 2 - Removing the Drive Axle

Install or Connect (Figure 1)

NOTICE: For steps 2, 3 and 4 see "Notice" on page 4C-1 of this section.

1. Drive axle (81 or 83) to hub.
2. Axle washer (150) and nut (151).

- Insert a drift through the opening in the top of the brake caliper into the vanes of the brake rotor. This will keep the axle from turning.

Tighten

- Nut (151) to 245 N•m (181 ft. lbs.).

3. Retainer (152) and cotter pin (153).
4. Drive axle-to-output shaft bolts (60 or 62).

Tighten

- Bolts (60 or 62) to 60 N•m (59 ft. lbs.).

5. Lower shock bolt and nut as described in FRONT SUSPENSION (SEC. 3C) in the 1992 Service Manual Sonoma and Jimmy Models.
6. Tire and wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

- Lower vehicle.

7. Negative (-) battery cable.

SHAFT AND TUBE ASSEMBLY REPLACEMENT

Remove or Disconnect (Figures 1 through 5)

1. Right drive axle as explained previously in this section.
2. Support bracket nuts (92) and washers (91).
3. Tube-to-carrier bolts (6).
    - Attach a slide hammer to the output shaft (1) and pull the shaft (1).
4. Shaft and tube assembly.

- Catch fluid in a suitable container.

Clean

- Sealing surfaces of tube (5) and carrier assembly (95) with a chlorinated solvent.

Install or Connect (Figures 1 through 5)

NOTICE: For steps 2 and 3 see "Notice" on page 4C-1 of this section.

- Apply a bead of sealer (GM part number 1052357 [Loctite™ 514] or equivalent) to the carrier sealing surface.

1. Shaft and tube assembly to carrier assembly (95).
2. Tube-to-carrier bolts (6).

Tighten

- Bolts (6) to 48 N•m (35 ft. lbs.).

3. Support bracket nuts (92) and washers (91).

Tighten

- Nuts (92) to 75 N•m (55 ft. lbs.).

4. Right drive axle (61) to the output shaft (1) as explained previously in this section.

Inspect

- Axle lubricant level, and add lubricant if necessary, as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.

OUTPUT SHAFT SEAL AND BEARING REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

Remove or Disconnect (Figures 1 through 6)

Tools Required:
J 23907 Slide Hammer
J 29369-2 Axle Tube Bearing Remover

1. Shaft and tube assembly as explained previously in this section.
2. Shaft (1) with deflector (2) and retaining ring (8).
    - Strike the inside of the shaft flange with a brass hammer to dislodge the shaft (1). Use care in pulling the splined shaft (1) through the seal diameter to avoid cutting the seal (3).
3. Shaft seal (3) and bearing (4) using J 29369-2 and J 23907 (figure 6).

Install or Connect (Figures 1 through 7)

Tools Required:
J 33844 Axle Tube Bearing Installer
J 33693 Output Shaft Seal Installer

Important

- Lubricate the seal lips, bearings and bearing surfaces with axle lubricant prior to reassembly.

1. Bearing (4) using J 33844.
2. Seal (3), using J 33893 (figure 7).
3. Shaft (1), taking care not to cut the seal (3).
4. Shaft and tube assembly as explained previously in this section.

DIFFERENTIAL CARRIER ASSEMBLY REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These com-

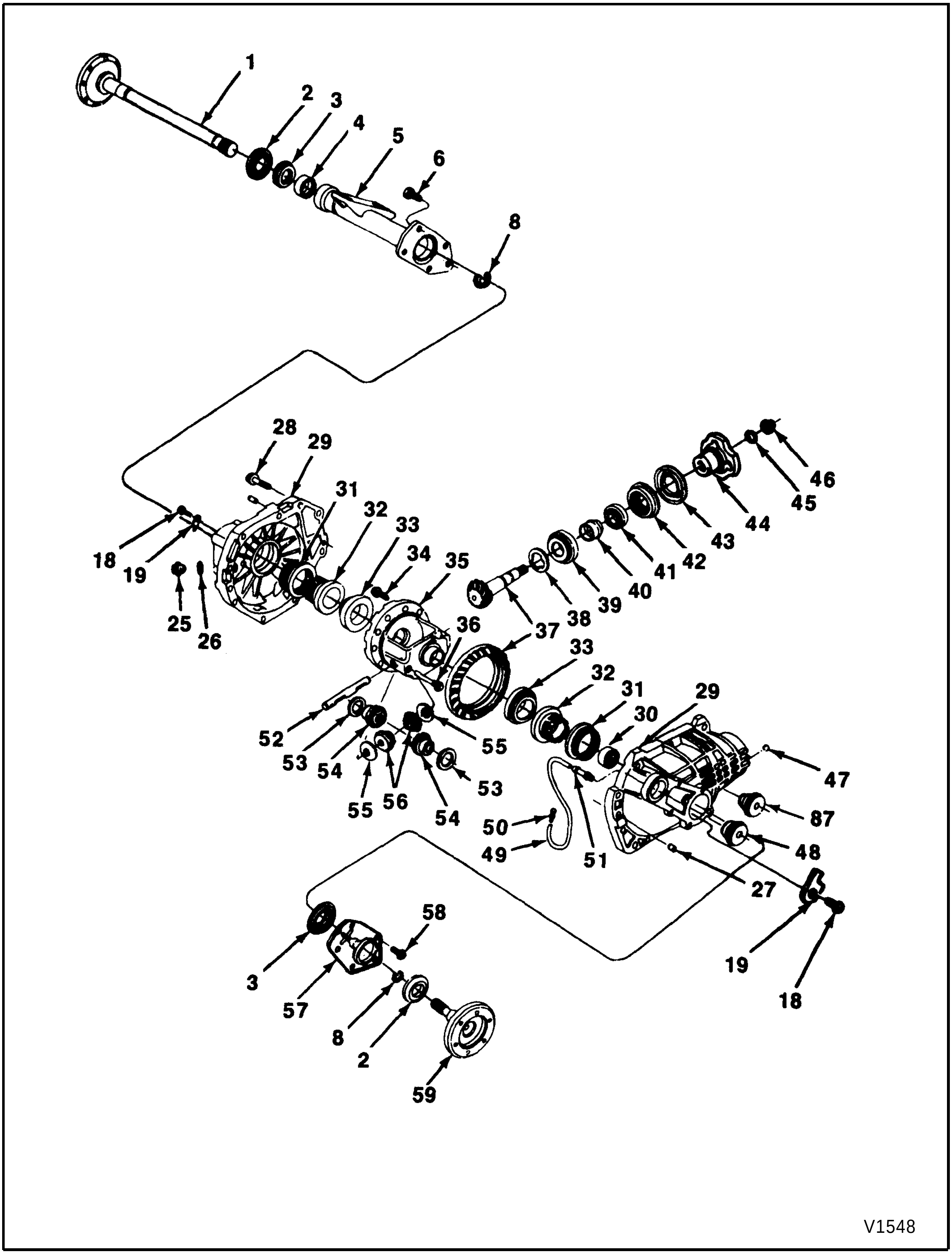
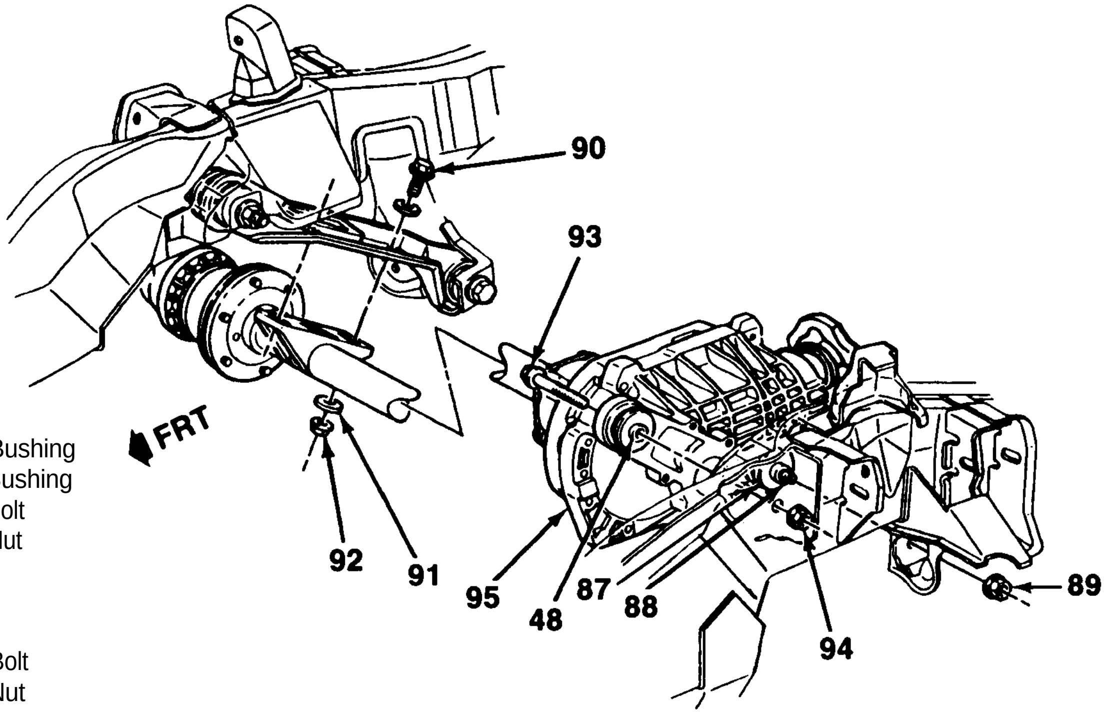


Figure 3 - Carrier Assembly and Components

1. Shaft
2. Deflector
3. Seal
4. Bearing
5. Tube
6. Bolt
8. Retaining Ring
18. Bolt
19. Lock
25. Plug
26. Washer
27. Pin
28. Bolt
29. Carrier Case
30. Bearing
31. Insert
32. Sleeve
33. Side Bearing
34. Bolt
35. Differential Case
36. Bolt
37. Ring and Pinion Gears
38. Shim
39. Bearing
40. Spacer
41. Bearing
42. Seal
43. Deflector
44. Flange
45. Washer
46. Nut
47. Plug
48. Upper Bushing
49. Vent Hose
50. Vent
51. Fitting
52. Shaft
53. Thrust Washer
54. Side Gear
55. Thrust Washer
56. Differential Pinion Gear
57. Cover
58. Bolt
59. Shaft
87. Lower Bushing

V1549

Figure 4 - Carrier Assembly and Components-Legend



48. Upper Bushing
87. Lower Bushing
88. Lower Bolt
89. Lower Nut
90. Bolt
91. Washer
92. Nut
93. Upper Bolt
94. Upper Nut
95. Carrier Assembly

V1471

Figure 5 - Carrier Assembly Installation

ponents include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

Remove or Disconnect (Figures 1 through 5 and 8)

1. Negative (-) battery cable.
   - Unlock the steering column so the linkage is free to move.
   - Raise the vehicle and suitably support as described in, GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Left and right front wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.
   - Insert a drift through the opening in the top of the brake caliper into the vanes in the brake rotor. This will keep the axle from turning.

CAUTION: To reduce the chance of personal Injury, raise the vehicle on a hoist or block the

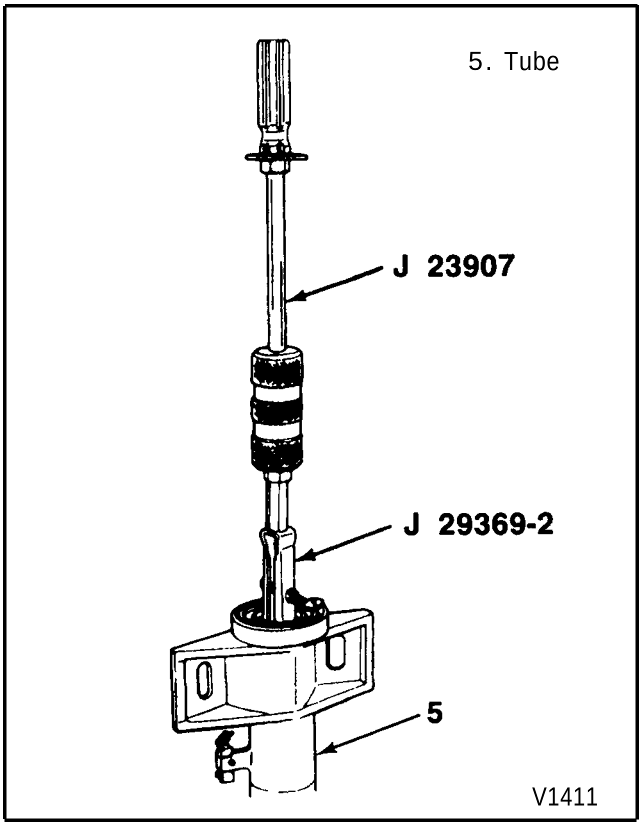


Figure 6 - Removing the Axle lube Bearing and Seal

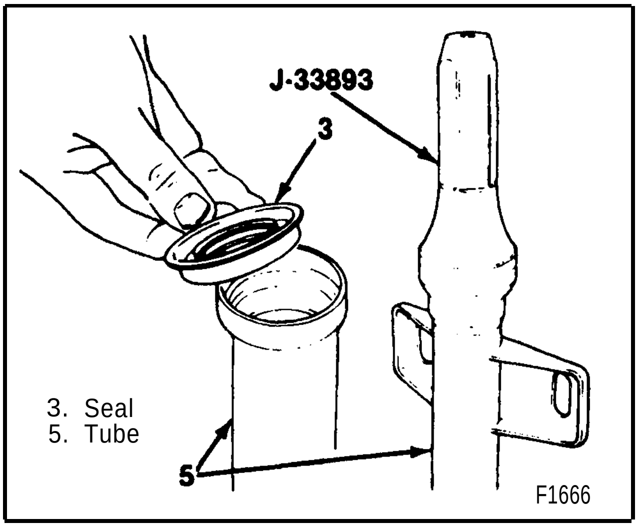


Figure 7 - Installing the Shaft Seal

wheels and apply the parking brake before removing any propeller shaft or lifting any wheel. Putting the transmission in PARK and applying the parking brake may not prevent the vehicle from moving.

3. Propeller shaft at front axle and support out of the way. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.
4. Axle vent hose (49).
5. Drive axle-to-output shaft bolts (80 and 62).
6. Tube-to-carrier bolts (6).
7. Drive axle (81) from output shaft (1) and support out of the way.
8. Drive axle (83) from output shaft (59) and support out of the way.
9. Axle tube support bracket-to-frame nuts (92) and washers (91) (figure 5).
10. Upper bolt (93) and upper nut (94).
11. Lower bolt (88) and lower nut (89).
12. Carrier and tube assembly.
    - Slide entire assembly to the right, lower the tube end, and twist the carrier to clear the mounting brackets, oil pan, and steering linkage.

Install or Connect (Figures 1 through 5 and 8)

NOTICE: For steps 4 through 7 see "Notice" on page 4C-1 of this section.

1. Carrier and tube assembly.
2. Upper bolt (93) and upper nut (94), loosely.
3. Lower bolt (88) and lower nut (89), loosely.
4. Axle tube support bracket-to-frame nuts (92) and washers (91) (figure 5).

    Tighten

    - Upper and lower bolts (93 and 88) to 90 N•m (66 ft. lbs.).
    - Axle tube support bracket-to-frame nuts (92) to 75 N•m (55 ft. lbs.).
5. Drive axle (81) to output shaft(l), using bolts (80).

    Tighten

    - Bolts (80) to 80 N•m (59 ft. lbs.).
6. Drive axle (83) to output shaft (59), using bolts (82).

    Tighten

    - Bolts (82) to 80 N•m (59 ft. lbs.).
7. Tube-to-carrier bolts (8).

    Tighten

    - Bolts (6) to 48 N•m (35 ft. lbs.).
8. Axle vent hose (49).
9. Front propeller shaft at front axle. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.
    - Align the reference marks made previously.

- Remove the drift.

10. Tire and wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

    Inspect

    - Axle lubricant level. Add lubricant as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.

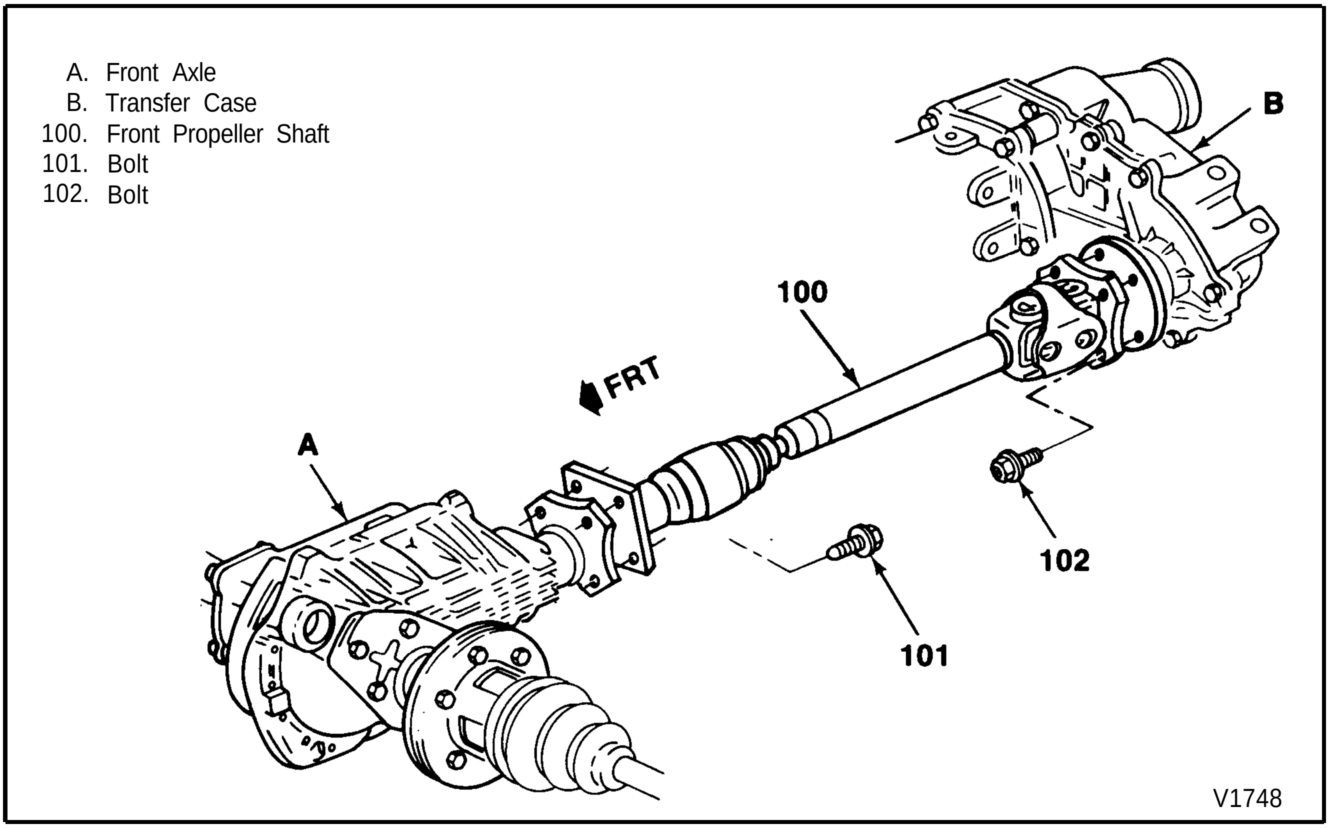


Figure 8 - Front Propeller Shaft

- Remove the safety stands and lower the vehicle.

11. Negative (-) battery cable.

DIFFERENTIAL CARRIER BUSHING REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

Remove or Disconnect (Figures 1 through 5, 8 and 9)

Tool Required:
J 33791 Carrier Bushing Remover and Installer Set

1. Differential carrier assembly as explained previously in this section.
2. Upper or lower bushing (48 or 87) using J 33791 (figure 9).

Install or Connect (Figures 1 through 5, 8 and 9)

Tool Required:
J 33791 Carrier Bushing Remover and Installer Set

1. Upper or lower bushing (48 or 87) using J 33791 (figure 9).

Important

- Be sure the spacer (J 33791-3) is correctly installed between the upper or lower bushing (48 or 87) and carrier ear to prevent the upper or lower bushing (48 or 87) from being pressed in too deeply.

2. Differential carrier assembly as explained previously in this section.

FRONT AXLE VENT HOSE

When replacing the hose, make sure that it is routed correctly, free of kinks, not hitting the exhaust crossover, and clear of sharp components. Make sure the vent (50) is not plugged (figures 3 and 4).

PINION FLANGE REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and

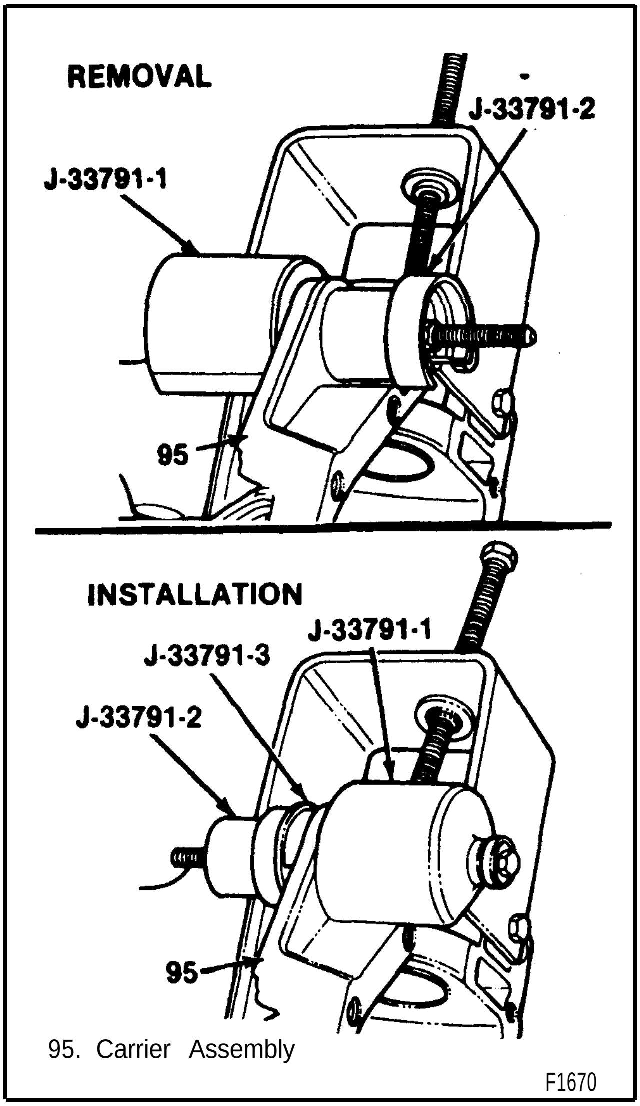


Figure 9 - Replacing the Carrier Bushings

reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

↔ Remove or Disconnect (Figures 3, 4, 8 and 10 through 12)

Tool Required:
J 8614-01 Flange Holder

- Unlock the steering column so the linkage is free to move.
- Raise the vehicle and suitably support as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

CAUTION: To reduce the chance of personal injury, raise the vehicle on a hoist or block the wheels and apply the parking brake before removing any propeller shaft or lifting any wheel. Putting the transmission in PARK and applying the parking brake may not prevent the vehicle from moving.

1. Bolts (101) from propeller shaft flange to front axle.
2. Front propeller shaft (100).
   - Support the front propeller shaft (100) out of the way.
   - Check and record preload with an inch-pound torque wrench (figure 12). This will give combined pinion bearing, seal, carrier bearing, axle bearing and seal preload.
3. Pinion flange nut (46) and washer (45).
   - Hold the pinion flange (44) with J 8614-01 (figure 10).
4. Pinion flange (44) using J 8614-01 (figure 11).
   - Have a suitable container to catch lubricant.

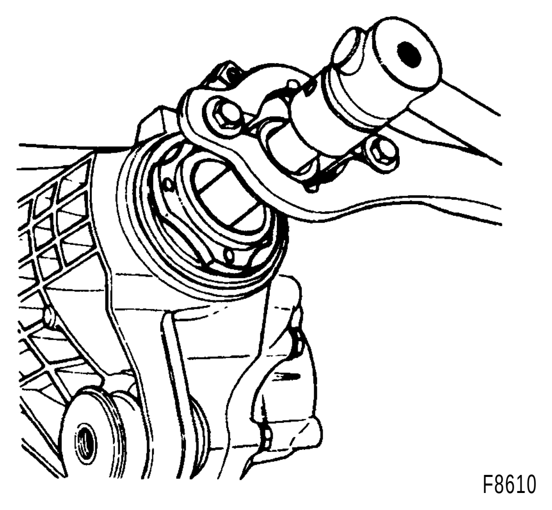


Figure 10 - Removing/Installing the Pinion Nut

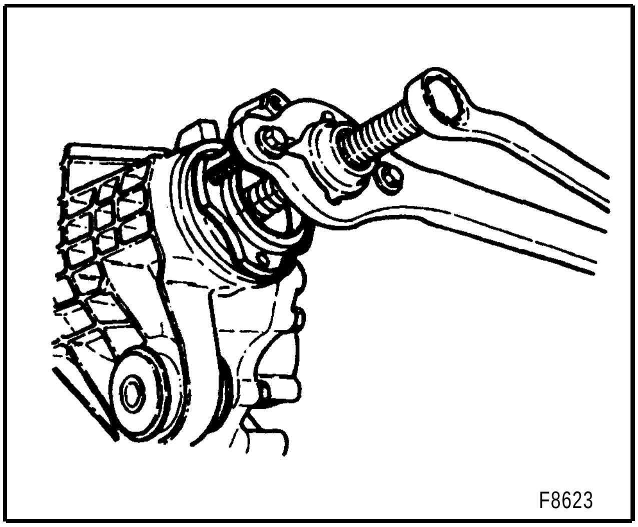


Figure 11 - Removing the Pinion Flange

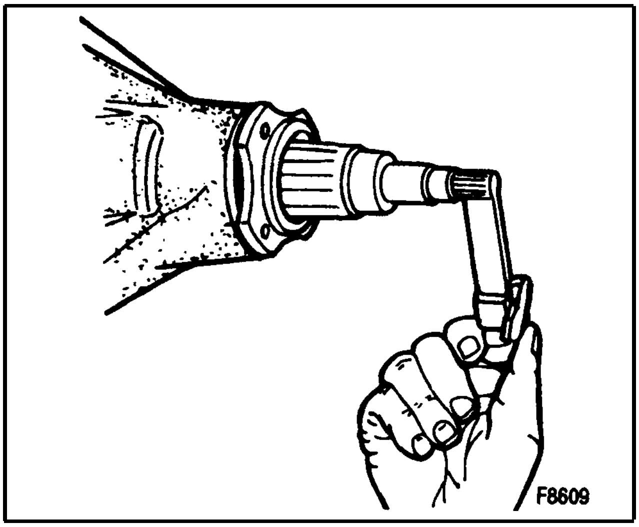


Figure 12 - Checking Pinion Preload

Install or Connect (Figures 3, 4, 8 and 10 through 12)

NOTICE: For steps 3 and 5 see "Notice" on page 4C-1 of this section.

Tool Required
J 8614-01 Flange Holder

1. Special seal lubricant (Part No. 1051069 or equivalent) to the outside of the pinion flange (44).
2. New pinion flange (44).
3. Washer (45) and nut (46), using J 8614-01 (figure 10).

Tighten

- Nut (46) a little at a time, turning the pinion flange (44) several times after each tightening to set the rollers. Check the bearing preload each time until preload is 0.3 to 0.6 N•m (3 to 5 in. lbs.) more than the reading recorded during removal (figure 12).

4. Front propeller shaft (100).
5. Bolts (101) to flange.

Tighten

- Bolts (101) to 70 N•m (52 ft. lbs.).

- Lower vehicle.

Inspect

- Axle for lubricant level and add lubricant as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.

PINION OIL SEAL REPLACEMENT

Important

- It is essential that the positions of all driveline components relative to the propeller shaft be observed and reference marked prior to disassembly. These components include the propshafts, drive axles, pinion flange, output shafts, etc. All components must be reassembled in the same relationship to each other as they were removed to maintain the factory balance.

Remove or Disconnect (Figures 3, 4, 8, 10 and 11)

Tool Required:
J 8614-01 Flange Holder

1. Bolts (101) from the pinion flange (44).
2. Front propeller shaft (100) from the pinion flange (44).
    - Support the front propeller shaft (100) out of the way.
3. Pinion flange nut (46) and washer (45) (figure 10).
    - Mark the pinion flange (44), front propeller shaft (100), and the nut (46) so that the proper bearing preload can be maintained.
    - Use J 8614-01 to hold the pinion flange (44) (figure 10).
4. Pinion flange (44) (figure 11).
    - Have a suitable container in place to catch lubricant.
5. Pinion oil seal (42) by driving it out of the carrier with a blunt chisel.
    - Do not damage the carrier.

Inspect

- Seal surface of the pinion flange (44) for tool marks, nicks, or damage such as a groove worn by the seal (42). Replace the pinion flange (44) if necessary.
- Carrier bore for burrs that might cause leaks around the outside of the seal (42).

Install or Connect (Figures 3, 4, 8 and 10 through 13)

NOTICE: For steps 4 and 6 see "Notice" on page 4C-1 of this section.

Tools Required:
J 8614-01 Flange Holder
J 33782 Pinion Oil Seal Installer

1. New pinion oil seal (42), using J 33782 (figure 13).
2. Special seal lubricant (Part No. 1050169 or equivalent) to the outside of the pinion flange (44) and the sealing lip of the new pinion oil seal (42).
3. Pinion flange (44).
4. Washer (45) and nut (46), using J 8614-01 (figure 10).

Tighten

- Nut (46) to the same position as marked during removal.
- Nut (46) 1.59 mm (1/16 inch) beyond the alignment marks.

5. Front propeller shaft (100) to the pinion flange (44).

6. Bolts (101).
   - Align the marks made during removal. Components must be reassembled in the same relative position to maintain proper balance.

Tighten

- Bolts (101) to 70 N•m (52 ft. lbs.).

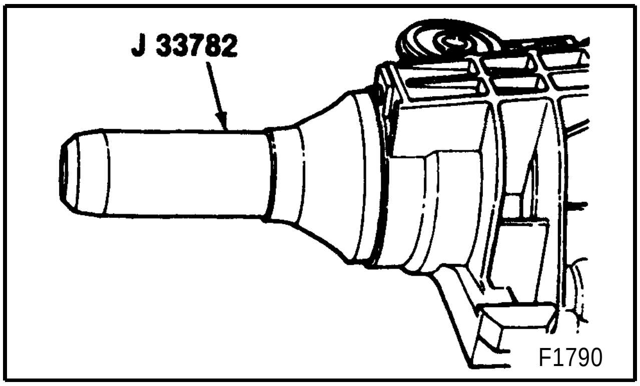


Figure 13 - Installing the Pinion Oil Seal

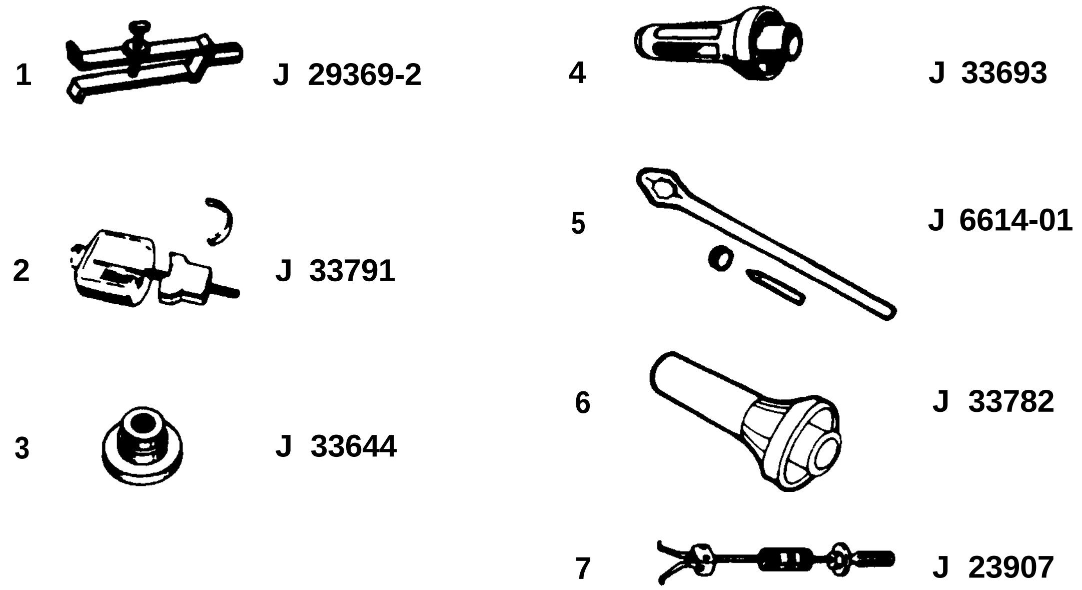
SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Carrier Output Shaft-to-Drive Axle Bolts	80	59
Right Side Axle Tube-to-Frame Bracket Nuts	75	55
Right Side Axle Tube-to-Carrier Bolts	48	35
Carrier Assembly Mounting		
Upper Bolts	90	66
Lower Bolts	90	66
Drive Axle Nut at Hub	245	181
Axle Plug	33	24
Front Propeller Shaft Flange-to-Front Axle Bolts	70	52

V1855

SPECIAL TOOLS



1. Axle Tube Bearing Remover
2. Carrier Bushing Remover and Installer Set
3. Axle Tube Bearing Installer
4. Output Shaft Seal Installer
5. Flange Holder
6. Pinion Oil Seal Installer
7. Slide Hammer

SECTION 5A

HYDRAULIC BRAKES

SYCLONE AND TYPHOON

CAUTION: When servicing wheel brake parts, do not create dust by grinding or sanding brake linings or by cleaning wheel brake parts with a dry brush or with compressed air. (A water dampened cloth should be used.) Many wheel brake parts contain asbestos fibers which can become airborne if dust is created during servicing. Breathing dust containing asbestos fibers may cause serious bodily harm.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be ceiled out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

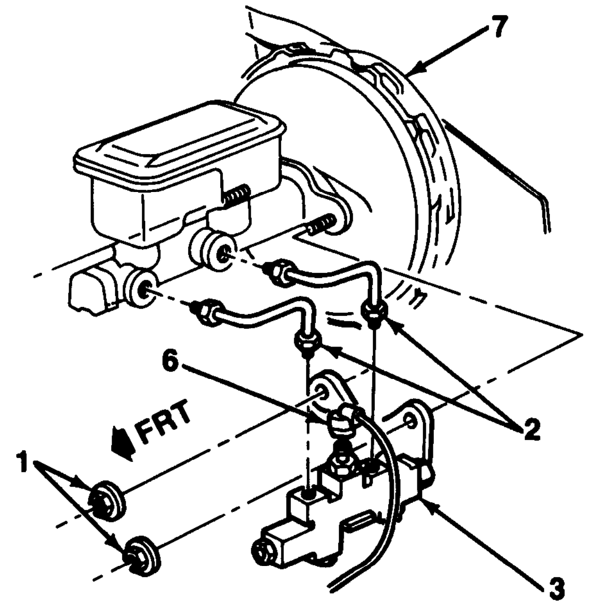
COMBINATION VALVE REPLACEMENT

The combination valve is not repairable and must be replaced as a complete assembly.

NOTICE: Brake fluid will damage painted surfaces. Brake fluid can also damage electrical connections. Use shop cloths, suitable containers and fender covers to prevent brake fluid from contacting such surfaces. Always reseal and wipe brake fluid containers clean to prevent spillage.

Remove or Disconnect (Figure 1)

1. Brake pipes (2) from the combination valve (3).
   - Plug the brake pipes (2) to prevent the loss of fluid or the entrance of contaminates.
2. Warning switch connector (6) from combination valve (3).
3. Master cylinder mounting nuts (1).
4. Combination valve (3) from booster (7).



1. Master Cylinder Mounting Nut
2. Brake Pipe
3. Combination Valve
6. Connector
7. Booster

V1401

Figure 1 - Removing the Combination Valve

Install or Connect (Figure 1)

NOTICE: For steps 2 and 4 see "Notice" on page 5A-1 of this section.

1. Combination valve (3) to booster (7).
2. Master cylinder mounting nuts (1).

Tighten

- Master cylinder mounting nuts(l) to 17 N•m (13 ft. lbs.).

3. Warning switch connector (6) to combination valve (3).

- Remove plugs from brake pipes (2).

4. Brake pipes (2).

Tighten

- Brake pipes (2) to 29 N•m (21 ft. lbs.).

5. Bleed the brake system as described in HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.

MASTER CYLINDER REPLACEMENT

NOTICE: Brake fluid will damage painted surfaces. Brake fluid can also damage electrical connections. Use shop cloths, suitable containers and fender covers to prevent brake fluid from contacting such surfaces. Always reseal and wipe brake fluid containers clean to prevent spillage.

Remove or Disconnect (Figure 2)

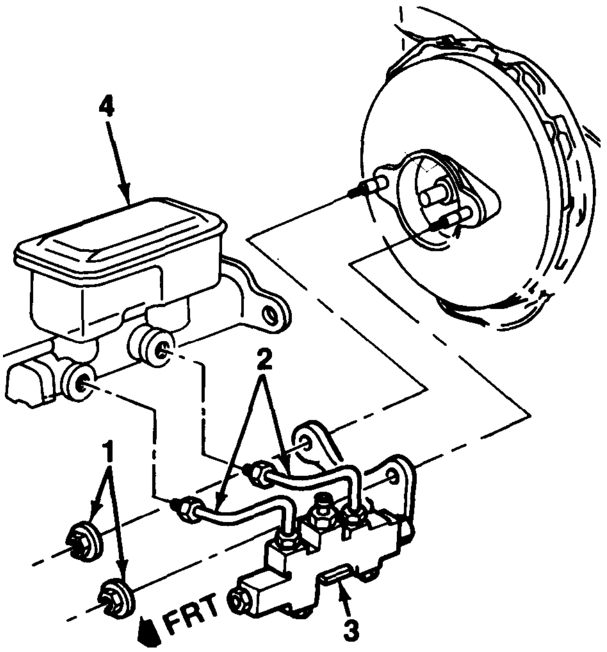
- Set the vehicle parking brakes.

1. Brake pipes (2) from master cylinder (4).
    - Plug the brake pipes (2) to prevent the loss of fluid or the entrance of contaminates.
2. Master cylinder mounting nuts (1).
3. Combination valve (3).
4. Master cylinder (4).

Install or Connect (Figure 2)

NOTICE: For steps 2 and 3 see "Notice" on page 5A-1 of this section.

- Prior to installation, bench bleed the master cylinder as described in HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.



1. Master Cylinder Mounting Nut
2. Brake Pipe
3. Combination Valve
4. Master Cylinder

V1402

Figure 2 - Removing the Master Cylinder

1. Master cylinder (4).
2. Combination valve (3) and master cylinder mounting nuts (1).

Tighten

- Master cylinder mounting nuts (1) to 17 N•m (13 ft. lbs.).

- Remove plugs from brake pipes (2).

3. Brake pipes (2) to master cylinder (4).

Tighten

- Brake pipes (2) to 29 N•m (21 ft. lbs.).

- Bleed the brakes as described in HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Release the parking brakes.

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Master Cylinder Mounting Nut	17	13
Brake Pipe	29	21

V1409

SECTION 5E1

FOUR WHEEL ANTILOCK BRAKE SYSTEM

SYCLONE AND TYPHOON

CONTENTS

DIAGNOSTIC CIRCUIT CHECK

With the exception of the following code 86, all of the diagnostic circuit check codes are the same as described in FOUR WHEEL ANTILOCK BRAKE SYSTEM (SEC. 5E1) in the 1992 Service Manual Sonoma and Jimmy Models.

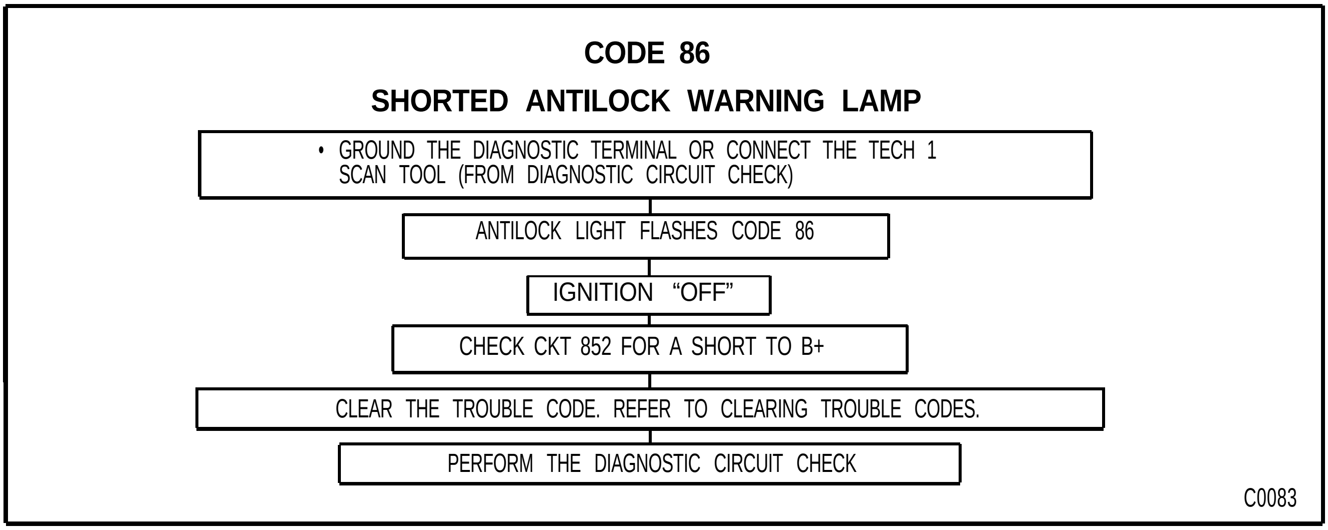


Figure 1 - Code 86

ON-VEHICLE SERVICE

EHCU MODULE REPLACEMENT

The replacement procedure is the same as described in FOUR WHEEL ANTILOCK BRAKE SYSTEM (SEC. 5E1) in the 1992 Service Manual Sonoma and Jimmy Models, with the exception of the washer tank reservoir which does not have to be removed.

SECTION 6A3

4.3 LITER V6

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The 4.3L Syclone and Typhoon engine uses most major components of the production LB4 engine. Standard production parts include the cylinder block (except bearing caps), camshaft, crankshaft, connecting rods, cylinder heads and valve train.

The parts unique to the Syclone and Typhoon base engine include the pistons, head gaskets, upper and lower intake manifolds and gaskets, fuel rail, port fuel injectors, exhaust manifolds, exhaust crossover pipe, turbocharger, charge air cooler, and various brackets, hoses and pipes. The throttle body is from a 5.7L port injected engine.

Service procedures for the Syclone and Typhoon only components have been included in this supplement. All remaining procedures common to the Syclone and Typhoon engine and a production LB4 engine are covered in the 1992 Service Manual Sonoma and Jimmy Models.

ON-VEHICLE SERVICE

VALVE ROCKER COVERS

LEFT VALVE ROCKER COVER

Remove or Disconnect (Figures 1 and 2)

- Drain charge air cooler radiator.

1. Negative (-) battery cable.
2. Serpentine drive belt.
3. Generator bolts and move generator aside.
4. Power brake hose (9).
5. Vacuum lines and electrical connectors from EVRV solenoid (12), ignition coil and MAP sensor (11) on multi-use bracket (4).
6. Charge air cooler coolant inlet pipe (5).
7. Multi-use bracket (4).
8. Valve rocker cover bolts.
9. Valve rocker cover (3) and gasket.

Clean

- Valve rocker cover (3) and cylinder head gasket surfaces.

Install or Connect (Figures 1 and 2)

1. Valve rocker cover (3) with gasket.

   NOTICE: See "Notice" on page 6A3-1 of this section.

2. Valve rocker cover bolts.

   Tighten

   - Valve rocker cover bolts to 10 N•m (89 in. lbs.).

3. Multi-use bracket (4).
4. Charge air cooler coolant inlet pipe (5).
5. Vacuum lines and electrical connectors to EVRV solenoid (12), ignition coil and MAP sensor (11).

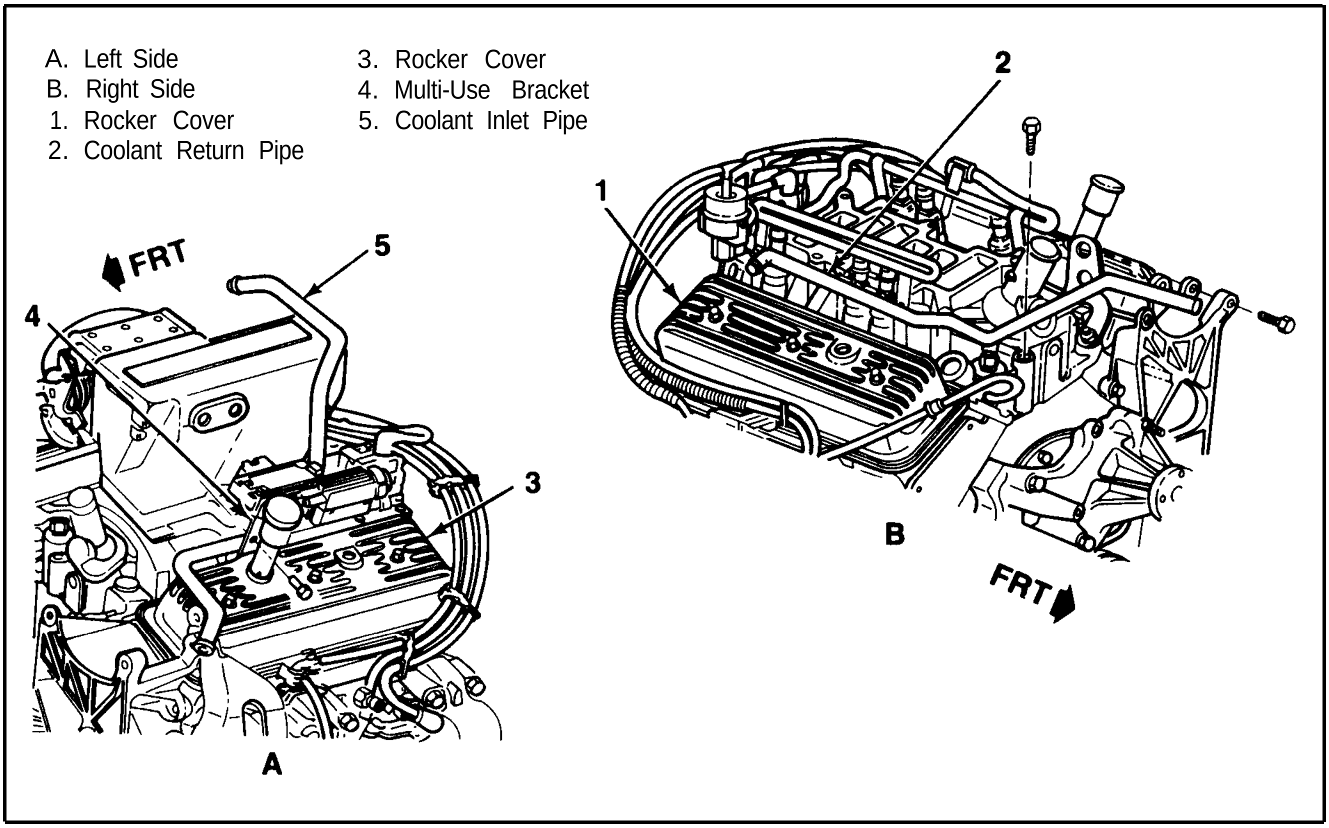


Figure 1 - Valve Rocker Covers

6. Power brake hose (9).
7. Generator and bolts.
8. Serpentine drive belt.
9. Negative (-) battery cable.

- Refill charge air cooler and radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.

RIGHT VALVE ROCKER COVER

Remove or Disconnect (Figures 1 and 2)

- Drain charge air cooler radiator.
- Drain engine radiator.

1. Negative (-) battery cable.
2. Charge air cooler clamps, hoses and ducts.
3. Charge air cooler.
4. PCV hoses and valves.
5. Turbocharger oil feed hose at turbocharger.
6. Air cleaner and duct.
7. Oxygen sensor connector.
8. Heater inlet hose from lower intake manifold.
9. Charge air cooler lateral (center) support.
10. Valve rocker cover bolts.
11. Valve rocker cover (1) and gasket.

Clean

- Valve rocker cover (1) and cylinder head gasket surfaces.

Install or Connect (Figures 1 and 2)

NOTICE: For steps 2, 4 and 8 see "Notice" on page 6A3-1 of this section.

1. Valve rocker cover (1) with gasket.
2. Valve rocker cover bolts.

Tighten

- Valve rocker cover bolts to 10 N•m (89 in. lbs.).

3. Heater inlet hose.
4. Turbocharger oil feed hose.

Tighten

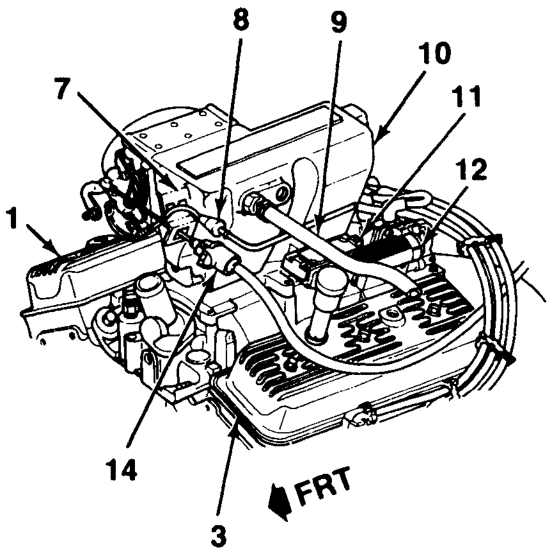
- Oil feed hose fitting to 22 N•m (16 ft. lbs.).

5. PCV hoses and valves.
6. Oxygen sensor connector.
7. Charge air cooler lateral support and nut to lower intake manifold finger tight.
8. Charge air cooler.

Tighten

- Charge air cooler lateral support nut at manifold.

9. Charge air cooler clamps and hoses.
10. Air cleaner and duct.
11. Negative (-) battery cable.



1. Rocker Cover
3. Rocker Cover
7. Cable Bracket
8. Accelerator Cable
9. Power Brake Hose
10. Upper Intake Manifold
11. MAP Sensor
12. EVRV Solenoid
14. TV Cable

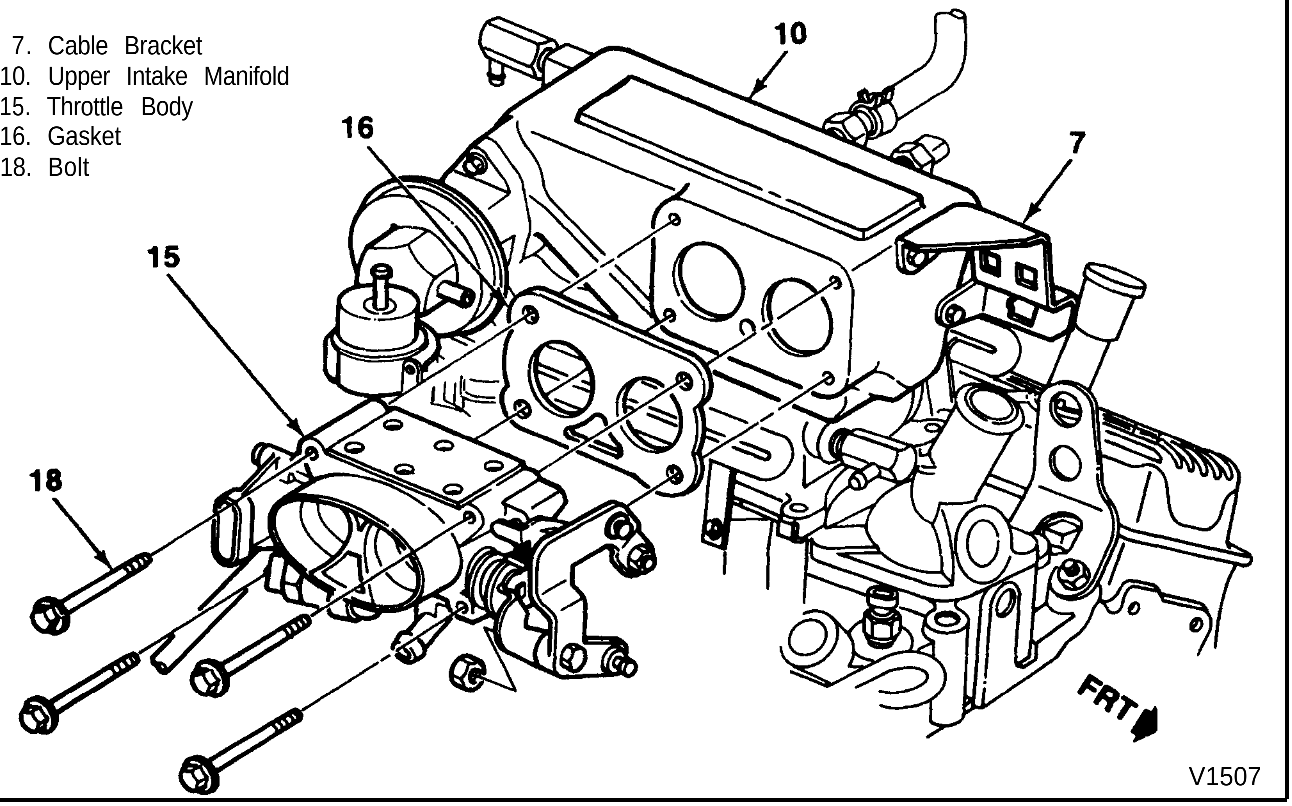
Figure 2 - Upper Intake Manifold

UPPER AND LOWER INTAKE MANIFOLDS

Remove or Disconnect (FIgures 1 through 6)

- Loosen wing bolt at air cleaner and move air cleaner and duct aside.
- Drain engine radiator.
- Drain charge air cooler radiator.

1. Negative (-) battery cable.
2. Charge air cooler clamps, ducts and hoses.
3. Charge air cooler from supports.
4. Charge air cooler lateral (center) support.
5. Electrical connections and hoses from EVRV solenoid (12) ignition coil and MAP sensor (11) on multi-use bracket (4).
6. Multi-use bracket (4) from lower intake manifold (22).
7. Upper intake manifold electrical connectors and hoses.
8. Throttle body (15), gasket (16), bolts (18) and cable bracket (7) from upper intake manifold (10).
9. Upper intake manifold bolts (19) upper intake manifold (10) and gasket (20).
10. Heater hose at lower intake manifold (22).
11. Charge air cooler coolant inlet pipe (5) by disconnecting clamp and hose from radiator.



7. Cable Bracket
10. Upper Intake Manifold
15. Throttle Body
16. Gasket
18. Bolt

Figure 3 - Throttle Body

12. Fuel injector electrical connectors.
13. Fuel pipes (23 and 27) at fuel rail (21).
14. Fuel rail (21) and injectors (29) by removing bolts (28).
15. A/C compressor rear brace.
16. Turbocharger coolant return line.
17. Upper radiator hose from lower intake manifold.
18. Ground strap from lower intake manifold (22).
19. Coolant sensor electrical connector.
20. Spark plug wires from distributor.
21. Distributor cap.
22. Distributor. Refer to IGNITION SYSTEM (SEC. 6D4) in this manual.
23. Lower intake manifold bolts and studs.
24. Lower intake manifold (22) and gaskets.

7. Cable Bracket
10. Upper Intake Manifold
19. Bolt
20. Gasket
21. Fuel Rail
22. Lower Intake Manifold

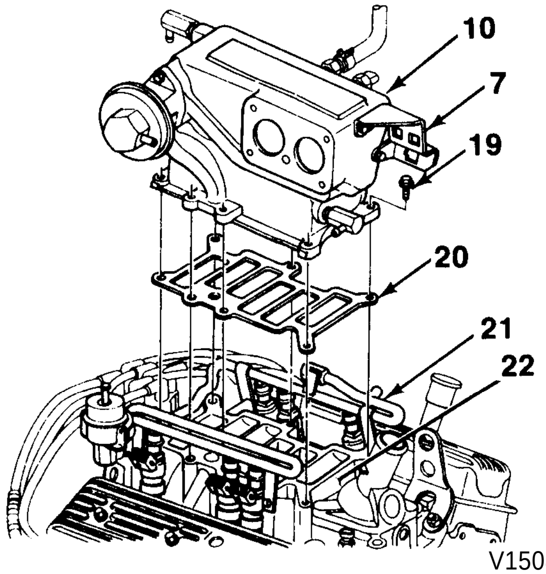


Figure 4 - Intake Manifolds

Clean

- Gasket and sealant surfaces on upper and lower intake manifolds (10 and 22), throttle body (15) and cylinder block.
- EGR and coolant passages if necessary.

Install or Connect (Figures 1 through 6)

NOTICE: For steps 3, 12, 13, 18 and 19 see "Notice" on page 6A3-1 of this section.

1. Gaskets on cylinder heads with port blocking plates facing the rear.

- Apply a 5 mm (3/16 inch) bead of RTV sealer, GM part number 1052366 or equivalent, to the front and rear of the cylinder block. Extend the bead 13 mm (1/2 inch) up each cylinder head to seal and retain the gaskets.

2. Lower intake manifold (22).
3. Lower intake manifold bolts and studs.

Tighten

- Lower intake manifold bolts and studs to 47 N•m (35 ft. lbs.).

4. Distributor. Refer to IGNITION SYSTEM (SEC. 6D4) in this manual.
5. Distributor cap.
6. Spark plug wires to distributor.
7. Coolant sensor electrical connector.
8. Ground strap.
9. Upper radiator hose.
10. Turbocharger coolant return line.
11. A/C compressor rear brace.
12. Fuel rail (21) and injectors (29) with bolts (28).
13. Fuel pipes (23 and 27) to fuel rail (21).

Tighten

- Fuel rail bolts (28) to 6.5 N•m (58 in. lbs.).
- Fuel pipe fittings to 22 N•m (16 ft. lbs.).

14. Fuel injector electrical connectors.
15. Charge air cooler coolant inlet pipe (5) into position on lower intake manifold (22).
16. Hose and clamp from radiator to charge air cooler coolant inlet pipe (5).
17. Heater hose to lower intake manifold (22).
18. Upper intake manifold (10), gasket (20) and bolts (19).

Tighten

- Upper intake manifold bolts (19) from the two middle bolts outward on each side to 23 N•m (17 ft. lbs.).

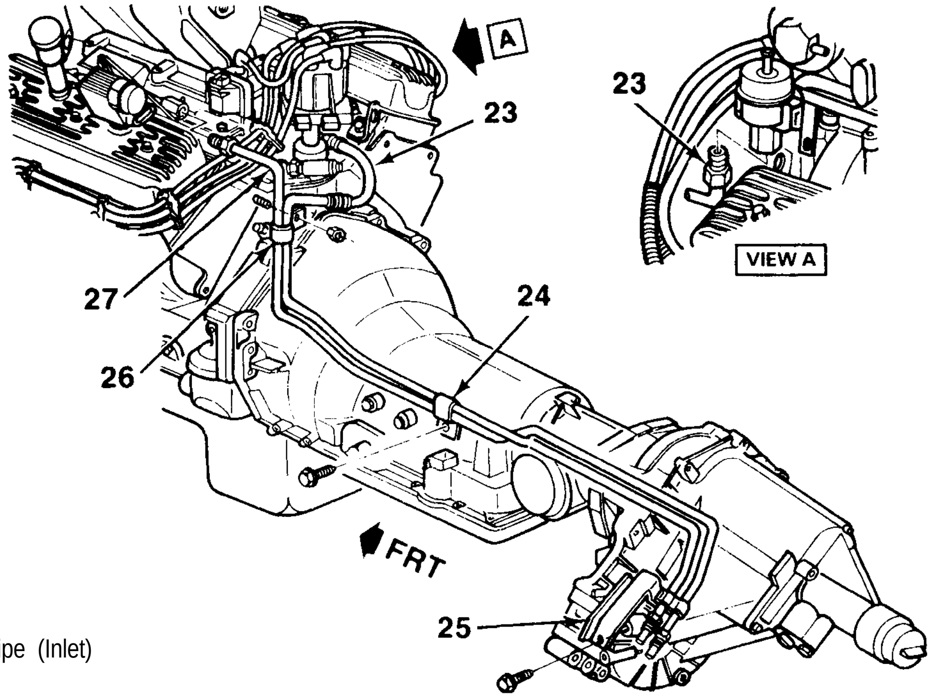
19. Throttle body (15), gasket (16), bolts (18) and cable bracket (7) to upper intake manifold (10).

Tighten

- Throttle body bolts (18) to 23 N•m (17 ft. lbs.).

20. Upper intake manifold electrical connectors and hoses.
21. Multi-use bracket (4).
22. Electrical connections and hoses to EVRV solenoid (12), ignition coil and MAP sensor (11).
23. Charge air cooler lateral support with nut, finger tight.
24. Charge air cooler to supports.
    - Tighten charge air cooler lateral support nut.
25. Charge air cooler hoses, ducts and clamps.
26. Negative (-) battery cable.

- Refill charge air cooler and radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.
- Refill engine radiator.



23. Fuel Pipe (Inlet)
24. Clip
25. Bracket
26. Clip
27. Fuel Pipe (Return)

Figure 5 - Fuel Lines

21. Fuel Rail
28. Bolt
29. Injector

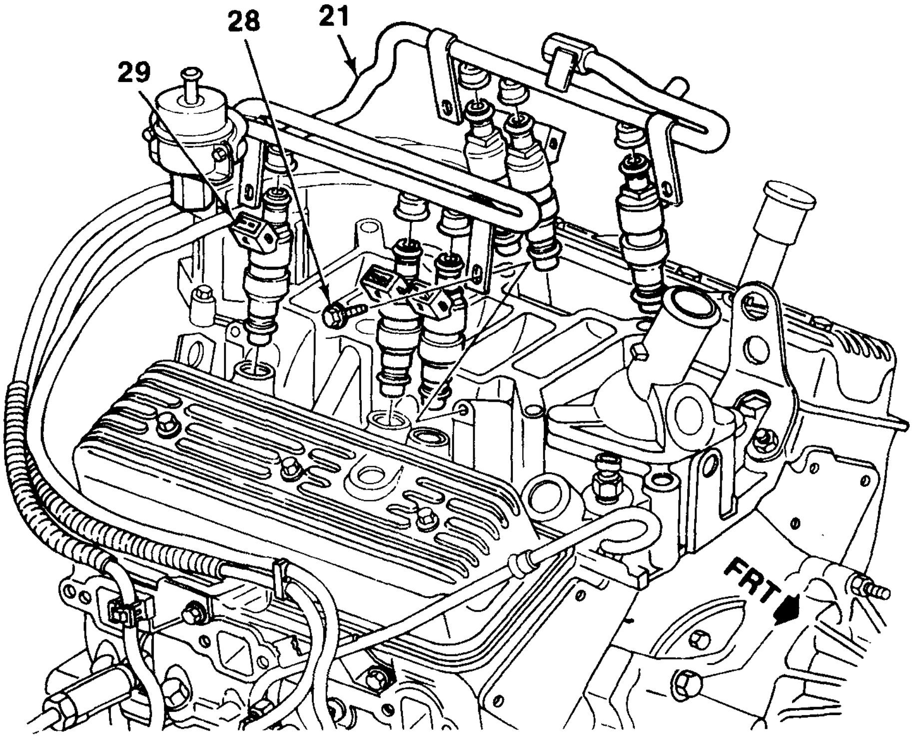


Figure 6 - Fuel Rail

EXHAUST MANIFOLDS

LEFT EXHAUST MANIFOLD

Remove or Disconnect (Figure 7)

1. Negative (-) battery cable.
2. Air cleaner and duct.
3. Turbocharger air inlet elbow.
4. Upper fan shroud.
- Loosen fan nuts.
5. Serpentine drive belt.
6. Fan and pulley.
7. Power steering pump pulley. Refer to POWER STEERING (SEC. 3B1) in this manual.
8. Rear brace at generator.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
9. Left front tire and wheel.
10. Left wheelhouse panel.
11. Power steering inlet hose from pump.
12. Power steering outlet hose from pump.
13. Oil filter lines bracket from power steering pump.
14. Intermediate shaft.
15. Exhaust crossover pipe at left exhaust manifold (30).
16. Power steering pump and rear brace as an assembly from the front bracket.
17. Spark plug wires from plugs.
18. Spark plugs.
19. Exhaust manifold bolts (32 and 33), studs (34), lock tabs (31), washers (35) and heat shields (36 and 38).
20. Exhaust manifold (30).

Install or Connect (Figure 7)

NOTICE: For steps 1, 2, 4, 5, 9, 11, 12, and 15 see "Notice" on page 6A3-1 of this section.

1. Exhaust manifold (30), heat shields (36 and 38), washers (35), lock tabs (31), bolts (32 and 33) and studs (34).
2. Spark plugs.

Tighten

- Exhaust manifold bolts (32 and 33) and studs (34) to 45 N•m (33 ft. lbs.).
- Spark plugs to 15 N•m (11 ft. lbs.).

3. Spark plug wires.
4. Power steering pump and rear brace to front bracket.

Tighten

- Front bracket bolts to 50 N•m (37 ft. lbs.).
- Rear brace nut to 45 N•m (33 ft. lbs.).

5. Exhaust crossover pipe.

Tighten

- Exhaust crossover pipe nuts to 16 N•m (12 ft. lbs.).

6. Intermediate shaft.
7. Oil filter lines bracket to power steering pump.
8. Power steering outlet hose to pump.
9. Power steering inlet hose to pump.

Tighten

- Inlet hose fitting to 27 N•m (20 ft. tbs.).

10. Left wheelhouse panel.
11. Left front tire and wheel.

Tighten

- Wheel nuts to 140 N•m (100 ft. lbs.).
- Lower vehicle.

12. Rear brace to generator.

Tighten

- Rear brace bolt to 25 N•m (18 ft. lbs.).

13. Power steering pump pulley. Refer to POWER STEERING (SEC. 3B1) in this manual.
14. Fan and pulley.
15. Serpentine drive belt.

Tighten

- Fan and pulley nuts to 24 N•m (18 ft. tbs.).

16. Upper fan shroud.
17. Turbocharger air inlet elbow.
18. Air cleaner and duct.
19. Negative (-) battery cable.

RIGHT EXHAUST MANIFOLD

Remove or Disconnect (Figure 7)

- Drain engine coolant radiator.
1. Battery cables and battery.
2. Battery tray with vacuum tank.
3. Turbocharger oil feed hose.
4. Turbocharger coolant return pipe.
5. Oxygen sensor connector.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
6. Right front tire and wheel.
7. Right wheelhouse panel.
8. Muffler(s) and tailpipe from catalytic converter.
9. Catalytic converter support bolts.
- Lower vehicle.
10. Turbocharger solenoid electrical connector.
- Loosen turbocharger coolant feed line.

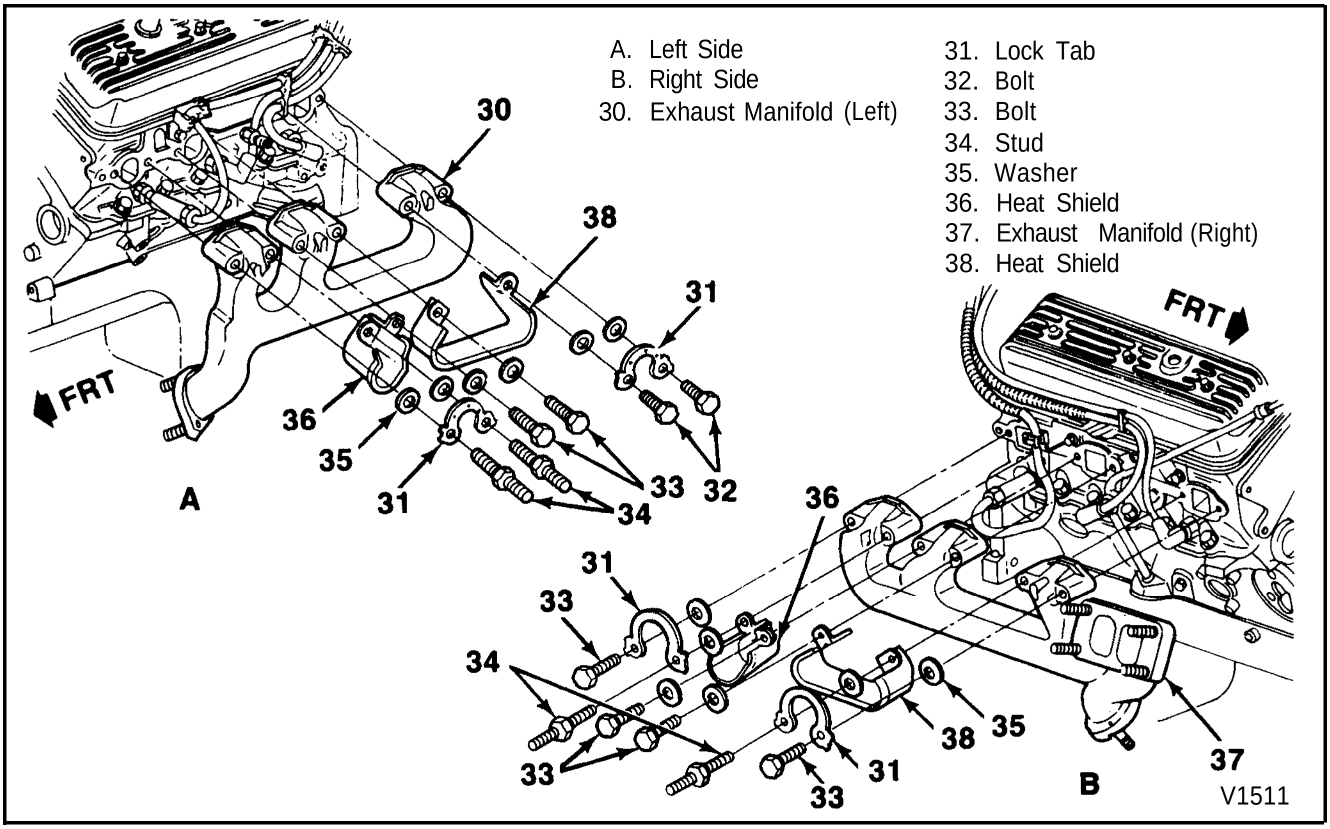


Figure 7 - Exhaust Manifolds

11. Turbocharger outlet pipe nuts.
    - Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
12. Turbocharger outlet pipe support bolt.
    - Move outlet pipe and catalytic converter away from the turbocharger.
13. Turbocharger oil return pipe from turbocharger.
14. Turbocharger mounting nuts.
15. Turbocharger coolant feed pipe from turbocharger.
16. Turbocharger.
17. Exhaust crossover pipe from right exhaust manifold (37).
18. Spark plug wires from plugs.
19. Spark plugs.
20. Charge air cooler lower supports.
21. Exhaust manifold bolts (33), studs (34) lock tabs (31) washers (35) and heat shields (36 and 38).
22. Exhaust manifold (37).

Install or Connect (Figure 7)

NOTICE: For steps 1, 2, 5, 7, 8, 9, 10, 11, 13, 14, 16, 18 and 19 see "Notice" on page 6A3-1 of this section.

1. Exhaust manifold (37), heat shields (36 and 38), washers (35), lock tabs (31), bolts (33) and studs (34).
2. Spark plugs.

Tighten

- Exhaust manifold bolts (33) and studs (34) to 45 N•m (33 ft. lbs.).
- Spark plugs to 15 N•m (11 ft. lbs.).

3. Spark plug wires.
4. Charge air cooler lower supports.
5. Exhaust crossover pipe and nuts.

Tighten

- Exhaust crossover pipe nuts to 16 N•m (12 ft. lbs.).

6. Turbocharger.
7. Turbocharger coolant feed pipe and bolt.
8. Turbocharger mounting nuts.
9. Turbocharger oil return pipe and bolts.

Tighten

- Coolant feed pipe bolt to 35 N•m (26 ft. lbs.).
- Mounting nuts to 45 N•m (33 ft. lbs.).
- Oil return pipe bolts to 6.5 N•m (58 in. lbs.).

10. Turbocharger outlet pipe and nuts.
11. Turbocharger outlet pipe support bolt.

Tighten

- Outlet pipe nuts to 55 N•m (41 ft. lbs.).
- Outlet pipe support bolt to 30 N•m (22 ft. lbs.).

12. Turbocharger solenoid electrical connector.

13. Catalytic converter support bolts.
14. Muffler(s) and tailpipe to catalytic converter.

Tighten

- Support bolts to 34 N•m (25 ft. lbs.).
- Tailpipe bolts to 32 N•m (24 ft. lbs.).

15. Right wheelhouse panel.
16. Right front tire and wheel.

Tighten

- Wheel nuts to 140 N•m (100 ft. lbs.).

- Lower vehicle.

17. Oxygen sensor connector.
18. Turbocharger oil feed hose.
19. Turbocharger coolant return pipe.

Tighten

- Oil feed hose fitting to 22 N•m (16 ft. lbs.).
- Coolant return pipe fitting to 22 N•m (16 ft. lbs.).

20. Battery tray and vacuum tank.
21. Battery and battery cables.

ENGINE ASSEMBLY

Remove or Disconnect (Figures 1 through 6)

1. Battery cables and battery.
2. Hood.
3. Air cleaner and duct.

- Drain engine coolant radiator.
- Drain charge air cooler radiator.

4. Turbocharger air inlet elbow.
5. Upper fan shroud.
6. Fan and pulley nuts.
7. Serpentine belt, fan and pulley.
8. Battery tray and vacuum tank.

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

9. Front tires and wheels.
10. Wheelhouse panels.
11. Muffler(s) and tailpipe from catalytic converter.
12. Catalytic converter support bolts.
13. Turbocharger outlet pipe bracket.
14. Turbocharger outlet pipe nuts.

- Move outlet pipe and catalytic converter away from the turbocharger.

15. Electrical connector from charge air cooler radiator temperature sensor and radiator hoses.
16. Charge air cooler radiator.
17. Exhaust crossover pipe.

- Lower vehicle.

18. Transmission cooler lines from radiator.
19. Upper and lower radiator hoses.
20. Engine oil cooler lines from radiator.
21. Heater and overflow hoses from radiator.
22. Radiator.
23. Oil pipes at filter adapter.
24. Power steering pump hoses from steering gear.
25. Engine coolant reservoir.
26. A/C compressor from bracket and move aside.
27. Charge air cooler clamps, ducts and hoses.
28. Charge air cooler from supports.
29. Throttle body (15) gasket (16) bolts (18) and cable bracket (7) from upper intake manifold (10) and move aside.
30. Heater hose from lower intake manifold (22).
31. Electrical connectors and hoses from upper intake manifold (10).
32. Upper intake manifold (10).
33. Fuel pipes (23 and 27) from fuel rail (21).
34. Electrical connectors and vacuum lines from engine.

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

35. Rear propeller shaft.

- Support transmission.

36. Transmission crossmember and mount.
37. Front propeller shaft.
38. Torque converter cover.
39. Shift linkage from transmission.
40. Torque converter bolts.
41. Fuel pipes (23 and 27) from hoses near transfer case.
42. Fuel line bracket (25) from transfer case.
43. Fuel line clip (24) and electrical clips and connectors from transmission and transfer case.
44. Transfer case and gasket.
45. TV cable (14) from transmission.
46. Transmission cooler lines from transmission.
47. Torque converter housing bolts and transmission.
48. Transmission cooler lines from oil pan.
49. Fuel line clip (26) oil line and electrical harness clips from cylinder heads.
50. Starter motor electrical connections.
51. Starter motor.
52. Engine mount through-bolts and nuts.

- Lower vehicle.

53. Electrical connections from oil pressure and knock sensors and ground strap.

- Install lifting device.

54. Engine.

Install or Connect (Figures 1 through 6)

NOTICE: For steps 3, 7, 8, 10, 12, 13, 15, 17 through 25, 30, 33, 38, 39, 42, 43, 47 and 54 see "Notice" on page 6A3-1 of this section.

- Lower engine into engine compartment.

1. Electrical connections to oil pressure and knock sensors and ground strap.
2. Engine onto engine mounts.

- Position engine wiring harness.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

3. Engine mount through-bolts and nuts.

Tighten

- Through-bolts to 83 N•m (61 ft. lbs.) or through-bolts nuts to 70 N•m (52 ft. lbs.).

4. Fuel line clip (26) oil line and electrical harness clips to cylinder heads.
5. Starter motor.
6. Starter motor electrical connections.
7. Transmission and torque converter housing bolts.

Tighten

- Bolts to 47 N•m (35 ft. lbs.).

8. Transmission cooler lines to transmission.

Tighten

- Transmission cooler line fittings to 22 N•m (16 ft. lbs.).

9. TV cable (14) to transmission.
10. Transfer case, gasket and bolts.

Tighten

- Bolts to 45 N•m (33 ft. lbs.).

11. Transmission cooler lines to oil pan clip.
12. Fuel line pipes (23 and 27) to hoses.
13. Fuel line bracket (25) to transfer case.

Tighten

- Fuel line hose fittings to 26 N•m (19 ft. lbs.).
- Bracket bolt to 35 N•m (26 ft. lbs.).

14. Fuel line clip (24) and electrical clips and connectors to transmission and transfer case.
15. Torque converter bolts.

Tighten

- Torque converter bolts to 63 N•m (46 ft. lbs.).

16. Shift linkage to transmission.
17. Torque converter cover and bolts.

Tighten

- Cover bolts to 47 N•m (35 ft. lbs.).

18. Front propeller shaft and bolts.

Tighten

- Propeller shaft bolts to 70 N•m (52 ft. lbs.).

19. Transmission crossmember and mount.

Tighten

- Crossmember nuts to 35 N•m (26 ft. lbs.).

20. Rear propeller shaft and bolts and nuts.

Tighten

- Propeller shaft nut to 20 N•m (15 ft. lbs.).

21. Turbocharger outlet pipe and nuts.
22. Turbocharger outlet pipe bracket.

Tighten

- Outlet pipe nuts to 55 N•m (41 ft. lbs.).
- Outlet pipe support bolt to 30 N•m (22 ft. lbs.).

23. Catalytic converter support bolts.
24. Muffler(s) and tailpipe to catalytic converter.

Tighten

- Support bolts to 34 N•m (25 ft. lbs.).
- Tailpipe bolts to 32 N•m (24 ft. lbs.).

25. Exhaust crossover pipe and nuts.

Tighten

- Exhaust crossover pipe nuts to 16 N•m (12 ft. lbs.).

26. Charge air cooler radiator.
27. Charge air cooler radiator hoses and electrical connection.

- Lower vehicle.

28. Electrical connectors and vacuum lines to engine.
29. Fuel pipes (23 and 27) to fuel rail (21).
30. Upper intake manifold (10), gasket (20) and bolts (19).

Tighten

- Upper intake manifold bolts (19) from the two middle bolts outward on each side to 23 N•m (17 ft. lbs.).

31. Electrical connectors and hoses to upper intake manifold (10).
32. Heater hose to lower intake manifold (22).
33. Throttle body (15), gasket (16), bolts (18) and cable bracket (7) to upper intake manifold (10).

Tighten

- Throttle body bolts (18) to 23 N•m (17 ft. lbs.).

34. Charge air cooler to supports.
35. Charge air cooler ducts, hoses and clamps.
36. A/C compressor to bracket.
37. Engine coolant reservoir.
38. Power steering pump hoses to steering gear.

Tighten

- Hose fittings to 28 N•m (21 ft. lbs.).

39. Oil pipes to filter adapter with bolt.

Tighten

- Oil pipes bolt to 35 N•m (26 ft. lbs.).

40. Radiator.
41. Heater and overflow hoses to radiator.
42. Engine oil cooler lines to radiator.
43. Transmission cooler lines to radiator.

Tighten

- Oil cooler line fittings to 35 N•m (26 ft. lbs.).
- Transmission cooler line fittings to 27 N•m (20 ft. lbs.).

44. Upper and lower radiator hoses.
45. Battery tray and vacuum tank.
46. Fan, pulley and nuts.
47. Serpentine belt.

Tighten

- Fan and pulley nuts to 24 N•m (18 ft. lbs.).

48. Upper fan shroud.
49. Turbocharger air inlet elbow.
50. Air cleaner and duct.
51. Hood.
52. Battery and cables.
    - Refill radiator with engine coolant.
    - Refill charge air cooler with coolant. Refer to TURBOCHARGER (SEC. 6J) in this manual.
53. Wheelhouse panels.
54. Front tires and wheels.

Tighten

- Wheel nuts to 140 N•m (100 ft. lbs.).

SPECIFICATIONS

ENGINE SPECIFICATIONS

All Specifications are in INCHES unless otherwise noted.

GENERAL DATA:				
Type				V6
Displacement				4.3L (262 Cu. In.)
RPO				LB4
Bore				4.00
Stroke				3.48
Compression Ratio				8.35:1
Firing Order				1-6-5-4-3-2
Oil Pressure (Minimum)				6 psi @ 1000 RPM; 18 psi @ 2000 RPM; 24 psi @ 4000 RPM
CYLINDER BORE:				
Diameter				3.9995-4.0025
out Of Round	Production			0.001 (Maximum)
	Service			0.002 (Maximum)
Taper	Production	Thrust Side		0.0005 (Maximum)
		Relief Side		0.001 (Maximum)
	Service			0.001 (Maximum)
PISTON:				
Clearance	Production			0.0015-0.0030
	Service Limit			0.0027 (Maximum)
PISTON RING:				
COMPRESSION	Groove Clearance	Production	Top	0.0012-0.0032
			2nd	
		Service Limit		Hi Limit Production + 0.001
	Gap	Production	Top	0.010-0.020
			2nd	0.010-0.025
		Service Limit		Hi Limit Production + 0.010
OIL	Groove Clearance	Production		0.002-0.007
		Service Limit		Hi Limit Production + 0.001
	Gap	Production		0.015-0.055
		Service Limit		Hi Production + 0.010
PISTON PIN:				
Diameter				0.9270-0.9273
Clearance In Piston	Production			0.0002-0.0007
	Service Limit			0.001 (Maximum)
Fit In Rod				0.0008-0.0016 Interference

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ENGINE SPECIFICATIONS (CONT)

All specifications are in INCHES unless otherwise noted.

DISPLACEMENT:			4.3L
CRANKSHAFT:			
Main Journal	Diameter	#1	2.4484-2.4493
		#2, #3	2.4481-2.4490
		#4	2.4479-2.4488
	Taper	Production	0.0002 (Maximum)
		Service Limit	0.001 (Maximum)
	Out Of Round	Production	0.0002 (Maximum)
		Service Limit	0.001 (Maximum)
Main Bearing Clearance	Production	#1	0.0008-0.0020
		#2, #3	0.0011-0.0023
		#4	0.0017-0.0032
	Service Limit	#1	0.0010-0.0015
		#2, #3	0.0010-0.0025
		#4	0.0025-0.0035
Crankshaft End Play			0.002-0.006
Crankpin	Diameter		2.2487-2.2497
	Taper	Production	0.0005
		Service Limit	0.001 (Maximum)
	Out Round	Production	0.0005
		Service Limit	0.001 (Maximum)
Rod Bearing Clearance	Production		0.0013-0.0035
	Service Limit		0.0030
Rod Side Clearance			0.006-0.014
CAMSHAFT:			
Lobe Lift ± 0.002	Intake		0.357
	Exhaust		0.390
Journal Diameter			1.8682-1.8692
Camshaft End Play			0.004-0.012
VALVE SYSTEM:			
Lifter			Hydraulic
Rocker Arm Ratio			1.50:1
Valve Lash		Intake	One Turn Down From Zero Lash
		Exhaust	
Face Angle (Intake & Exhaust)			45°
Seat Angle (intake & Exhaust)			46°
Seat Runout (Intake & Exhaust)			0.002 (Maximum)
Seat Width		Intake	1/32-1/16
		Exhaust	1/16-3/32
Stem Clearance	Production	Intake	0.0010-0.0027
		Exhaust	0.0010-0.0027
	Service	Intake	High Limit Production +0.001
		Exhaust	High Limit Production +0.002
Valve Spring (Outer)	Free Length		2.03
	Pressure lbs. @ in.	Closed	76-84 lbs. @ 1.70-in.
		Open	194-206 lbs. @ 1.25-in.
	Installed Height ± 1/32"		1-23/32
Valve Spring Damper	Free Length		1.86
	Approx. # of Coils		4

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FASTENER TORQUE SPECIFICATIONS

	N-m	Ft. Lbs.	In. Lbs.
Valve Rocker Cover Bolt	10		89
Turbocharger Oil Feed Hose Fitting	22	16	
Lower Intake Manifold Bolt/Stud	47	35	
Upper Intake Manifold Bolt	23	17	
Exhaust Manifold Bolt/Stud	45	33	
Sparkplug	15	11	
Power Steering Pump Front Bracket Bolt	50	37	
Power Steering Pump Rear Brace Nut	45	33	
Exhaust Crossover Pipe Nut	16	12	
Power Steering Pump Inlet Hose Fitting	27	20	
Wheel Nut	140	100	
Generator Rear Brace Bolt	25	18	
Fan and Pulley Nut	24	18	
Turbocharger Coolant Feed Pipe Bolt	35	26	
Turbocharger Mounting Nut	45	33	
Turbocharger Oil Return Pipe Bolt	6.5		58
Turbocharger Outlet Pipe Nut	55	41	
Turbocharger Outlet Pipe Support Bolt	30	22	
Catalytic Converter Support Bolt	34	25	
Tailpipe-to-Catalytic Converter Bolt	32	24	
Engine Mount Through-Bolt	83	61	
Engine Mount Through-Bolt Nut	70	52	
Transmission Torque Converter Housing Bolt	47	35	
Transmission Cooler Line Fitting	22	16	
Transfer Case-to-Transmission Bolt	45	33	
Fuel Line Pipe-to-Hose Fitting	26	19	
Fuel Line Bracket-to-Transfer Case Bolt	35	26	
Torque Converter-to-Flywheel Bolt	63	46	
Torque Converter Cover Bolt	47	35	
Front Propeller Shaft Bolt	70	52	
Transmission Crossmember Nut	35	26	
Rear Propeller Shaft Nut	20	15	
Throttle Body Bolt	23	17	
Oil Pipes-to-Filter Adapter Bolt	35	26	
Transmission Cooler Line Fitting-to-Radiator	27	20	
Turbocharger Coolant Return Pipe Fitting	22	16	
Fuel Pipe Fitting-to-Fuel Rail	22	16	
Fuel Rail Bolt	6.5		58
Power Steering Pump Hose Fitting-to-Steering Gear	28	21	
Engine Oil Cooler Fitting-to-Radiator	35	26	

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SECTION 6B2

RADIATOR

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

RADIATOR

The radiator is the same type that is used on any S/T truck with a 4.3L (LB4) engine. Only the removal and installation procedures are different. For further information on the radiator, refer to the 1992 Service Manual Sonoma and Jimmy Models.

ON-VEHICLE SERVICE

RADIATOR REPLACEMENT

SYCLONE AND TYPHOON

Remove or Disconnect (Figures 1 and 2)

1. Air cleaner and duct.
2. Turbocharger inlet elbow.
- Drain radiator (5).
3. Battery and battery tray. Refer to BATTERY (SEC. 6D1) in this manual.
4. Heater hose (1) and clamp (3) from radiator (5).
5. Coolant reservoir hose.
6. Upper fan shroud.
7. Upper radiator hose (4) and clamp (3) from radiator (5).
8. Lower radiator hose (6) and clamp (3) from radiator (5).
9. Transmission fluid cooler pipes from radiator (5).
10. Engine oil cooler pipes from radiator (5).
11. Radiator (5).

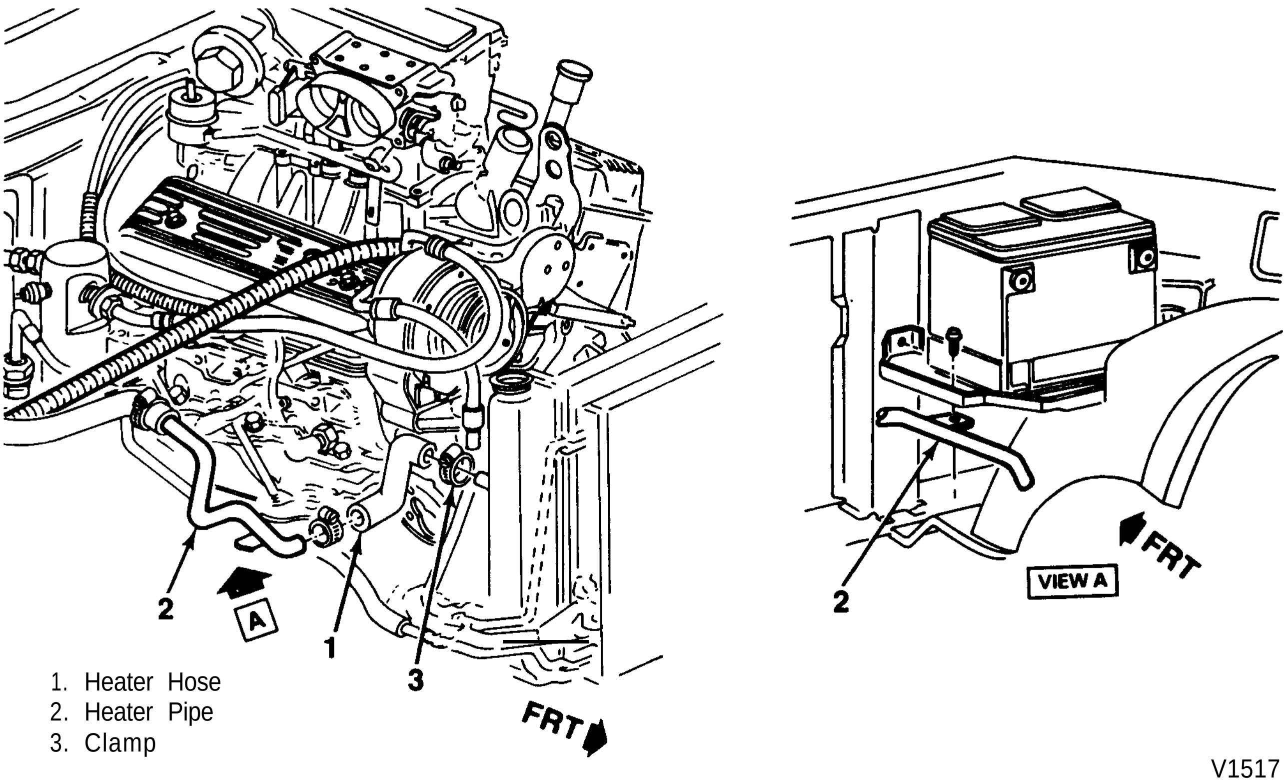
Install or Connect (Figures 1 and 2)

1. Radiator (5).
2. Engine oil cooler pipes.
3. Transmission fluid cooler pipes.

lighten

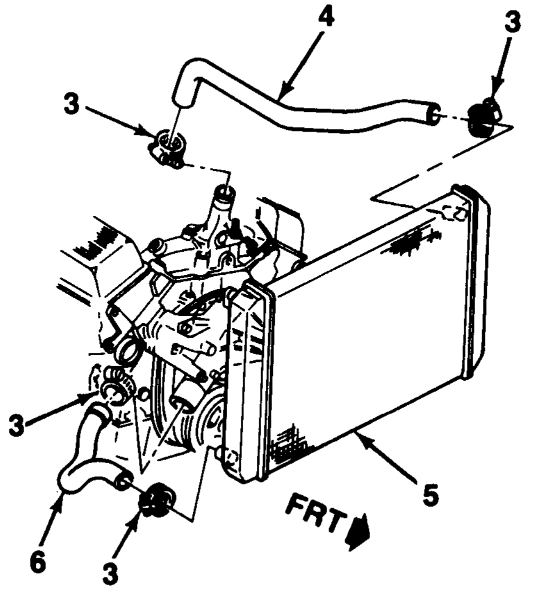
- Engine oil cooler pipe fittings to 35 N•m (26 ft. lbs.).
- Transmission fluid cooler pipe fittings to 27 N•m (20 ft. lbs.).

4. Lower radiator hose (6) and clamp (3).
5. Upper radiator hose (4) and clamp (3).
6. Upper fan shroud.
7. Coolant reservoir hose.
8. Heater hose (1) and clamp (3).
9. Battery and battery tray. Refer to BATTERY (SEC. 6D1) in this manual.
10. Turbocharger inlet elbow.
11. Air cleaner and duct.
- Refill radiator (5) with coolant.



1. Heater Hose
2. Heater Pipe
3. Clamp

Figure 1 - Heater Hose



3. Clamp
4. Hose
5. Radiator
6. Hose

Figure 2 - Radiator Hoses

SPECIFICATIONS

FITTING TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Engine Oil Cooler Pipe Fitting	35	26
Transmission Fluid Cooler Pipe Fitting	27	20

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SECTION 6C

FUEL SYSTEM

ENGINE FUEL

SYCLONE AND TYPHOON

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICAL, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

Important

When working on the fuel system, there are several things to keep in mind.

- **Any time fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.**
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Always use a backup wrench when loosening or tightening a screw couple fitting.
- Torque all screw couple fittings to specified torque value.
- Pipe used on all Fuel Injection systems has fittings that require the use of an “O” Ring.

Replace all pipe with the same pipe and fittings that were removed.

- All fuel pipe must meet the GM Specification 124-M or its equivalent.
- All fuel hose must meet GM Specification 6163-M or its equivalent. If fuel hose requires service, replace the fuel hose, do not repair.
- Do not replace fuel pipe with fuel hose. If a section of fuel pipe requires repair, the maximum length of fuel pipe replaced by fuel hose may not exceed six inches.
- On Fuel Injection systems, always relieve the line pressure before servicing any fuel system components.
- Do not do any repairs on the fuel system until you have read the copy and checked the illustrations relating to that repair.
- Adhere to all Notices and Cautions.

FUEL INJECTION SYSTEM

Fuel is recirculated through a rail continuously while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operations.

The fuel pressure regulator that is mounted on the fuel rail, maintains a variable pressure across the injectors, based on intake manifold vacuum. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank.

The pressure regulator also utilizes an “O” ring for attachment. The “O” ring used is the same one that is used for the injectors.

FUEL

GASOLINE

The turbo-charged engine, 4.3L (VIN Z), is designed to use unleaded fuel with a minimum (R+M)/2 octane number of 91. The fuel should meet ASTM specification ASTM D4814 for the U.S. or CGSB 3.5-M87 for Canada.

Using leaded fuel can damage the emission control system and could result in loss of emission warranty coverage.

EVAPORATIVE EMISSION SYSTEM

All vehicles are equipped with an Evaporative Emission System. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere. Information on this system will be found in DRIVEABILITY AND EMISSIONS FUEL INJECTION (PORT) (SEC. 6E3) in this manual.

FUEL TANK

A baffle is installed in the tank to serve as a slosh baffle.

FUEL TANK FILLER PIPE (Figure 1)

To help prevent refueling with leaded fuel, the fuel filler neck has a built-in restrictor and deflector. The opening in the restrictor will accept only the smaller unleaded gasoline fuel nozzle which must be fully inserted to bypass the deflector. Attempted refueling with a leaded fuel nozzle or failure to fully insert the unleaded fuel nozzle will result in fuel splashing back out of the filler neck.

FUEL FILLER CAP (Figure 1)

The fuel tank filler neck is equipped with a screw type cap. The threaded part of the cap requires several turns counterclockwise to remove. The long threaded area was designed to allow any remaining fuel tank pressure to escape during the cap removal operation. A built-in rachet type torque limiting device prevents over-tightening. To install, turn the cap clockwise until a clicking noise is heard. This signals that the correct torque has been reached and the cap is fully seated.

NOTICE: If a fuel filler cap requires replacement, only a cap with the same features should be used. Failure to use the correct cap can result in a serious malfunction of the system.

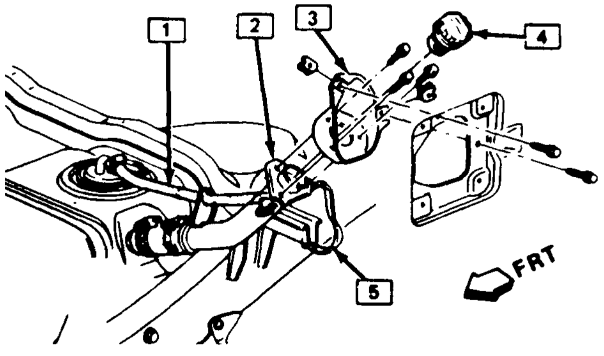


Figure 1 - Fuel Filler Pipe (Typical)

FUEL LEVEL METER (SENDER UNIT)/FUEL PUMP ASSEMBLY

FUEL LEVEL METER (Figure 2)

FUEL PUMP (Figure 2)

An electric fuel pump located in the fuel tank is used to provide fuel pressure. It is attached to the bottom of the fuel sending unit. To control fuel pump operation, a fuel pump relay and fuel pump switch are used.

When the ignition switch is turned to "RUN" position, the fuel pump relay activates the electric fuel pump for approximately two seconds to prime the injector(s). If the ECM does not receive reference pulses from the distributor/crankshaft sensor after this time, the ECM opens the fuel pump relay ground circuit. The relay will once again activate the fuel pump when the ECM receives distributor/crankshaft sensor reference pulses and grounds the fuel pump relay circuit.

FUEL PUMP FILTER (Figure 2)

A woven plastic filter is located on the lower end of the fuel pick-up pipe in the fuel tank. This filter prevents dirt from entering the fuel line and also stops water unless the filter becomes completely submerged in water. This filter is self cleaning and normally requires no maintenance. Fuel stoppage at this point indicates that the fuel tank contains an abnormal amount of sediment or water. Therefore, should this occur, the fuel tank should be removed and thoroughly cleaned and the tank filter replaced. Also see "Fuel System Cleaning."

PULSATOR (Figure 2)

The pulsator dampers vibrations set up in the fuel system by the fuel pump. The pulsator provides for quieter operation of the fuel system.

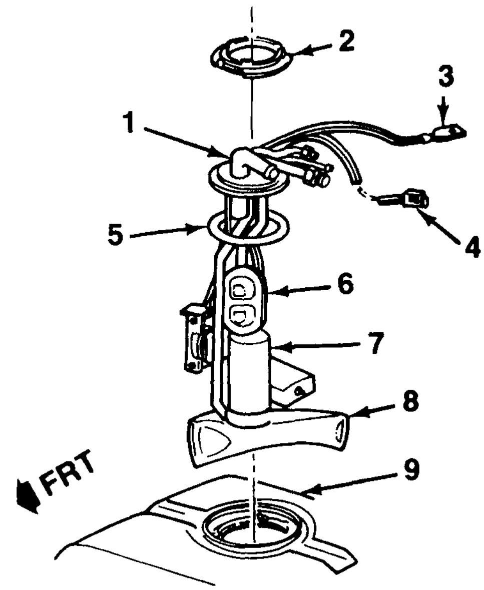


Figure 2 - Fuel Level Meter (Sender Unit)/Fuel Pump Assembly (Typical)

IN-LINE FUEL FILTER

The Syclone and Typhoon use an in-line fuel filter. The filter is located on the left frame rail, near the fuel tank.

In-line filters use an "O" ring where the fuel pipes screw into the fuel filter.

If an element should ever become plugged, the engine will stop. An engine stoppage caused by a plugged filter element may be preceded by a hesitation or sluggish operation.

FUEL/VAPOR PIPES AND HOSES

The fuel feed and return pipes extend from the fuel gage sending unit to the engine compartment. The pipes are secured to the frame with clip and screw assemblies. Both fuel feed pipes and return pipe must be properly routed and retained, and should be inspected occasionally for leaks, kinks or dents. If evidence of dirt is found in the throttle body unit or fuel filter during disassembly, the pipes should be disconnected and blown out. Check the fuel strainer on fuel gage sending unit for damage or omission.

The vapor pipe extends from the fuel gage sender to the canister. However, it does not follow the same route as the fuel feed pipe.

If replacement of a fuel feed pipe or vapor pipe is required, use service replacement part.

Under no conditions use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations and corrosion.

NOTICE: The hoses are specially manufactured and if replacement becomes necessary, it is important to use only the service replacement hoses identified with the words "Fluoroelastomer" on them. Hoses not so marked could cause early failure or failure to meet emission standard. If a hose is damaged, the hose must be replaced. Do not attempt to repair the hose.

FUEL LINE O-RINGS

The fuel line "O" Rings used are made of Viton®. They are brown in color. Viton® is less affected than rubber by the additives used in many fuels and therefore rubber should not be substituted.

ACCELERATOR CONTROLS

The accelerator control system is cable type. There are no linkage adjustments. Therefore, the specific cable for each application must be used. Only the specific replacement part will work.

When work has been performed on accelerator controls, always make sure that all components are installed correctly and that linkage and cables are not rubbing or binding in any manner. The throttle should operate freely without bind between full closed and wide open throttle.

DIAGNOSIS

ALCOHOL-IN-FUEL

Certain driveability complaints such as hesitation, lack of power, stall, no start, etc. may be caused by an excessive amount of alcohol in fuel. The complaints may be due to fuel system corrosion and subsequent fuel filter plugging, deterioration of rubber components such as the O-ring seals.

Various types and concentrations of alcohols are used in commercial gasoline. Some alcohols are more detrimental to fuel system components than others. If an excessive amount of alcohol in the fuel is suspected as the cause of a driveability condition, the following procedure may be used to detect the presence of alcohol in the fuel. In this procedure, water is used to extract the alcohol from the fuel. However, the specific type of alcohol (methanol or ethanol) will not be determined by this procedure.

The fuel sample should be drawn from the bottom part of the tank so that any water, if already present, can be detected. The sample should be bright and clear. If the sample appears cloudy or contaminated with water as indicated by a water layer in the bottom part of the sample, this procedure should not be used. The fuel system should then be cleaned. (See "Fuel System Cleaning.")

TESTING PROCEDURE

1. Using a 100 ml cylinder with 1 ml graduation marks, fill with fuel to the 90 ml mark.
2. Add 10 ml of water to bring the total fluid volume to 100 ml and install a stopper.
3. Shake vigorously for 10 to 15 seconds.
4. Carefully loosen stopper to release pressure.
5. Close the stopper and shake vigorously again for 10 to 15 seconds.
6. Carefully loosen stopper to release pressure.
7. Put the graduated cylinder on a level surface for approximately 5 minutes to allow time for adequate liquid separation.

If alcohol is present in the fuel, the volume of the lower layer, which would now contain alcohol and water will be greater than 10 ml. For example, if the volume of the lower layer is increased to 15 ml it would indicate at least 5 percent alcohol in fuel. The actual amount of alcohol may be somewhat greater because this procedure does not extract all of the alcohol from the fuel.

FUEL TANK LEAK CHECK (OFF-VEHICLE)

1. Plug all outlets as follows:
   a. Install filler neck and vent hoses, upper neck assembly and install filler cap.
   b. Install fuel tank meter asm. with seal and plug fuel line.
   c. Install short piece of fuel line on fuel tank meter vent tube.
2. Apply air pressure to tank through vent tube. When air can be heard escaping from filler neck cap, approximately 7 to 10 kPa (1 to 1.5 psi), pinch the fuel line hose to retain pressure.
3. Test suspect area for leaks with soap solution or by submersion. If leak is noted, replace tank.

FUEL SYSTEM PRESSURE TEST

The fuel system pressure test will be found in: DRIVEABILITY AND EMISSIONS FUEL INJECTION (PORT) (SEC. 6E3) in this manual (Chart A7).

It is necessary to relieve the fuel system pressure prior to servicing components on the system. See "Fuel System Pressure Relief" for procedure.

FUEL LEVEL METER (SENDER UNIT) DIAGNOSIS

For checking and testing of fuel gages, refer to INSTRUMENT PANEL AND GAGES (SEC. 8C) in the 1992 Service Manual Sonoma and Jimmy Models.

FUEL PUMP ELECTRICAL DIAGNOSIS

For electrical diagnosis refer to DRIVEABILITY AND EMISSIONS FUEL INJECTION (PORT) (SEC. 6E3) in this manual.

ON-VEHICLE SERVICE

FUEL SYSTEM PRESSURE RELIEF

The port fuel injection system is designed to hold pump pressure (checking type system) after the engine is turned off, thereby requiring a fuel pressure relief procedure prior to servicing the fuel system.

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing fuel system components.

After relieving system pressure, a small amount of fuel may be released when servicing fuel lines or connections. in order to reduce the chance of personal injury, cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when disconnect is completed.

Tool Required:
J 34730-1 Fuel Pressure Gage

1. Disconnect negative battery terminal to avoid fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. Connect gage J 34730-1 to fuel pressure connection. Wrap a shop towel around fitting while connecting gage to avoid spillage.
4. Install bleed hose into an approved container and open valve to bleed system pressure. Fuel connections are now safe for servicing.
5. Drain any fuel remaining in gage into an approved container.

FUEL SYSTEM INSPECTION

Always check and replace any "O" Rings and/or washers that appear damaged.

Important

A minimum of 13.0 mm (1/2 inch) clearance must be maintained around sharp edges such as flanges, pinch weld, etc., to prevent contact and chaffing. A minimum of 19 mm (3/4 inch) clearance must be maintained around any moving parts.

When repair to the fuel system has been completed, start engine and check all connections that were loosened for possible leaks.

IN-LINE FUEL FILTER REPLACEMENT

The fuel filter is located on the left frame rail near the fuel tank.

Remove or Disconnect (Figure 3)

1. Relieve fuel system pressure. See "Fuel System Pressure Relief."
2. Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

CAUTION: To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle at the opposite end from which components are being removed. This will reduce the possibility of the vehicle falling off of the hoist.

3. Fuel lines from filter.
4. Filter from vehicle.

Install or Connect (Figure 3)

1. Filter in position loosely.
2. Using new "O" ring seals, install the fuel lines into the filter.

   Important

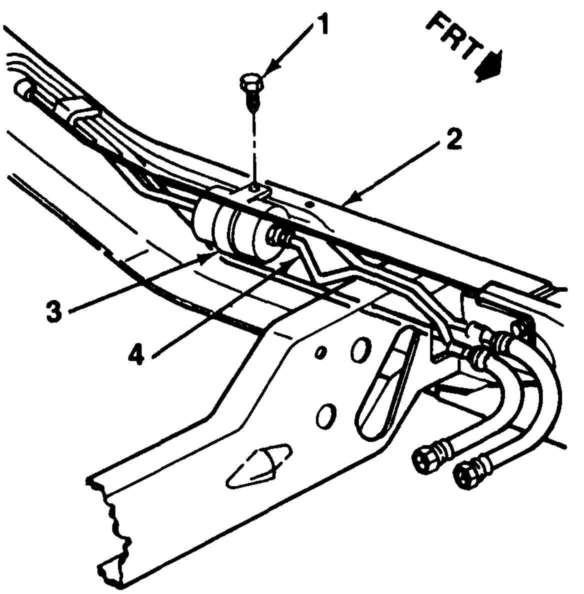
   - Use back-up wrench to prevent filler, "O" ring or fuel line damage.
   - Torque line fittings to specification.
3. Secure filter to vehicle.
4. Lower vehicle.

Inspect

- Start engine and inspect for leaks.

DRAINING FUEL TANK

NOTICE: If vehicle is to be stored for any appreciable length of time, the fuel should be drained from the complete system, including injector nozzle(s), fuel pump, all fuel pipes and the fuel tank in order to prevent gum formations and resultant improper engine performance.



1. Bolt - Tighten to 7 N•m (62 In. Lbs.)
2. Frame
3. Fuel Filter
4. Fuel Pipe Assembly

V1698

Figure 3 - Fuel Filter Installation

1. Remove the negative cable from the battery and have a Class B fire extinguisher near the work area.
2. Use a hand-operated pump device when possible, to drain as much fuel through the filler tube as possible.
3. If a hand-operated pump device cannot be used or to complete the draining process, use a siphon at the main (not return) fuel pipe at the fuel pump or the fuel tank gage unit.

CAUTION: Never drain or store fuel in an open container due to the possibility of fire or explosion.

4. Reinstall any removed hoses, pipes and cap.

FUEL TANK REPLACEMENT

SYCLONE

Remove or Disconnect (Figures 4 through 6)

Tool Required:
J 36608 Fuel Gage (Sending) Unit Remover and Installer

1. Drain tank.

CAUTION: To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle at the opposite end from which components are being removed. This will reduce the possibility of the vehicle falling off of the hoist.

2. Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
3. Tank meter assembly harness connector from frame harness connector.
4. Ground wire retaining screw from underbody (if used).
5. Hoses from tank meter asm.
6. Hoses at tank from filler and vent pipes.
7. Fuel tank shield (11), by removing bolts (8 and 9) and nuts (10).
8. Support fuel tank and disconnect the two fuel tank retaining straps.
9. Tank.
10. Fuel tank meter assembly and seal (gasket) using J 36608.
11. Sound insulators.

Install or Connect (Figures 4 through 6)

1. Fuel tank meter assembly and seal (gasket), if removed.

Important

- Use a new seal.

2. Sound insulators.
3. Fuel tank, while supporting.
4. Straps. Tighten the front fuel tank retaining strap bolts and the rear strap nut to specification.
5. Fuel tank shield (11), by attaching bolts (8 and 9) and nuts (10).

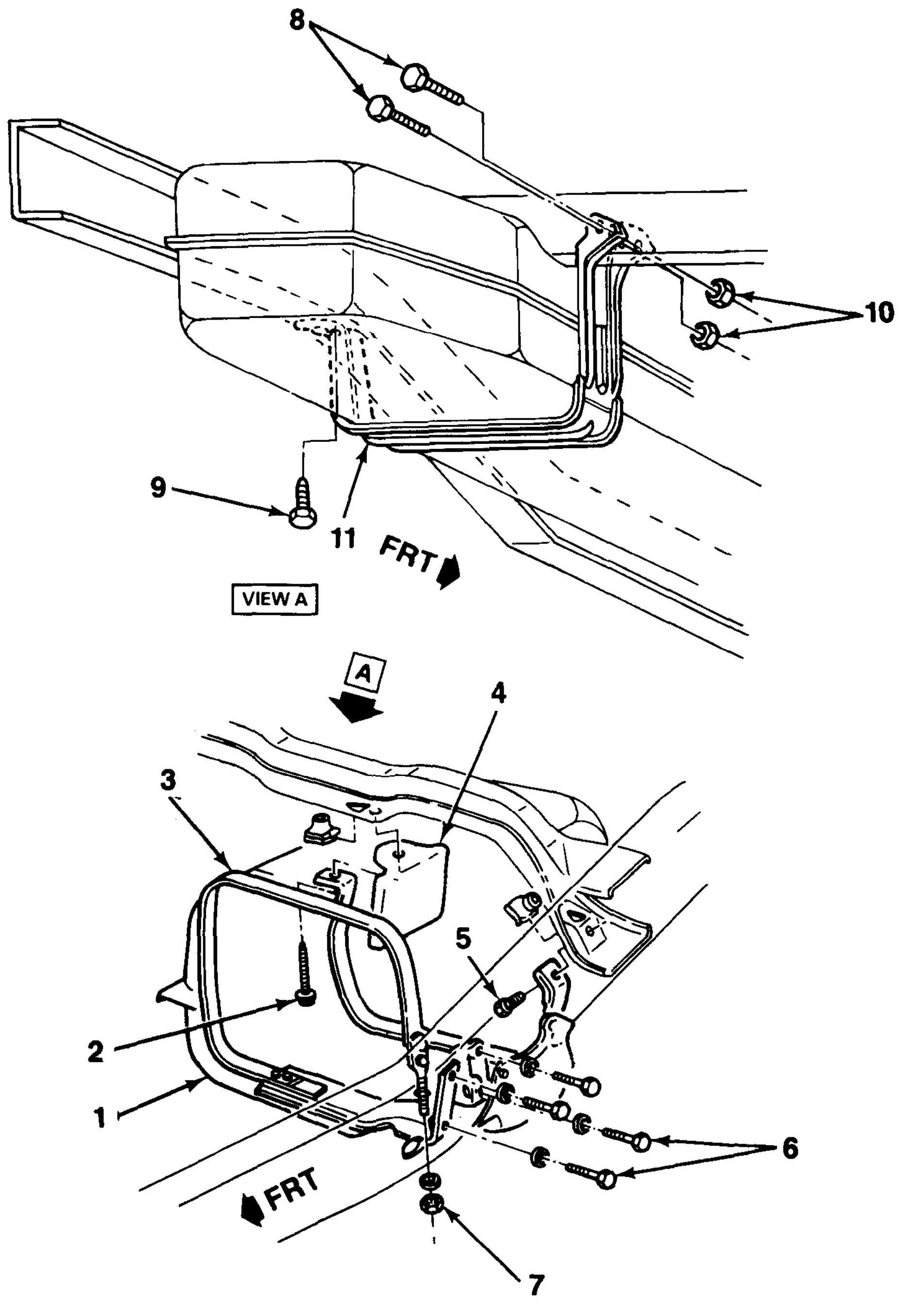
Tighten

- Bolt (8) to 17 N•m (13 ft. lbs.).
- Bolt (9) to 25 N•m (18 ft. lbs.).
- Nuts (10) to 17 N•m (13 ft. lbs.).

6. Hoses to fuel tank meter asm.
7. Hoses to filler and vent pipes. Tighten clamps.
8. Ground lead to underbody (if used).
9. Fuel tank meter assembly harness connector to body harness connector.
10. Lower vehicle.
11. Refill tank.

Inspect

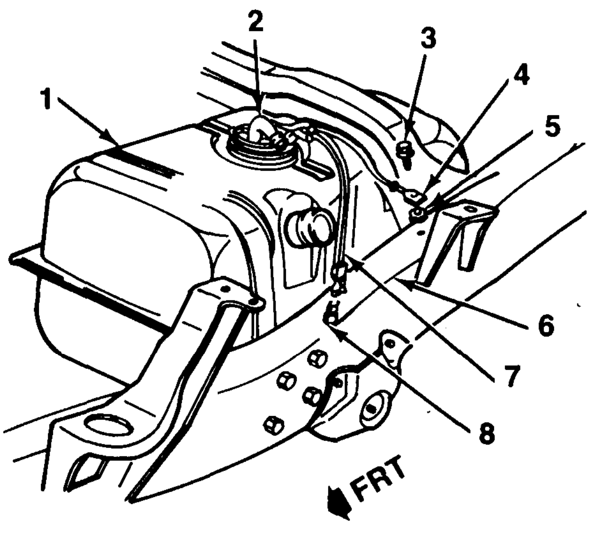
- Leaks.



1. Fuel Tank
2. Bolt - Tighten to 18 N•m (13 Ft. Lbs.)
3. Strap
4. Protector
5. Bolt - Tighten to 35 N•m (26 Ft. Lbs.)
6. Bolt - Tighten to 35 N•m (26 Ft. Lbs.)
7. Nut - Tighten to 7 N•m (5 Ft. Lbs.)
8. Bolt - 17 N•m (13 Ft. Lbs.)
9. Bolt - 25 N•m (18 Ft. Lbs.)
10. Nut - 17 N•m (13 Ft. Lbs.)
11. Fuel Tank Shield

V1871

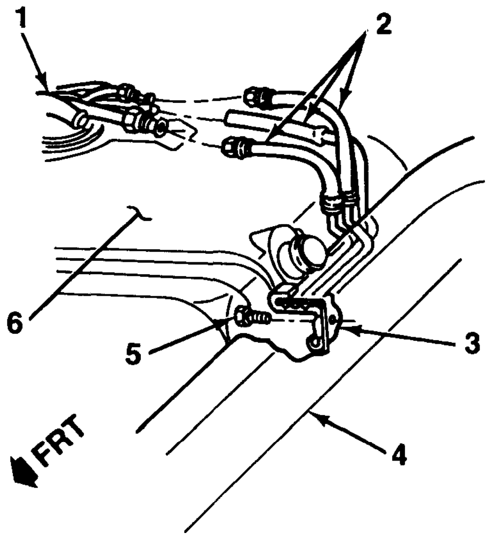
Figure 4 - Fuel Tank Installation



1. Fuel Tank
2. Fuel Tank Meter Assembly
3. Bolt - Tighten to 2 N•m (18 In. Lbs.)
4. Ground Wire
5. Washer
6. Frame
7. Tank Meter Assembly Harness
8. Frame Harness Connector

V1699

Figure 5 - Fuel Tank Unit Wiring



1. Fuel Tank Meter Assembly
2. Hose
3. Pipe Clip
4. Frame
5. Bolt
6. Fuel Tank

V1700

Figure 6 - Fuel Tank Unit Hoses

FUEL SYSTEM CLEANING

CAUTION: This procedure will not remove all fuel vapor. Do not attempt any repair on tank or filler neck where heat or flame is required, as an explosion resulting in personal injury could occur.

Important

- Have a Class B fire extinguisher near the work area.

If trouble is due to contaminated fuel or foreign material that has been put into the tank, it can usually be cleaned. If tank is rusted internally, it should be replaced.

1. Relieve fuel system pressure. See “Fuel System Pressure Relief.”
2. Disconnect negative battery cable.
3. Drain fuel tank - see “Draining Fuel Tank.”
4. Remove fuel tank - see “Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon.
5. Remove the fuel inlet filter and inspect for contamination. If filter is plugged, replace. (Leave fuel line disconnected.)
6. Locate tank away from heat, flame or other source of ignition. Remove fuel tank meter asm. and inspect condition of filter. If filter is contaminated, a new filter should be installed upon reassembly.
7. Complete draining of tank by rocking it and allowing fuel to run out of tank unit hole.
8. Purge fuel tank, see “Fuel Tank Purging Procedure.”
9. Disconnect fuel feed pipe and use air pressure to clean fuel line and fuel return line. Apply air pressure in the direction fuel normally flows through line.
10. Use low air pressure to clean pipes on tank unit.
11. Install fuel tank meter assembly, with new seal, into tank and install tank. Connect tank unit wires and all fuel pipes except fuel line at the throttle body. (See “Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon for proper procedure.)
12. Disconnect fuel feed hose to chassis pipe at front.
13. Connect a hose onto fuel pipe and insert other end of hose into an empty one gallon fuel can.
14. Connect battery cable.
15. Put 23 liters (six gallons) of clean fuel in the tank and apply 12 volts to the fuel pump test connector to pump two liters (two quarts) of fuel into fuel can. This will purge fuel pump.
16. Remove hose and connect fuel line. Use new “O” rings as needed (see “Fuel Line “O” Rings”).
17. Start engine.

Inspect

- For leaks.

FUEL TANK PURGING PROCEDURE

1. Relieve fuel system pressure - see “Fuel System Pressure Relief.”
2. Negative battery cable.
3. Remove fuel tank meter assembly and drain all remaining fuel from tank.
4. Visually inspect interior cavity of tank. If any fuel is evident, drain again.
5. Move tank to flushing area.
6. Fill tank completely with tap water, agitate vigorously and drain.
7. Add fuel emulsifying agent to the tank, refill with water, agitate mixture for 10 minutes, drain tank completely.

   For the correct fuel emulsifying agent to water mixture, refer to the manufacturer’s specifications. Use an available emulsifying agent, such as “Product-Sol No. 913” or equivalent.
8. When empty, refill the tank until it is overflowing with water. Completely flush out remaining mixture and empty tank.
9. If available, an explosion meter should be used to check for a negative reading.
10. Perform required service work.

FUEL LEVEL METER/FUEL PUMP ASSEMBLY REPLACEMENT

FUEL PUMP FILTER REPLACEMENT

Remove or Disconnect (Figure 2)

1. Relieve fuel system pressure - see “Fuel System Pressure Relief.”
2. Negative battery cable.
3. Fuel tank unit - see “Fuel Level Meter/Fuel Pump Assembly Replacement.”
4. Filter.

Install or Connect (Figure 2)

1. Filter.
2. Fuel tank unit.
3. Negative battery cable.

FUEL PUMP REPLACEMENT

Remove or Disconnect (Figure 2)

1. Relieve fuel pressure, see “Fuel System Pressure Relief.”
2. Negative battery cable.
3. Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

CAUTION: To help avoid personal injury when a vehicle is on a hoist, provide additional support for the vehicle at the opposite end from which components are being removed. This will reduce the possibility of the vehicle falling off of the hoist.

4. Fuel tank (see “‘Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon).
5. Remove fuel tank sending unit and pump assembly by turning cam lock ring counterclockwise. Lift assembly from fuel tank and remove fuel pump from fuel tank sending unit.
6. Pull fuel pump up into attaching hose while pulling outward away from bottom support. Take care to prevent damage to rubber insulator and strainer during removal. After pump assembly is clear of bottom support, pull pump assembly out of rubber connector for removal.

Inspect

- Inspect fuel pump attaching hose for any signs of deterioration. Replace as necessary. Also check rubber sound insulator at bottom of pump; replace if required.

Install or Connect (Figure 2)

1. Push fuel pump assembly into attaching hose.
2. Fuel tank sending unit and pump assembly into tank assembly. Use new “O” ring seal during reassembly.
3. Cam lock over assembly and lock by turning clockwise.
4. Electrical connector.
5. Fuel tank - see “Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon.

PULSATOR REPLACEMENT

Remove or Disconnect (Figure 2)

1. Relieve fuel system pressure - see “Fuel System Pressure Relief.”
2. Negative battery cable.
3. Fuel tank unit - see “Fuel Level Meter/Fuel Pump Assembly Replacement.”
4. Fuel pump - see “Fuel Pump Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon.
5. Pulsator.

Install or Connect (Figure 2)

1. Pulsator.
2. Fuel Pump.
3. Tank Unit.
4. Negative battery cable.

FUEL LEVEL METER REPLACEMENT

Remove or Disconnect (Figure 2)

1. Relieve fuel system pressure - see “Fuel System Pressure Relief.”
2. Negative battery cable.
3. Fuel tank - see “Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon.
4. Tank Unit.
5. Filter.
6. Fuel Pump.
7. Pulsator.
8. Fuel level meter.

Install or Connect (Figure 2)

1. Fuel level meter.
2. Pulsator.
3. Fuel pump.
4. Filter.
5. Tank unit.
6. Fuel tank - see “Fuel Tank Replacement” in this manual for Syclone and FUEL SYSTEM (SEC. 6C) in the 1992 Service Manual Sonoma and Jimmy Models for Typhoon.
7. Negative battery cable.

FUEL FEED AND RETURN PIPE REPLACEMENT

If replacement of a fuel feed, fuel return or emission pipe is required, use welded steel tubing meeting GM Specification 124M, or its equivalent. The replacement pipe must utilize the same type of fittings as the original pipe to ensure the integrity of connection (figure 7).

NOTICE: Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations. Only tubing meeting the 124M Specification is capable of meeting all the pressure and vibration characteristics necessary to ensure the durability standard required.

Due to the fact that the fuel pipes are under high pressure on this system, they require special consideration for service.

- All fuel feed and fuel return line attachments in the system are screw fittings type. The vapor return line is a conventional hose, pipe and clamp.
- Always use a back-up wrench when loosening or tightening the fittings.
- Screw fittings used on this system utilize “O” rings for the fuel feed and return pipes and the two sizes of “O” rings are not interchangeable (see “Fuel Line “O” Rings”).
- Anytime that the fuel or return pipes are disconnected, inspect the “O” rings for cut or other type of damage and replace as necessary (see “Fuel Line “O” Rings”).
- The flare used on these fuel pipes is not compatible with the flare used on normal fuel pipes.
- Use correct torque when tightening these fittings.
- If pipes are replaced, always use original equipment parts or parts that meet GM Specification 124M.
- Damaged fuel hose(s) must be replaced. Do not repair fuel hose(s), other than by replacement.

FUEL VAPOR PIPES AND HOSES REPLACEMENT

CAUTION: Do not attempt to repair flexible fuel lines due to possible safety hazard. Replace only with the same type of flexible fuel lines and fittings as those removed. Never use rubber hose to repair fuel pipes.

ACCELERATOR CONTROL CABLE

The accelerator control system is cable type. There are no linkage adjustments (figure 6).

Check for correct opening and closing positions by operating accelerator pedal. Make sure that the throttle valve reaches wide-open throttle position. If it does not, inspect for damaged or bent brackets, levers, or other components; or, for poor carpet fit under the accelerator pedal.

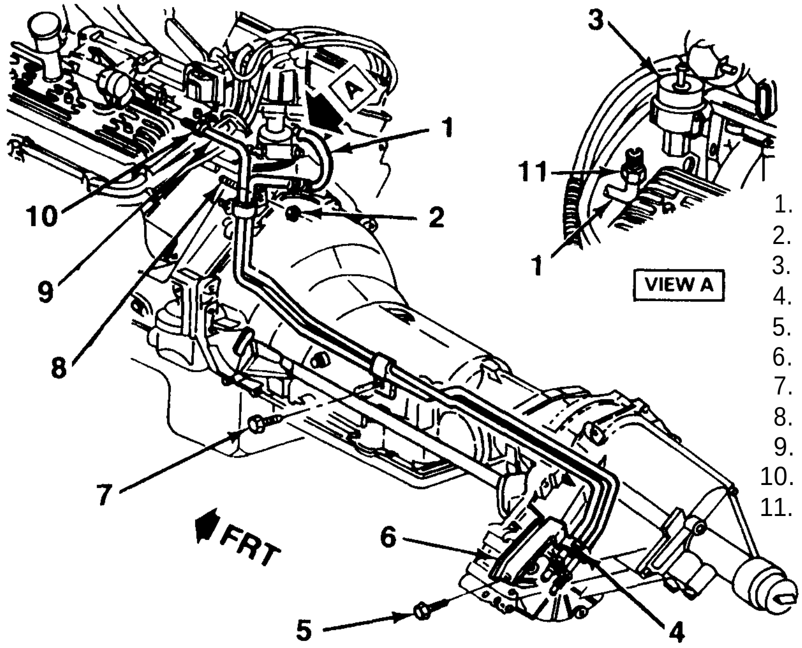
If any binding is present in the linkage, check for:

1. Proper routing of cable.
2. Kinked or damaged cable.
3. Free movement of:
    a. Throttle lever at the throttle body.
    b. Cable at throttle body or control lever/pulley.
    c. Accelerator lever at bearing support.
    d. Pedal at lever.

Whenever disconnecting or replacing parts, lube pivot points with Accelerator Linkage Lubricant, GM Part Number 1052541 or equivalent.

When performing service on the accelerator control cable, observe the following:

- Retainer must be installed with tang secured overhead of stud.
- Conduit fitting at both ends of cable must have locking tangs expanded and locked in attaching holes.
- The braided portion of the accelerator cable assembly must not come in contact with the front of dash sealer during assembly, repair or replacement of the assembly.
- Flexible components (hoses, wires, conduits, etc.) must not be routed within 50 mm (2.0 in.) of moving parts of accelerator linkage outboard of support unless routing is positively controlled.



1. Fuel Pipe - Return
2. Nut - Tighten to 28 N•m (21 Ft. Lbs.)
3. Fuel Regulator
4. Nut
5. Bolt - Tighten to 35 N•m (26 Ft. Lbs.)
6. Bracket
7. Bolt - Tighten to 7 N•m (62 In. Lbs.)
8. Stud - Tighten to 35 N•m (26 Ft. Lbs.)
9. Fuel Pipe - Feed
10. Pipe Fitting Tighten to 22 N•m (16 Ft. Lbs.)
11. Pipe Fitting - Tighten to 22 N•m (16 Ft. Lbs.)

V1873

Figure 7 - Engine Fuel Hoses and Pipes

ACCELERATOR PEDAL

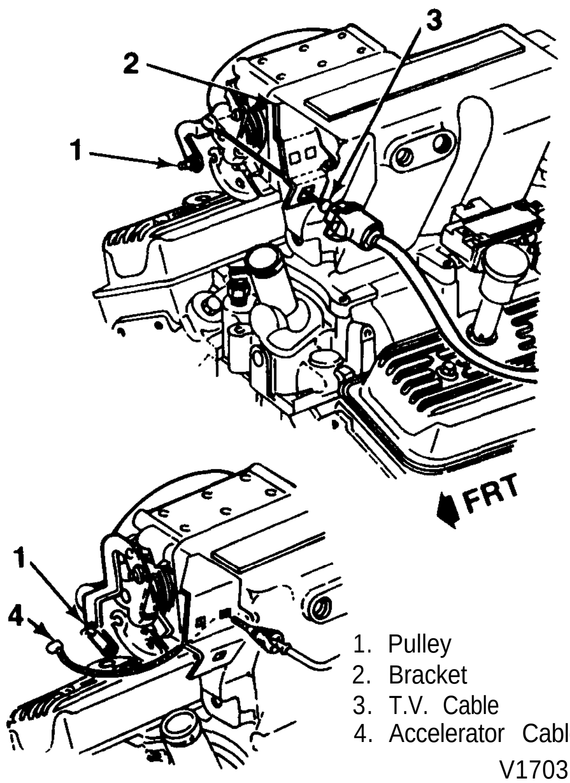
When performing service on the accelerator pedal, observe the following:

- The mounting surface between support and dash panel must be free of insulation. The carpet in pedal and tunnel area must be positioned to lay flat and be free of wrinkles.
- Slip accelerator control cable through slot in rod and then install retainer in rod, being sure it is seated. Care must be utilized in pressing the retainer into hole in rod to assure the cable is not kinked or damaged in any way (figure 9).
- After securing, all components of the accelerator linkage must operate freely without bind between full-closed throttle and full wide-open throttle.
- Wires, hoses, cables or other obstructions must not be placed within 13 mm (.5 in.) of cable or rod at any point in their travel.

THROTTLE BODY ASSEMBLY

The throttle body assembly repair procedures cover component replacement with the unit on the vehicle. However, throttle body replacement requires that the complete unit be removed from the engine.

An eight digit part identification number is stamped on the bottom of the throttle body casting next to the coolant cover (figure 10). Refer to this number if servicing, or part replacement is required.



1. Pulley
2. Bracket
3. T.V. Cable
4. Accelerator Cable

V1703

Figure 8 - Accelerator Control Cable

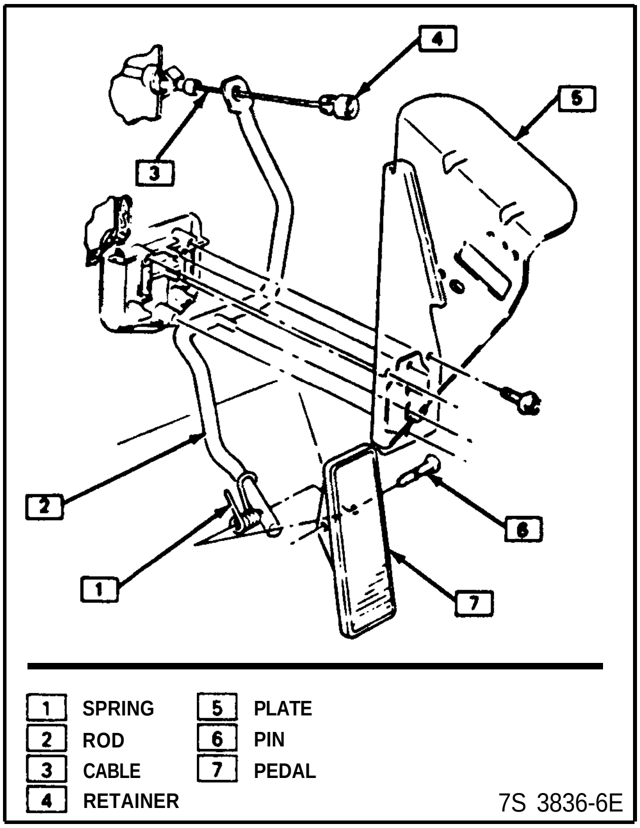


Figure 9 - Accelerator Control Pedal, Passenger Compartment

Cleaning

- The throttle bore and valve deposits may be cleaned on-vehicle, using carburetor cleaner and a parts cleaning brush. Do not use a cleaner that contains methyl ethyl ketone, an extremely strong solvent, and not necessary for this type of deposit.
- The throttle body metal parts may be cleaned following disassembly, in a cold immersion-type cleaner such as GM X-55 or equivalent.

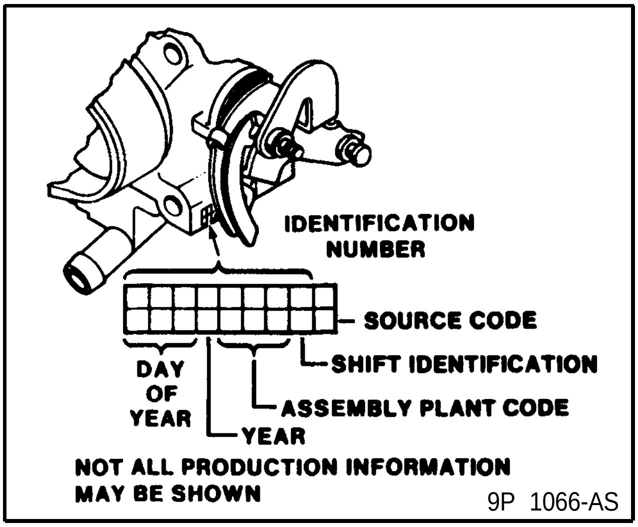


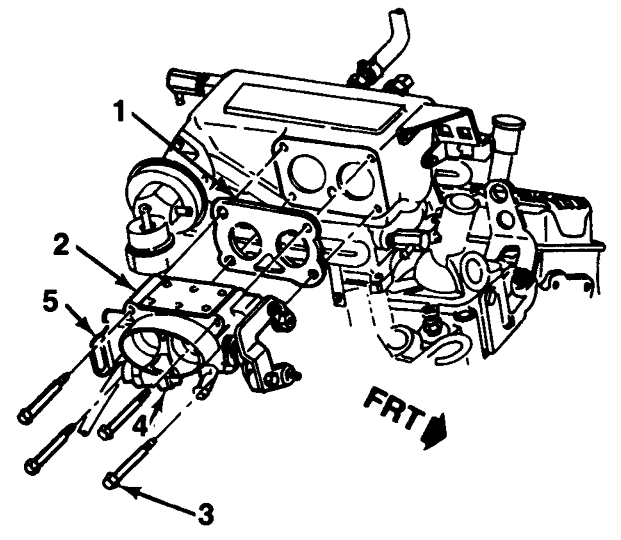
Figure 10 - Throttle Body Identification

NOTICE: The TPS and IAC valve should NOT come in contact with solvent or cleaner, as they may be damaged.

THROTTLE BODY

Remove or Disconnect (Figure 11)

1. Negative battery terminal.
   - Loosen charge air cooler (CAC) mounting bolts and reposition CAC to gain access to throttle body.
2. Electrical connectors from TPS (5) and IAC valve (4).
3. Vacuum lines.
4. Accelerator control, T.V. (transmission control), and cruise control cables.



1. Gasket
2. Throttle Body Assembly
3. Bolt
4. Idle Air Control (IAC) Valve
5. Throttle Position Sensor (TPS)

V1704

Figure 11 - Throttle Body Removal

5. Throttle body attaching bolts (3).
6. Throttle body assembly (2) and flange gasket (1).
   - Discard gasket (1).

Clean

NOTICE: Use care in cleaning old gasket material from machined aluminum surfaces. Sharp took may damage sealing surfaces.

- Gasket sealing surfaces.

Install or Connect (Figure 11)

1. Throttle body assembly (2) with new flange gasket (1).

NOTICE: See "Notice" on page 6C-1 of this section.

2. Throttle body attaching bolts (3).

Tighten

- Throttle body attaching bolts (3) to 24 N•m (18 ft. lbs.).

3. Accelerator control, T.V., and cruise control cables.

Important

- Make sure throttle and cruise control cables do not hold throttle open.

4. Vacuum lines.
5. Electrical connectors to TPS (5) and IAC valve (4).
- Reposition CAC and tighten bolts.
6. Negative battery terminal.

Inspect

- With the engine "OFF," check to see that the accelerator pedal is free.
  – Depress pedal to the floor and release.
- Reset IAC valve pintle position:
  a. Depress accelerator pedal slightly.
  b. Start and run engine for five seconds.
  c. Turn ignition "OFF" for ten seconds.
  d. Restart engine and check for proper idle operation.

THROTTLE POSITION SENSOR (TPS)

Remove or Disconnect (Figure 12)

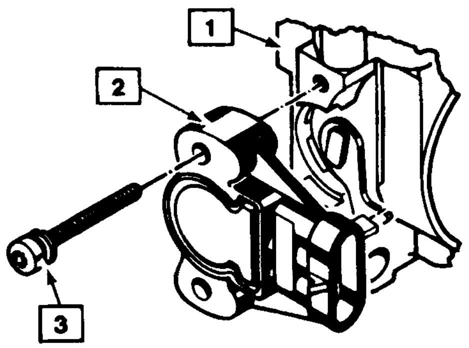
1. PCV valve hose (nearest to throttle body) and move out of the way.
2. Electrical connector.
3. TPS attaching screws (3).
4. Throttle Position Sensor (TPS) (2).

NOTICE: The TPS is an electrical component and must not be soaked in any liquid cleaner or solvent as damage may result.

Install or Connect (Figure 12)

1. With throttle valve in the closed position, install the throttle position sensor (2) on the throttle body assembly (1), making sure TPS lever lines up with the TPS drive lever on the throttle shaft.

NOTICE: See "Notice" on page 6C-1 of this section.



1 THROTTLE BODY ASSEMBLY
2 THROTTLE POSITION SENSOR (TPS)
3 TPS ATTACHING SCREW

9P 1179-AS

Figure 12 - Throttle Position Sensor

2. TPS attaching screws (3).

Tighten

- TPS attaching screws (3) to 2.0 N•m (18 in. lbs.).

3. Electrical connector.
4. PCV valve hose (nearest to throttle body).

IDLE AIR CONTROL (IAC) VALVE

Remove or Disconnect (Figures 13 and 14)

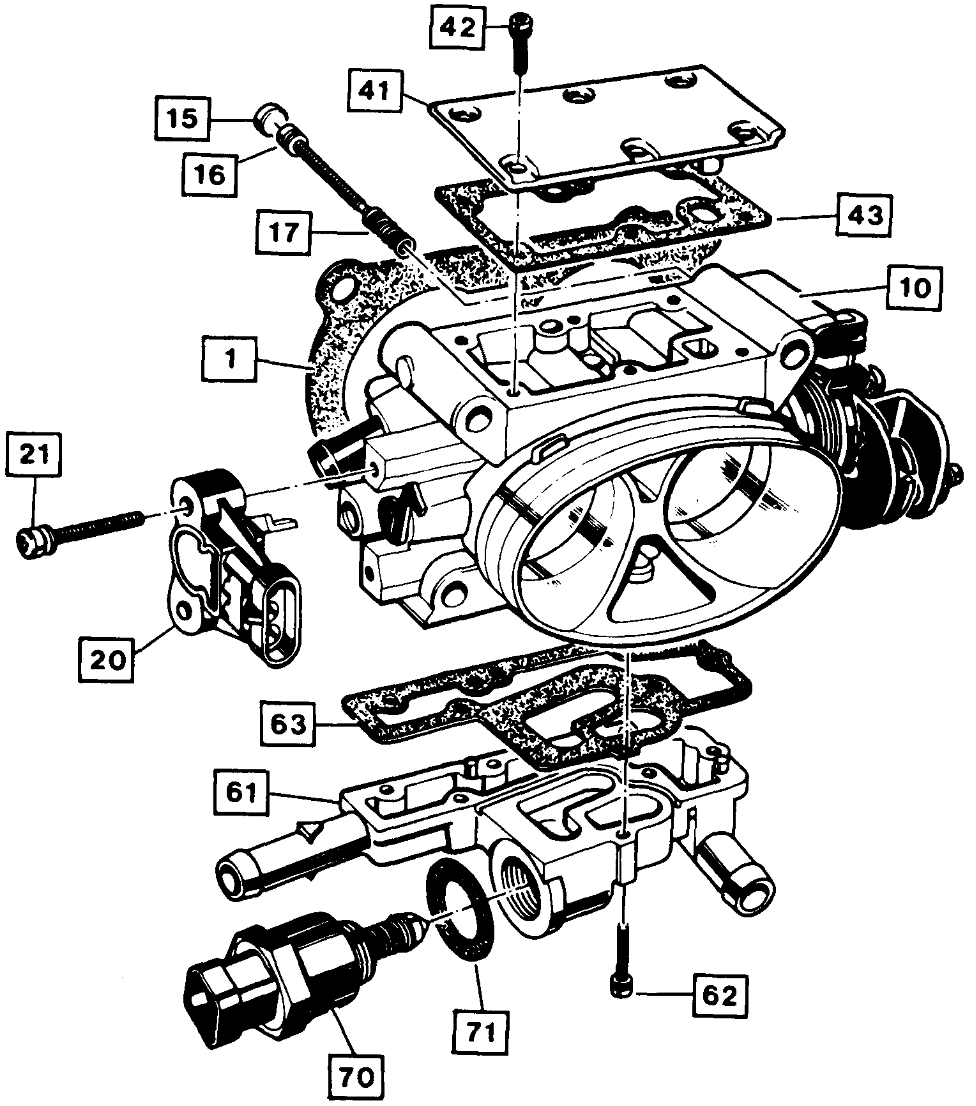
1. Throttle body as explained previously in this section.
2. Electrical connector.
3. IAC valve assembly (70) and gasket (71).
   – Discard gasket.

NOTICE: On IAC valves that have been in service: Do not push or pull on the IAC valve pintle. The force required to move the pintle may damage the threads on the worm drive.

Also, do not soak IAC valve in any liquid cleaner or solvent, as damage may result.

Cleaning and Inspection

- Both original and replacement IAC valves have a special factory-applied thread locking compound applied to the screw threads. If the valve removed from the throttle body is being reinstalled, do not remove the thread locking compound that may be on the threads.
- Clean IAC valve gasket sealing surface, pintle valve seat and air passage.
  – Use carburetor cleaner to remove carbon deposits. Do not use a cleaner that contains methyl ethyl ketone, an extremely strong solvent, and not necessary for this type of deposit.



1	GASKET - FLANGE
10	THROTTLE BODY ASSEMBLY
15	PLUG-IDLE STOP SCREW
16	SCREW ASSEMBLY - IDLE STOP
17	SPRING - IDLE STOP SCREW ASSEMBLY
20	SENSOR - THROTTLE POSITION (TPS)
21	SCREW ASSEMBLY - TPS ATTACHING
41	COVER-CLEAN AIR
42	SCREW ASSEMBLY - CLEAN AIR COVER ATTACHING
43	GASKET - CLEAN AIR COVER
61	IACV/COOLANT COVER ASSEMBLY
62	SCREW ASSEMBLY - IACV COVER ASSEMBLY TO THROTTLE BODY
63	GASKET - IACV/COOLANT COVER TO THROTTLE BODY
70	VALVE ASSEMBLY - IDLE AIR CONTROL (IAC)
71	GASKET - IAC VALVE ASSEMBLY

V3213

Figure 13 - Model B210 Throttle Body Assembly

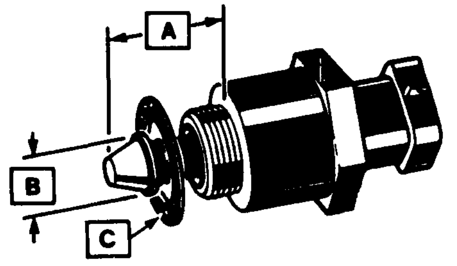


Figure 14 - Idle Air Control Valve Assembly

- Shiny spots on the pintle or seat are normal, and do not indicate misalignment or a bent pintle shaft.
- If air passage has heavy deposits, remove throttle body for complete cleaning.

Important

- If installing a new IAC valve, be sure to replace with an identical part. IAC valve pintle shape and diameter are designed for the specific application.

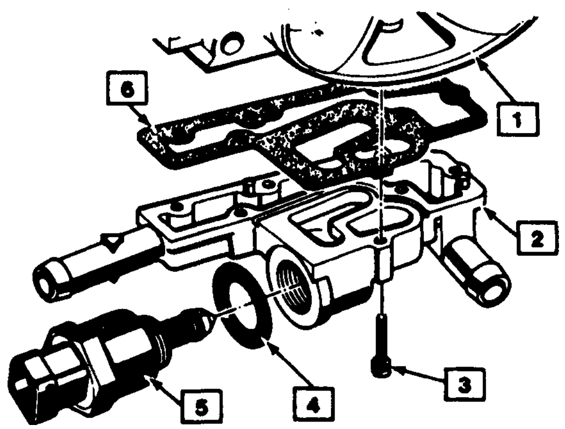


Figure 15 - Idle Air Control Valve/Coolant Cover Assembly

Measure (If Installing a New IAC Valve) (Figure 14)

- Distance between tip of IAC valve pintle and mounting surface.
  - If greater than 28 mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve.

Install or Connect (Figure 13)

1. IAC valve assembly (70) with new gasket (71).

   Tighten

   - IAC valve to 18 N•m (13 ft. lbs.).
     - Use a socket or box wrench on valve hex.
2. Electrical connector.
   - Reset IAC valve pintle position:
     a. Depress accelerator pedal slightly.
     b. Start and run engine for five seconds.
     c. Turn ignition “OFF” for ten seconds.
     d. Restart engine and check for proper idle operation.
3. Throttle body as explained previously in this section.

IDLE AIR CONTROL VALVE/ COOLANT COVER ASSEMBLY

Remove or Disconnect

- Throttle body from intake plenum as explained under “Throttle Body.”

Disassemble (Figure 15)

1. IAC valve assembly (5) and gasket (4).
   - Discard gasket.
2. IAC valve cover assembly screws (3).
3. Cover assembly (2) and gasket (8).
   - Discard gasket.

Cleaning and inspection

- Clean gasket sealing surface.
- Inspect gasket sealing surface for corrosion or damage that would cause a coolant leak. Replace cover assembly or throttle body if necessary.

Assemble (Figure 15)

1. New cover gasket (8).
2. Cover assembly (2).
3. Cover screws (3).

   Tighten

   - IAC valve cover screws (3) to 3.0 N•m (27 in. lbs.).

Measure (If Installing a New IAC Valve) (Figures 14 and 15)

- Distance between tip of IAC valve pintle and mounting surface.
  - If greater than 28 mm, use finger pressure to slowly retract the pintle. The force required to retract the pintle of a new valve will not cause damage to the valve.

4. IAC valve assembly (5) with new gasket (4).

Tighten

- IAC valve to 18 N•m (13 ft. lbs.).
  - Use a socket or box wrench on valve hex.

Install or Connect

- Throttle body to intake plenum as described under "Throttle Body."

CLEAN AIR COVER AND GASKET

Remove or Disconnect (Figure 13)

1. Clean air cover attaching screws (42).
2. Clean air cover (41) and gasket (43).
   - Discard gasket (43).

Clean

- Gasket sealing surfaces.

Install or Connect (Figure 13)

1. New clean air cover gasket (43) on throttle body.
2. Clean air cover (41).

NOTICE: See "Notice" on page 6C-1 of this section.

3. Clean air cover attaching screws (42).

Tighten

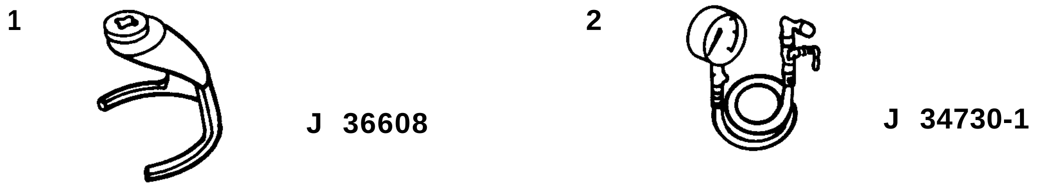
- Clean air cover attaching screws to 3.4 N•m (30 in. lbs.).

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

Fuel Filler-to-Frame Bolt	7	—	62
Fuel Tank Strap-to-Protector Bolt	18	13	—
Fuel Tank Strap-to-Crossmember Bolt	35	26	—
Fuel Tank Strap-to-Frame Bolt	35	26	—
Fuel Tank Strap Nut	7	—	62
Fuel Tank Ground Wire Bolt	2	—	18
Fuel Pipe Clamp Nut	28	21	—
Fuel Pipe Bracket Bolt	35	26	—
Fuel Pipe Clamp Bolt	7	—	62
Fuel Pipe Clamp Stud	35	26	—
Fuel Pipe Fitting	22	16	—
Throttle Body Attaching Bolt	24	18	—
Throttle Position Attaching Screw	2	—	18
IAC Valve	18	13	—
IAC Valve Cover Screw	3	—	27
Clean Air Cover Attaching Screw	3.4	—	30
Fuel Tank Shield-to-Crossmember Bolt	17	13	—
Fuel Tank Shield-to-Frame Bolt	25	18	—
Fuel Tank Shield-to-Crossmember Nut	17	13	—

V1871



1. Fuel Tank Sending Unit Remover and Installer
2. Fuel Pressure Gage (Part of Diagnostic Kit J 34730-C)

V1718

SECTION 6D1

BATTERY

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when Installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

BATTERY CABLE ROUTING

The battery cable should be routed as shown in figure 1. Cables must be routed on top of the starter solenoid, toward the rear of the vehicle, providing a loop for service and exhaust manifold clearance. The cables must also be strapped to the transmission filler tube, below the clip and at the exhaust down pipe support bracket on the transmission.

NOTICE: Be sure cables do not come in contact with the exhaust manifold, otherwise damage could result.

Important

- Positive battery cable post should be rotated to the 3 o'clock position as shown in VIEW E.
- Negative battery cable post should be rotated to the 8 o'clock position as shown in VIEW E.

BATTERY TRAY REPLACEMENT

Remove or Disconnect (Figure 2)

1. Battery as described in BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Screws (32).
3. Bolts (36).
4. Bolt (45).
5. Screw (38) and washer (33) from under wheel housing.
6. Battery tray (31).
7. Line from cruise control vacuum tank.

Install or Connect (Figure 2)

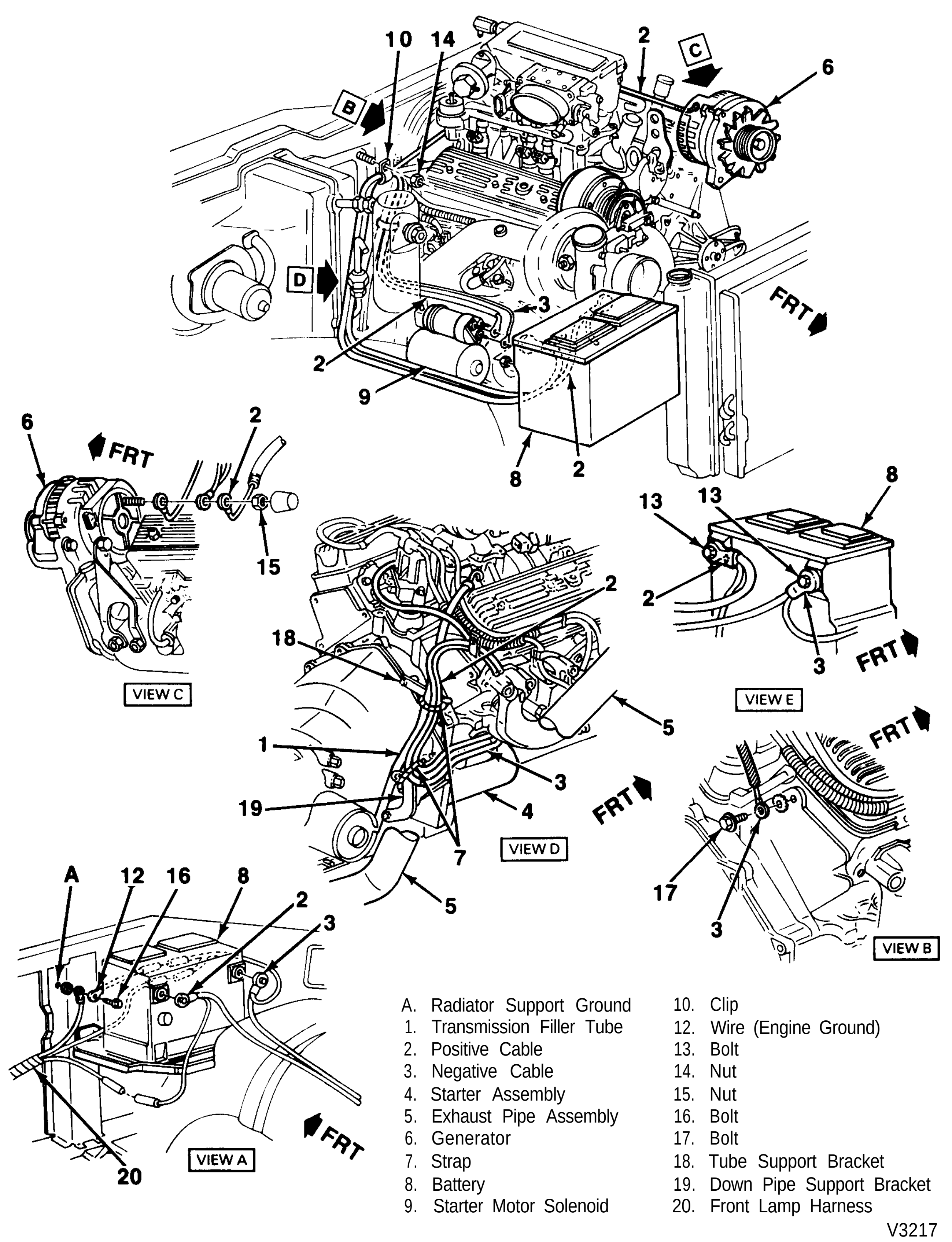
1. Line to cruise control vacuum tank.
2. Battery tray (31).
3. Screw (38) and washer (33) under wheel housing.

   Tighten

   - Screw (38) to 27 N•m (20 ft. lbs.).
4. Bolts (36).
5. Bolt (45).
6. Screws (32).

   Tighten

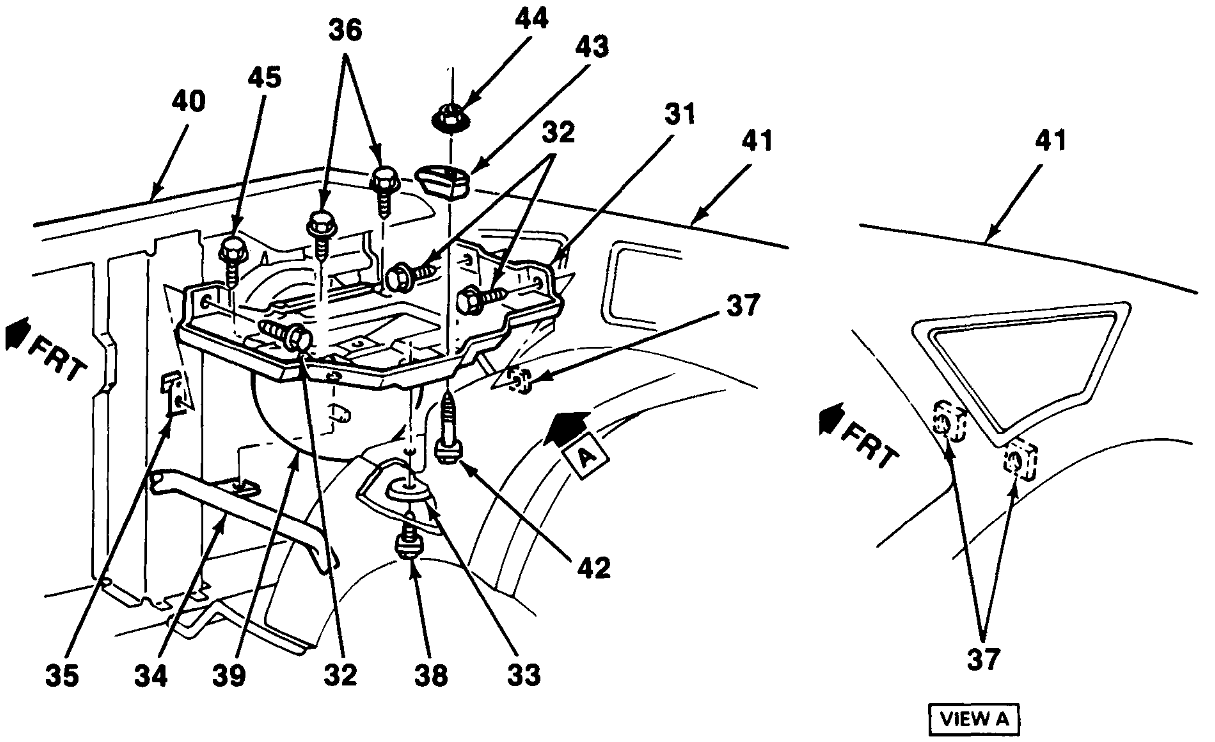
   - Bolts (36) and (45) to 11 N•m (97 in. lbs.).
   - Screws (32) to 27 N•m (20 ft. lbs.).
7. Battery as described in BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.



A. Radiator Support Ground
1. Transmission Filler Tube
2. Positive Cable
3. Negative Cable
4. Starter Assembly
5. Exhaust Pipe Assembly
6. Generator
7. Strap
8. Battery
9. Starter Motor Solenoid
10. Clip
12. Wire (Engine Ground)
13. Bolt
14. Nut
15. Nut
16. Bolt
17. Bolt
18. Tube Support Bracket
19. Down Pipe Support Bracket
20. Front Lamp Harness

V3217

Figure 1 - Battery Cable Routing



31. Battery Tray	36. Bolt	42. Bolt
32. Screw	37. Weld Nut	43. Retainer
33. Washer	38. Screw	44. Hex Flange Nut
34. Outlet Heater Hose	39. Cruise Control Vacuum Tank	45. Bolt
35. U-Nut	40. Radiator Support	
	41. Front Fender	

V1754

Figure 2 - Removing Battery Tray Assembly

SPECIFICATIONS

BATTERY SPECIFICATIONS

Part No.	Application	Description	Replacement Cat. No.	Volts	Cold Cranking Amperes Rating at - 18°C (0°F)	Reserve Capacity (Minutes at 25 Amps)	Load Test (Amperes)
1981734	All	Delco 734	78A-72	12	630	115	310

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FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Lower Wheelhouse-to-Battery Tray Screw	27	20	
Battery Tray-to-Vacuum Tank Bolt	11		97
Battery Tray-to-Bracket Bolt	11		97
Screw to Front Fender Assembly	27	20	
Screw to Radiator Support	27	20	
Battery Cable-to-Battery Bolt	17	13	
Clip Nut	2.8		25
Generator Nut	6		53
Engine Ground Bolt	22	16	
Sheet Metal Ground Bolt	4		35

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SECTION 6D4

IGNITION SYSTEM

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The ignition system includes a battery, a distributor, an engine control switch, spark plugs, and the primary and secondary wiring.

ON-VEHICLE SERVICE

DISTRIBUTOR REPLACEMENT

The distributor has a separate coil which is mounted on the right side of the engine.

←→ **Remove or Disconnect**

1. Negative (-) battery cable.
   - Drain charge air cooler radiator.
2. Charge air cooler clamp and hoses.
3. Charge air cooler.
4. Upper intake manifold connectors and hoses.
5. Bolts from throttle body and cable bracket.
6. Throttle body and cable bracket.
7. Bolts from upper intake manifold.
8. Upper intake manifold.
9. Two screws on the sides of the distributor cap.
10. Coil wire and spark plug wires on either the left or right side of the distributor.
11. Distributor cap and move it aside.
    - Scribe a mark on the distributor shaft in line with the rotor.
    - Scribe a mark on the engine in line with the rotor.
    - Note the position of the distributor housing in relation to the engine.
12. Distributor bolt, washer and hold-down clamp.
13. Distributor.

→← **Install or Connect**

NOTICE: For steps 2, 6 and 7 see "Notice" on page 6D4-1 of this section.

1. Distributor.
   - To ensure correct timing of the distributor it must be installed with the rotor correctly positioned as noted during removal. Line up the rotor, the mark on the distributor shaft, and the mark on the engine.

- If the distributor shaft won't drop into the engine, insert a screwdriver into the hole for the distributor and turn the oil pump driveshaft.

2. Distributor hold-down clamp, washer and bolt.

Tighten

- Bolt to 27 N•m (20 ft. lbs.).

3. Distributor cap.
4. Spark plug wires and coil wire.
5. Two screws on the sides of the distributor cap.
6. Upper intake manifold and bolts.

Tighten

- Bolts to 23 N•m (17 ft. lbs.).

7. Throttle body, cable bracket and bolts.

Tighten

- Bolts to 23 N•m (17 ft. lbs.).

8. Upper intake manifold connectors and hoses.
9. Charge air cooler.
10. Charge air cooler hoses and clamp.
11. Negative (-) battery cable.

- Fill charge air cooler radiator. Refer to TURBOCHARGER (SEC. 6J) in this manual.
- Check the ignition timing.

SPARK PLUG REPLACEMENT

Remove or Disconnect

- Raise and suitably support the vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Front wheels. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.
2. Right and left wheelhouse panels as described in SHEET METAL (SEC. 2B) in the 1992 Service Manual Sonoma and Jimmy Models.
3. Spark plug wires. Twist boots one-half turn before disconnecting.
4. Spark plugs.

Install or Connect

- Adjust new spark plug gap to 0.035 inch, using a spark plug feeler gage.

1. Spark plugs.

Tighten

- Spark plugs to 15 N•m (11 ft. lbs.).

2. Spark plug wires.

- If installing new wires, apply dielectric silicone grease to the inside of the plug and distributor cap boots.

3. Right and left wheelhouse panels as described in SHEET METAL (SEC. 2B) in the 1992 Service Manual Sonoma and Jimmy Models.
4. Front wheels. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

- Lower vehicle.

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Distributor Hold-Down Bolt	27	20
Upper Intake Manifold Bolt	23	17
Throttle Body Bolt	23	17
Cable Bracket Bolt	23	17

V1809

SPARK PLUGS

Engine	Plug	Gap (Inch)	Torque	
			N•m	Ft. Lbs.
4.3L	CR42TS	0.035	15	11

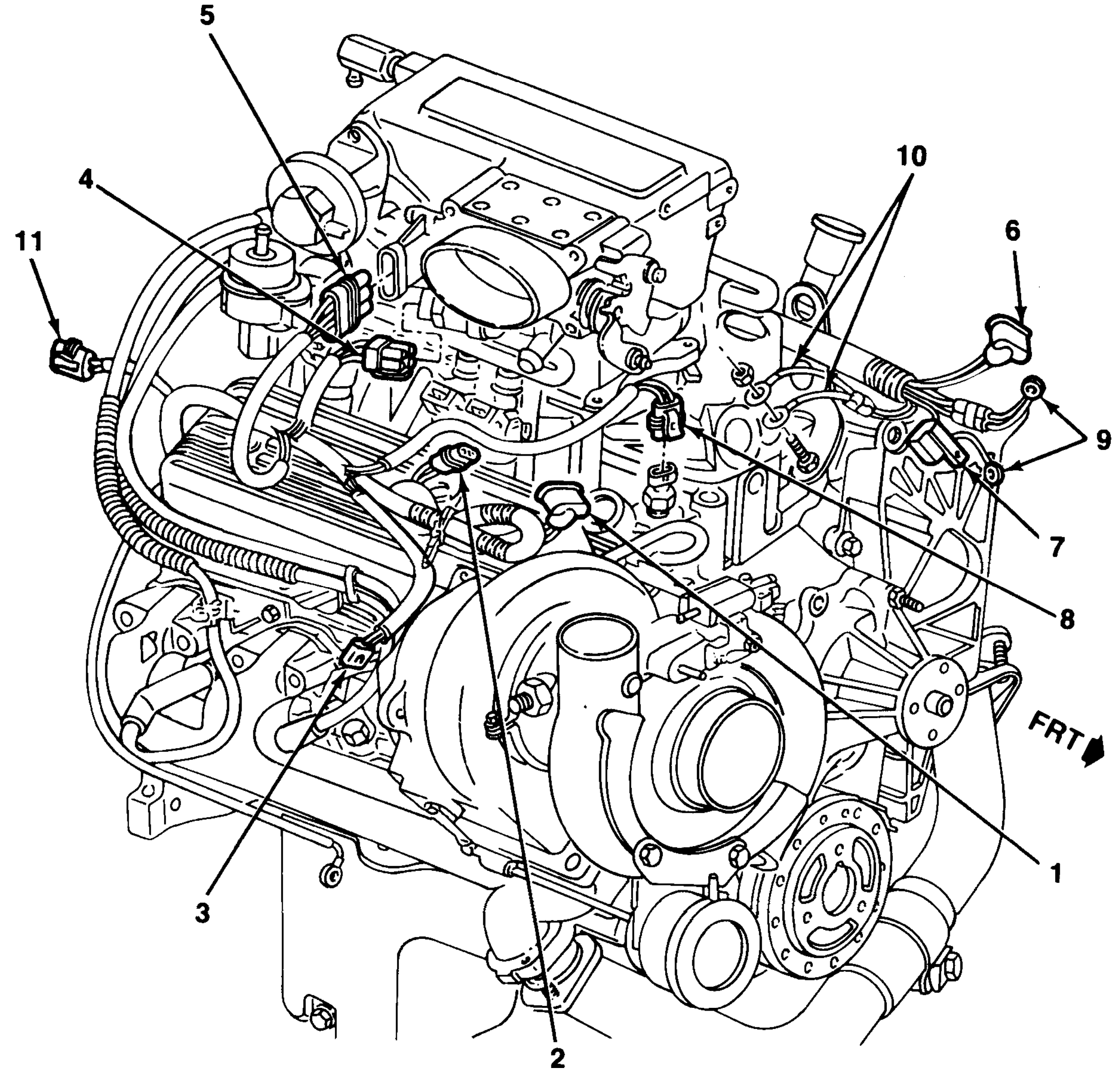
V1426

SECTION 6D7

ENGINE WIRING

SYCLONE AND TYPHOON

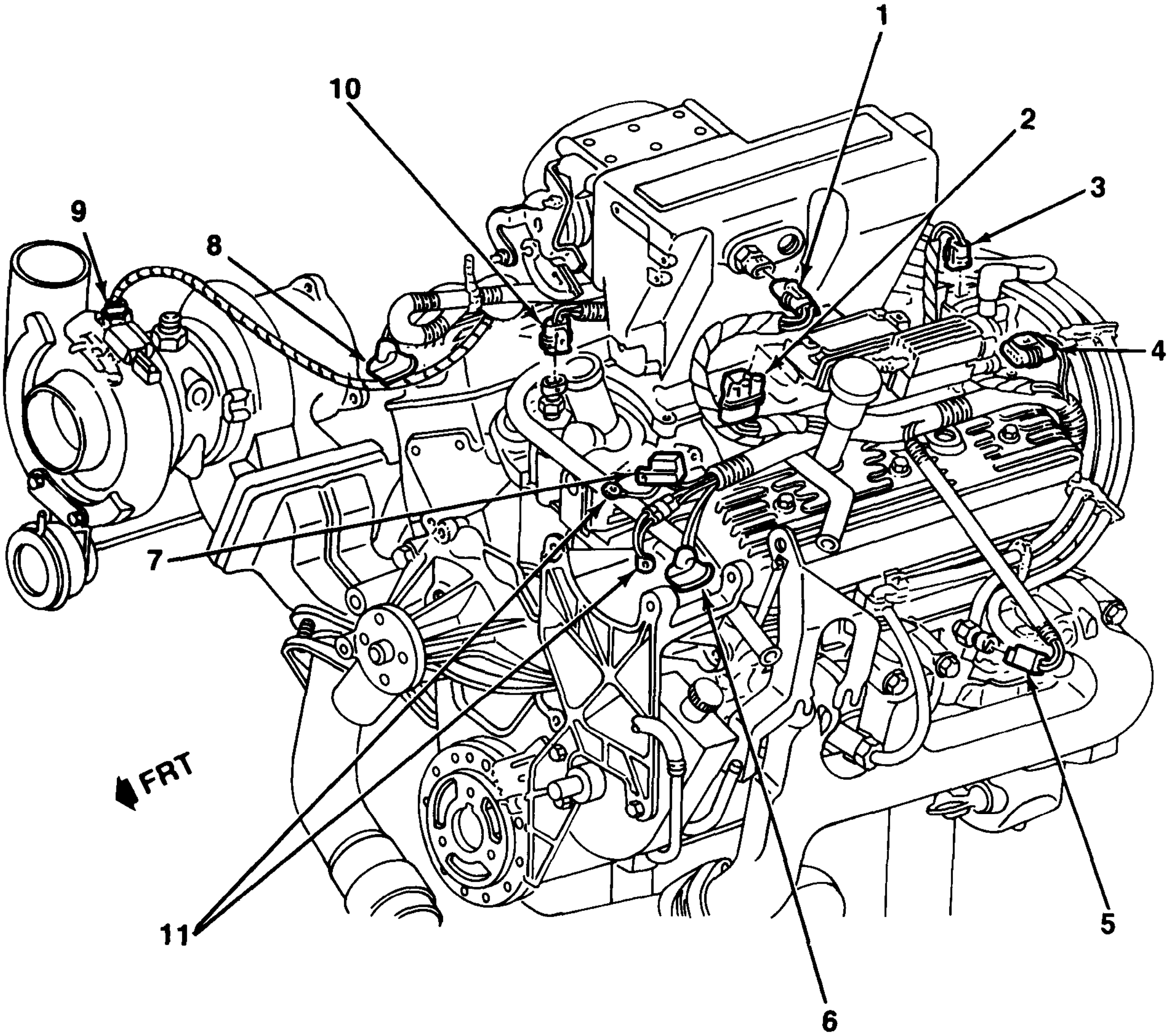
When it is necessary to move any of the wiring, whether to lift wires away from their harnesses or move harnesses to reach some component, take care that all wiring is replaced in its original position and all harnesses routed correctly. If clips or retainers break, replace them. Electrical problems can result from wiring or harnesses becoming loose and moving from their original positions or from being rerouted. Refer to figures 1 through 4 for correct routing of Syclone and Typhoon engine wiring.



1. A/C Compressor Connector
2. Wastegate Solenoid Connector
3. Heated Oxygen Sensor Connector
4. IAC Connector
5. TPS Connector
6. Generator Connector
7. IC Pump Fuse
8. Coolant Temperature Sensor Connector
9. Battery Power Leads to Alternator
10. Grounds
11. A/C Wiring Harness Connector (for A/C Pressure Switch)

V1770

Figure 1 - Engine Wiring–Right Front–4.3L Turbo Engine



1. MAT Sensor Connector
2. MAP Sensor Connector
3. Coil Lead Connector
4. EVRV Solenoid Connector
5. Coolant Temperature Sensor Connector for Gage
6. Generator Connector
7. IC Pump Fuse
8. A/C Compressor Connector
9. Boost Solenoid Connector
10. Coolant Temperature Sensor Connector for ECM
11. Battery Power Leads to Alternator

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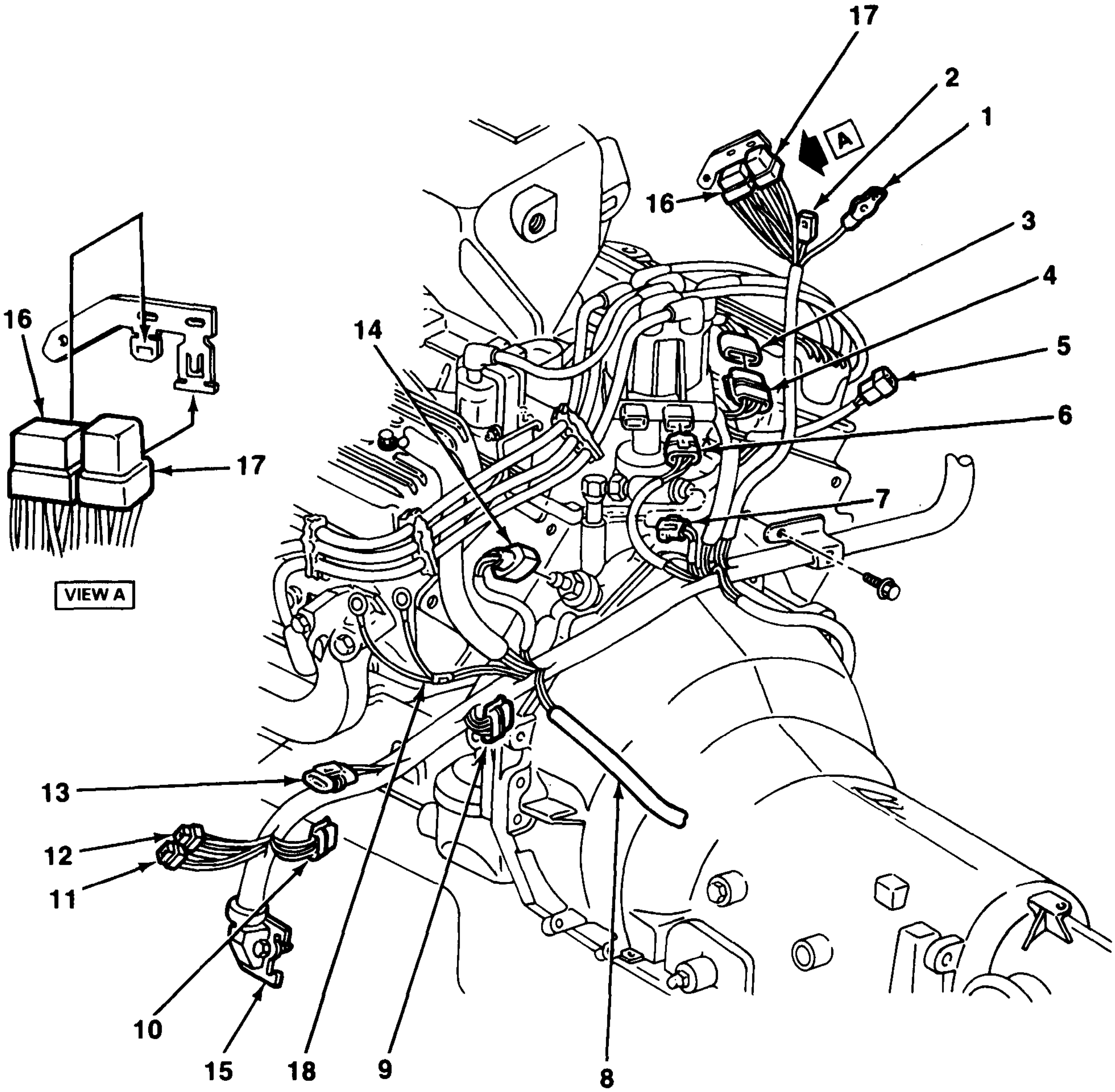
Figure 2 - Engine Wiring–Left Front–4.3L Turbo Engine



1. To Junction Block
2. Fuel Pump Test Connector
3. Injector Subharness Connector
4. Injector Subharness Connector
5. A/C Pressure Switch Connector
6. EST Connector
7. Oil Pressure Switch Connector
8. To VSS and TCC
9. Wiper Motor Connector
10. IC Pump Extension Harness Connector
11. Fuel Pump Relay Connector
12. A/C Relay Connector
13. Engine/4WAL Harness Connector
14. Knock Sensor Connector
15. Bulkhead Connector
16. Turbo Boost Relay
17. IC Pump Relay
18. Back of Head Grounds

V1772

Figure 3 - Engine Wiring–Rear–4.3L Turbo Engine

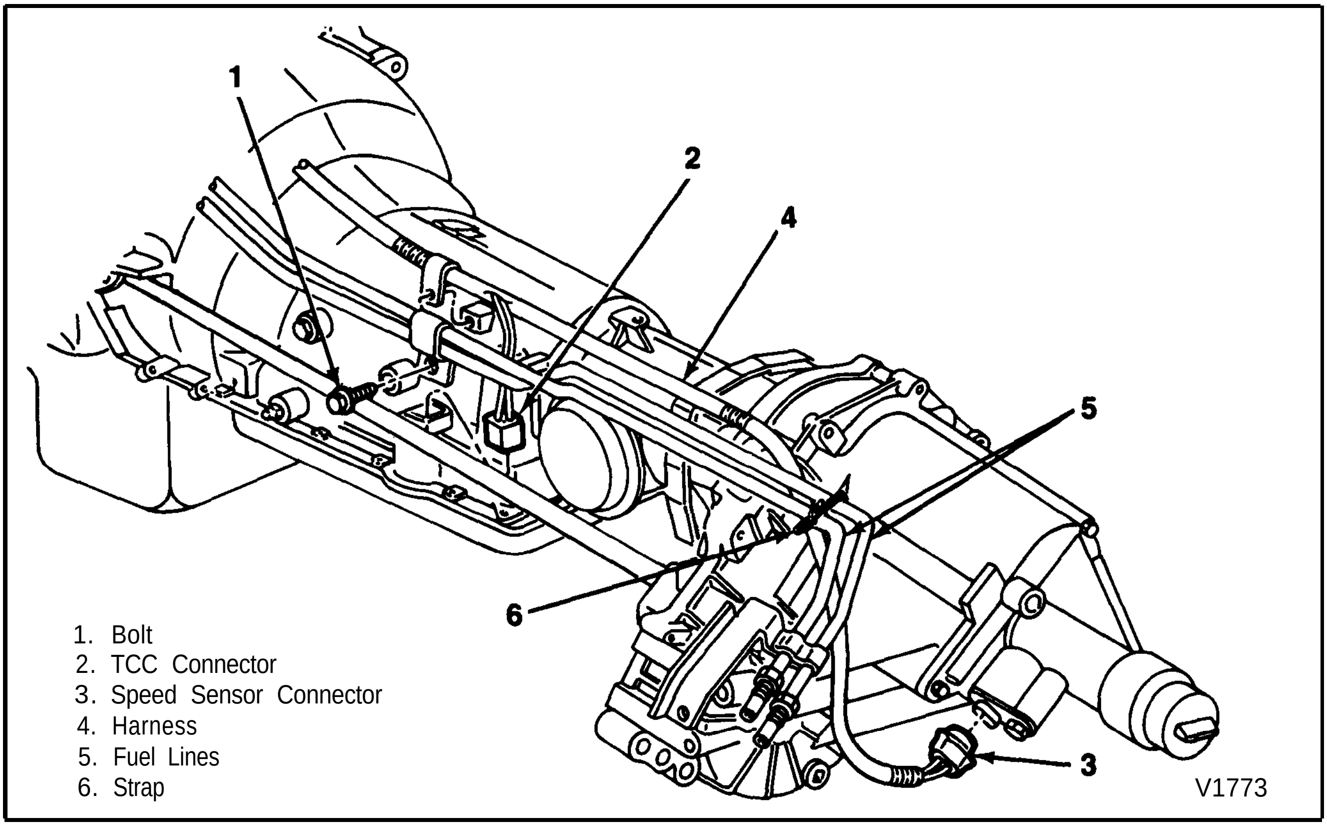


Figure 4 - Engine Wiring at Transmission–4.3L Turbo Engine

SECTION 6E

DRIVEABILITY AND EMISSIONS

GENERAL INFORMATION

SYCLONE AND TYPHOON

NOTICE: *When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installingfasteners that require it. If the above conditions are notfollowed, parts or system damage could result.*

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

CONTENTS

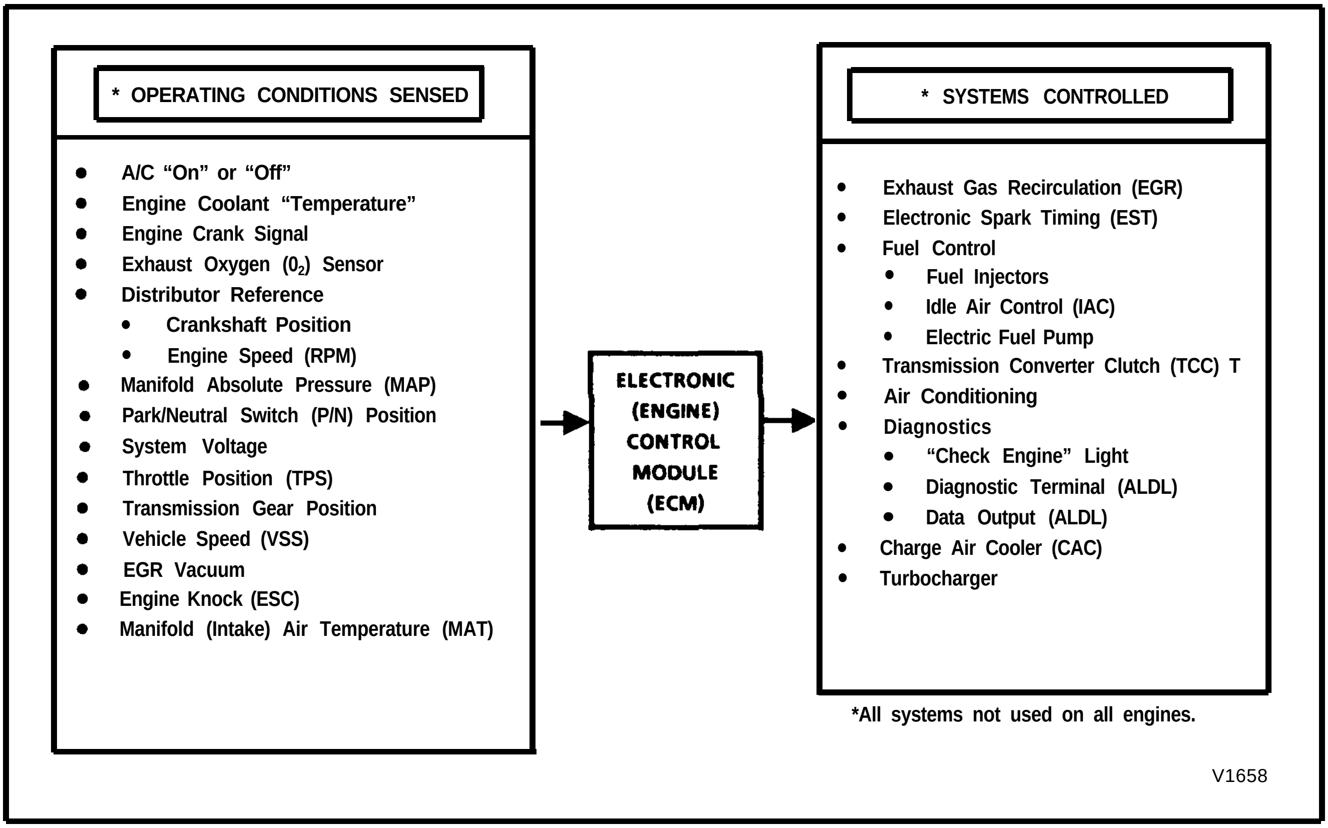


Figure 1 - ECM Inputs and Outputs

DRIVEABILITY AND EMISSIONS CONTROL

An Electronic Control Module (ECM) is designed to maintain exhaust emission levels at federal standards while providing good driveability and fuel efficiency. The functions of the system are based on data gathered by sensors and switches located throughout the vehicle. The ECM maintains control over fuel delivery, ignition, idle air flow, the fuel pump and other system components, while monitoring the system for faulty operation with its diagnostic capabilities. See (Figure 1).

It is important to review the component sections and wiring diagrams in DRIVEABILITY AND EMISSIONS (SECTION 6E3) to determine which systems are controlled by the ECM.

EMISSIONS CONTROL INFORMATION LABEL

The underhood Vehicle Emissions Control Information label (Figure 2) contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information which identifies the year, the manufacturing division of the engine, the displacement of the engine in liters, the class of vehicle, and type of fuel metering. There is also an illustrated emission component and vacuum hose schematic.

This label is located in the engine compartment of every General Motors vehicle. If the label has been removed, it can be ordered from GM Service Parts Operations (GMSPO).

MAINTENANCE SCHEDULE

Refer to the General Motors Maintenance Schedule in MAINTENANCE AND LUBRICATION (SECTION 0B) for the maintenance service that should be performed to retain emission control performance.

BLOCKING DRIVE WHEELS

The vehicle drive wheels always should be blocked and parking brake firmly set while checking the system.

WHAT THIS SECTION CONTAINS

Driveability and Emissions, Section 6E has been developed to describe the function and operation of the electronic engine control system that controls the driveability and emissions of the vehicle. Emphasis is placed on the diagnosis and repair of problems related to the system.

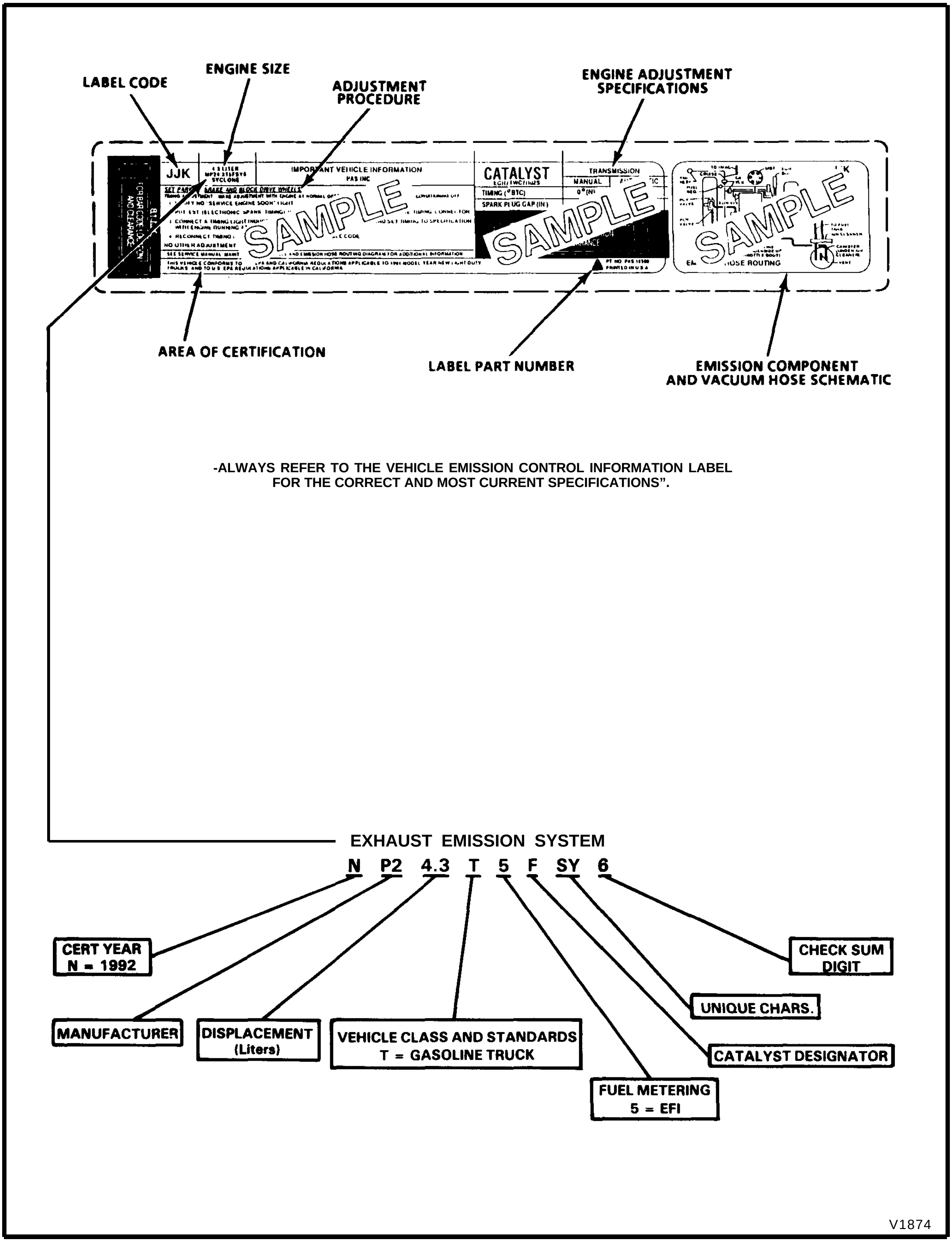


Figure 2 - Vehicle Emission Control Information Label (Typical)

Driveability and Emissions, Section 6E provides general diagnostic procedures, Tech 1 Diagnostic Computer use, wiring and terminal repair procedures, and descriptions of special tools. It then leads into DRIVEABILITY AND EMISSIONS (SECTION 6E3). DRIVEABILITY AND EMISSIONS (SECTION 6E3) deals with engine control systems using port fuel injection for fuel delivery.

DRIVEABILITY AND EMISSIONS (SECTION 6E3) is divided into three major sub-sections dealing with diagnosis and repair. They can be summarized as follows.

SECTION A: CIRCUIT INFORMATION & DIAGNOSIS

- Component Locations
- Wiring Diagrams
- ECM Terminal End View and Terminal Definitions
- Diagnostic Circuit Check. This must be the first step of any diagnostic procedure.
- Diagnostic Code Charts with facing pages containing circuit diagrams, circuit operation information, and helpful diagnostic information.

SECTION B: DRIVEABILITY &EMISSIONS SYMPTOMS

- This sub-section assists in diagnosis of intermittent problems or problems which don't result in the storing of diagnostic codes. It is arranged by symptoms of poor driveability and emissions and lists possible causes of the problems.

SECTION C: COMPONENT CHECKS & SERVICE

- Component and Circuit Descriptions
- On-Vehicle Service
- Functional Checks/Diagnostic Charts

VISUAL/PHYSICAL UNDERHOOD INSPECTION

A careful visual and physical underhood inspection must be performed as part of any diagnostic procedure or in finding the cause of an emissions test failure. This can often lead to fixing a problem without further steps. Inspect all vacuum hoses for correct routing, pinches, cuts, or disconnects. Be sure to inspect hoses that are difficult to see beneath the air cleaner, compressor, generator, etc. Inspect all the wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, or contact with sharp edges or hot exhaust manifolds. This visual/physical inspection is very important. It must be done carefully and thoroughly.

BASIC KNOWLEDGE AND TOOLS REQUIRED

To use this manual most effectively, a general understanding of basic electrical circuits and circuit testing tools is required. You should be familiar with wiring diagrams, the meaning of voltage, ohms, amps, the basic theories of electricity, and understand what happens in an open or shorted wire.

To perform system diagnosis, the use of a Tech I Diagnostic Computer or equivalent Scan tool is required. A tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance, vacuum gauge, and jumper wires are also required. Please become acquainted with the tools and their use before attempting to diagnose a vehicle. Special tools which are required for system service and the ones described above are illustrated at the end of this section.

Electrostatic Discharge Damage

Electronic components used in control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a cat seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible Electrostatic Discharge damage:

- Do Not touch the ECM connector pins or soldered components on the ECM circuit board.
- When handling a PROM, CAL-PAK or MEM-CAL (calibrators), Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

DIAGNOSTIC INFORMATION

The diagnostic tree charts and functional checks in this manual are designed to locate a faulty circuit or component through logic based on the process of elimination. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple failures.

The ECM performs a continual self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The ECM s language for communicating the source of a malfunction is a system of diagnostic trouble codes. The codes are two digit numbers that can range from 12 to 99. When a malfunction is detected by the ECM, a code is set and the Check Engine light is illuminated.

“Check Engine” Light

This light is on the instrument panel and has the following functions.

- It informs the driver that a problem has occurred and that the vehicle should be taken for service as soon as reasonably possible.
- It displays Codes stored by the ECM which help the technician diagnose system problems.
- It indicates Open Loop or Closed Loop operation.

As a bulb and system check, the light will come ON with the key ON and the engine not running. When the engine is started, the light will turn OFF. If the light remains ON, the self-diagnostic system has detected a problem. If the problem goes away, the light will go out in most cases after 10 seconds, but a code will remain stored in the ECM.

When the light remains ON while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a **Diagnostic Circuit Check must be performed.** The procedures for these checks are given in ENGINE COMPONENTS/WIRING DIAGRAMS/DIAGNOSTIC CHARTS (SECTION 6E3-A). These checks will expose malfunctions which may not be detected if other diagnostics are performed prematurely.

Intermittent “Check Engine” Light

In the case of an intermittent problem, the Check Engine light will light for ten (10) seconds and then will go out. However, the corresponding code will be stored in the memory of the ECM until the battery voltage to the ECM has been removed. When unexpected codes appear during the code reading process, one can assume that these codes were set by an intermittent malfunction and could be helpful in diagnosing the system.

An intermittent code may or may not reset. If it is an intermittent failure, a Diagnostic Code Chart is not used. Consult the Diagnostic Aids on the page facing the diagnostic chart corresponding to the intermittent trouble code. SYMPTOMS (SECTION 6E3-B) also covers the topic of Intermittents. A physical inspection of the applicable sub-system most often will resolve the problem.

Reading Codes

The provision for communicating with the ECM is the Assembly Line Diagnostic Link (ALDL) connector (See Figure 3). It is usually located under the instrument panel and is sometimes covered by a plastic cover labeled DIAGNOSTIC CONNECTOR. It is used in the assembly plant to receive information in checking that the engine is operating properly before it leaves the plant. The code(s) stored in the ECM s memory can be read either through TECH 1 Diagnostic Computer, a hand-held diagnostic scanner plugged into the ALDL connector or by counting the number of flashes of the Check Engine light when the diagnostic terminal of the ALDL connector is grounded. The ALDL connector terminal B (diagnostic terminal) is the second terminal from the right of the ALDL connector s top row. The terminal is most easily grounded by connecting it to terminal A (internal ECM ground), the terminal to the right of terminal B on the top row of the ALDL connector.

Once terminals A and B have been connected, the ignition switch must be moved to the ON position, with the engine not running. At this point, the Check Engine light should flash Code 12 three times consecutively. This would be the following flash sequence: flash, pause, flash-flash, long pause, flash, pause, flash-flash, long pause, flash, pause, flash-flash. Code 12 indicates that the ECM s diagnostic system is operating. If Code 12 is not indicated, a problem is present within the diagnostic system itself, and should be addressed by consulting the appropriate diagnostic chart in ENGINE COMPONENTS/WIRING DIAGRAMS/DIAGNOSTIC CHARTS (SECTION 6E3-A).

Following the output of Code 12, the Check Engine light will indicate a diagnostic code three times if a code is present, or it will simply continue to output Code 12. If more than one diagnostic code has been stored in the ECM s memory, the codes will be output from the lowest to the highest, with each code being displayed three times.

Clearing Codes

To clear the codes from the memory of the ECM, either to determine if the malfunction will occur again or because repair has been completed, the ECM power feed must be disconnected for at least thirty (30) seconds. The ECM power feed can be disconnected at the ECMB fuse in the fuse block. (The negative battery terminal may be disconnected, but other on-board memory data, such as preset radio tuning, will also be lost.)

NOTICE: To prevent ECM damage, the key must be "OFF" when disconnecting or reconnecting ECM power.

When using a hand-held Tech 1 Diagnostic Computer, or "Scan" tool to read the codes, clearing the diagnostic codes is done in the same manner as in the above procedure.

Diagnostic Mode

When the Diagnostic terminal is grounded with the ignition "ON" and the engine "OFF," the system will enter what is called the Diagnostic Mode. In this mode the ECM will:

1. Display a Code 12 by flashing the "Check Engine" light (indicating the system is operating correctly).
2. Display any stored codes by flashing the "Check Engine" light. Each code will be flashed three times, then Code 12 will be flashed again.
3. Energize all ECM controlled relays and solenoids except fuel pump relay. This allows checking circuits which may be difficult to energize without driving the vehicle and being under particular operating conditions.
4. The IAC valve moves to its fully extended position on most models, blocking the idle air passage. This is useful in checking the minimum idle speed.

Field Service Mode

If the diagnostic terminal is grounded with the engine running, the system will enter the Field Service mode. In this mode, the "Check Engine" light will indicate whether the system is in "Open Loop" or "Closed Loop."

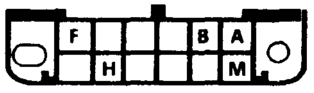
In "Open Loop" the "Check Engine" light flashes two and one-half times per second.

In "Closed Loop," the light flashes once per second. Also, in "Closed Loop," the light will stay "OFF" most of the time if the system is running lean. It will stay "ON" most of the time if the system is running rich.

While the system is in Field Service Mode, new codes cannot be stored in the ECM and the "Closed Loop" timer is bypassed.

ECM Learning Ability

The ECM has a "learning" ability which allows it to make corrections for minor variations in the fuel system to improve driveability. If the battery is disconnected, to clear diagnostic codes or for other repair, the "learning" process resets and begins again. A change may be noted in the vehicle's performance.



TERMINAL IDENTIFICATION

A	GROUND
B	DIAGNOSTIC TERMINAL
F	T.C.C. (IF USED)
H	SPEED INPUT FROM ANTILOCK MODULE
M	SERIAL DATA

V1550

Figure 3 - ALDL Connector

To "teach" the vehicle, ensure that the engine is at operating temperature. The vehicle should be driven at part throttle, with moderate acceleration and idle conditions until normal performance returns.

DIAGNOSTIC CIRCUIT CHECK

After the visual/physical underhood inspection, the "Diagnostic Circuit Check" (Figure 4) is the starting point for all diagnostic procedures or finding the cause of an emissions test failure.

The correct procedure to diagnose a problem is to follow three basic steps

1. Are the On-Vehicle Diagnostics working? This is determined by performing the "Diagnostic Circuit Check." Since this is the starting point for the diagnostic procedures or finding the cause of an emissions test failure, *always begin here.*
   If the On-Vehicle Diagnostics aren't working, the "Diagnostic Circuit Check" will lead to a diagnostic chart in ENGINE COMPONENTS/ WIRING DIAGRAMS/DIAGNOSTIC CHARTS (SECTION 6E3-A) to correct the problem. If the On-Vehicle Diagnostics are working correctly, the next step is
2. Is there a Code stored? If a code is stored, go directly to the numbered code chart in ENGINE COMPONENTS/WIRING DIAGRAMS/ DIAGNOSTIC CHARTS (SECTION 6E3-A). This will determine if the fault is still present. If no code is stored, then
3. "Scan" Serial Data transmitted by the ECM. This involves reading the information available on the Serial Data Stream with Tech 1 or one of the tools available for that purpose. Information on these tools and the meaning of the various displays can be found in the succeeding paragraphs. Expected readings under a particular operating condition can be found on the facing page of the Diagnostic Circuit Check.

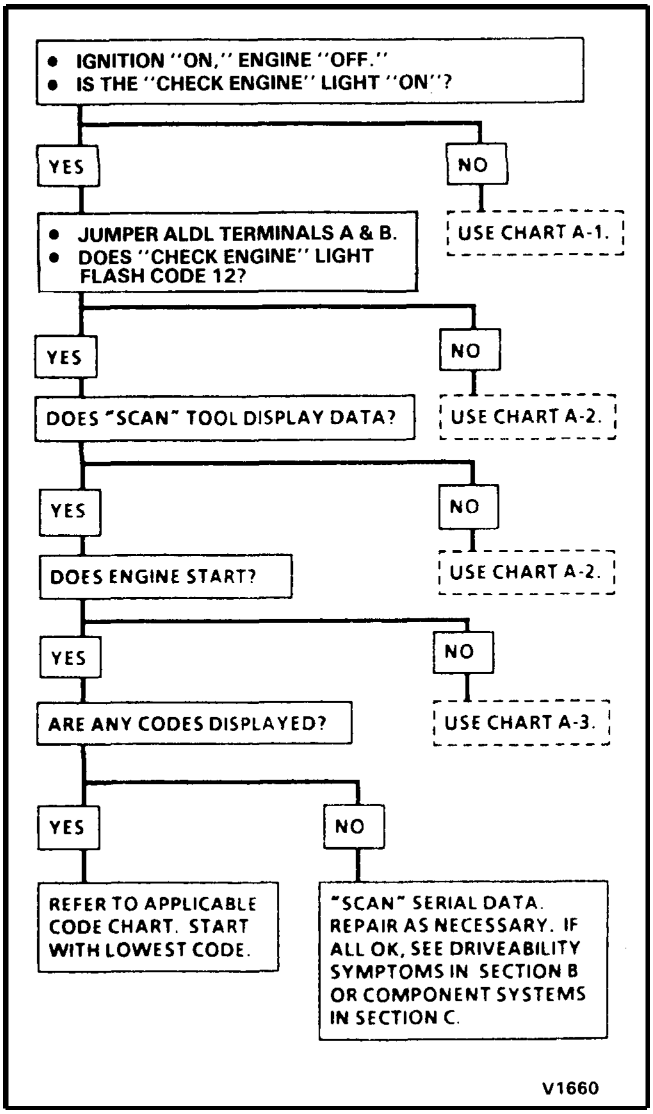


Figure 4 - Diagnostic Circuit Check

ALDL "SCAN" TOOLS

The ECM can communicate a variety of information through ALDL connecter terminal M . This data is transmitted at a high frequency which requires a Tech 1 Diagnostic Computer (Scan) tool for interpretation. There are several Scan tools available for reading this information.

With an understanding of the data which the tool displays, and knowledge of the circuits involved, the tool can be very useful in obtaining information which would be more difficult or impossible to obtain with other equipment.

Tech 1 and Scan tools do not make the use of diagnostic charts unnecessary, nor can they indicate exactly where a problem is in a particular circuit. Tree Charts incorporate diagnosis procedures using a Scan tool where possible and most charts require the use of a Tech 1 when it is applicable.

A "SCAN" TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY "SCAN" TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.

ECM s have three modes for transmitting information. The following information will describe the system operation in each of the three modes.

Normal (Open) Mode

On engines that can be monitored in the Open mode, certain parameters can be observed without changing the engine operating characteristics. The parameters capable of being read vary with engine families. Most Scan tools are programmed so that the system will go directly into the ALDL mode if the Open mode is not available.

ALDL Mode (Also Called 10K or Special)

In this mode, all obtainable data is readable. However, in this mode, the system operating characteristics are modified as follows.

- Closed Loop timers are bypassed.
- EST (spark) is advanced.
- P/N restrict functions are disabled.
- IAC valve controls engine idle to 1000 rpm ± 50 rpm (if applicable).
- On some engines, canister purge solenoid is enabled.

Factory Test Mode (Also Called Back-up or 3.9 K)

In this mode, the ECM is operating on the fuel back-up logic used to control the fuel delivery if the ECM fails. This mode verifies that the back-up feature is OK. The parameters that can be read on a "Scan" tool in this mode are not of much use for service.

“SCAN” TOOL USE WITH INTERMITTENTS

In some "Scan" tool applications, the data update rate makes the tool less effective than a voltmeter, such as when trying to detect an intermittent problem which lasts for a very short time. However, the Tech 1 allows manipulation of wiring harnesses or components under the hood with the engine not running, while observing the Tech 1 readout.

The "Scan" tool can be plugged in and observed while driving the vehicle under the condition when the "Check Engine" light turns ON momentarily or when the engine driveability is momentarily poor. If the problem seems to be related to certain parameters that can be checked on the Tech 1, they should be checked while driving the vehicle. If there does not seem to be any correlation between the problem and any specific circuit, the Tech 1 can be checked on each position, watching for a period of time to see if there is any change in the readings that indicates intermittent operation.

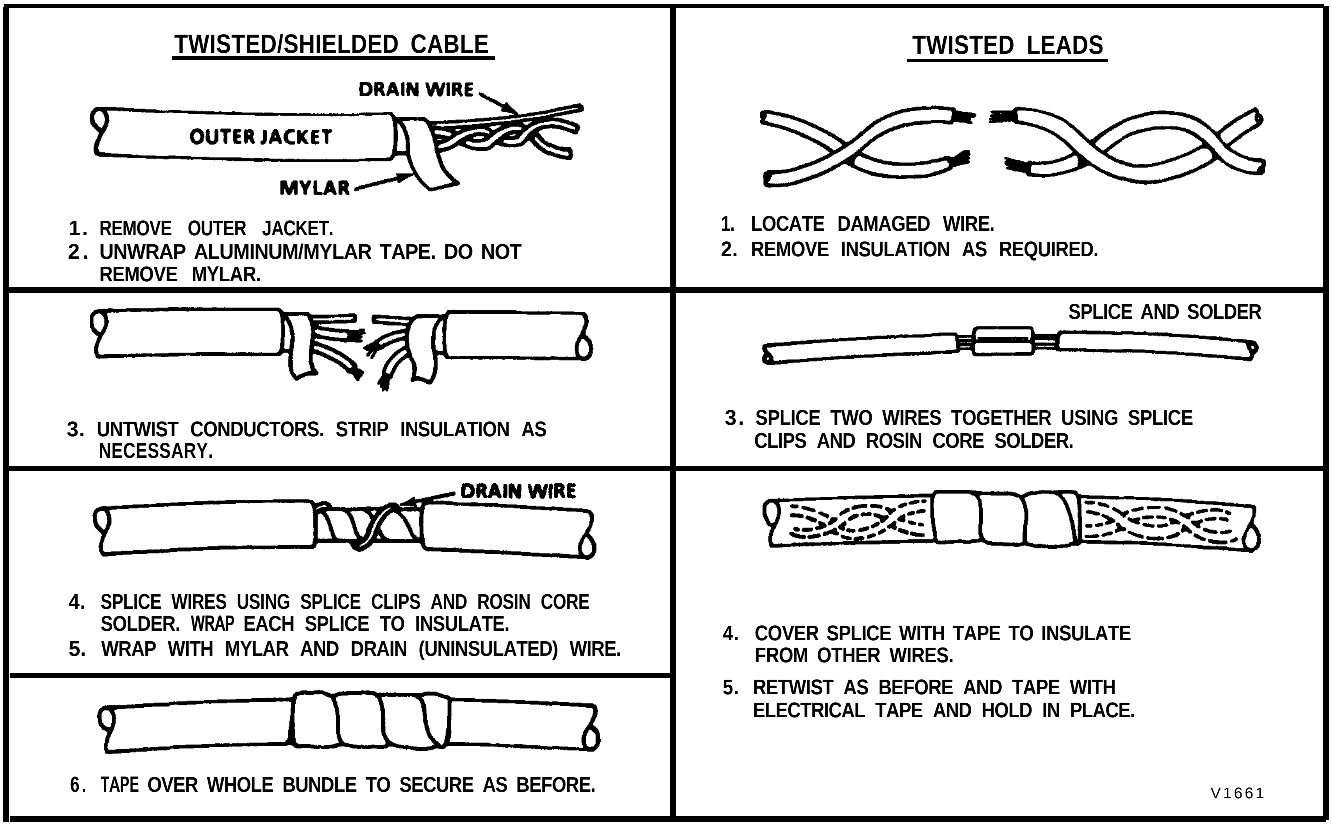
The Tech 1 is also an easy way to compare the operating parameters of a poorly operating engine with those of a known good one. For example, a sensor may shift in value but not set a trouble code. Comparing the sensor's readings with those of a known good vehicle may uncover the problem.

The Tech 1 has the ability to save time in diagnosis and prevent the replacement of good parts. The key to using the Tech 1 successfully for diagnosis lies in the technician's ability to understand the system he is trying to diagnose as well as an understanding of the Tech 1 operation and limitations. The technician should read the tool manufacturer's operating manual to become familiar with the tool's operation.

WIRING HARNESS SERVICE

To meet GM engineering repair standards, use Terminal Repair Kit, J 38125-A. to repair wiring and replace connectors. The kit includes crimping tools, hardware, terminal removal tools, heat torch and instruction manual. Also refer to the 1992 Sonoma GT/ Syclone/Typhoon Electrical Diagrams and Diagnosis Manual for additional wiring and connector repair.

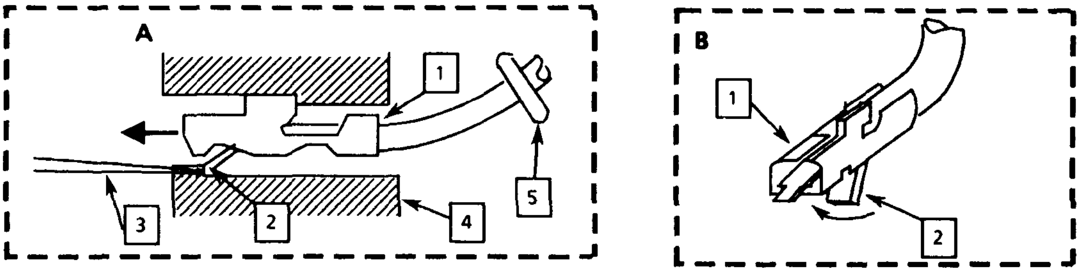
Wire harnesses should be replaced with proper part number harnesses. When signal wires are spliced into a harness, use wire with high temperature insulation only. See Figure 5 for instructions.



1. REMOVE OUTER JACKET.
2. UNWRAP ALUMINUM/MYLAR TAPE. DO NOT REMOVE MYLAR.
3. UNTWIST CONDUCTORS. STRIP INSULATION AS NECESSARY.
4. SPLICE WIRES USING SPLICE CLIPS AND ROSIN CORE SOLDER. WRAP EACH SPLICE TO INSULATE.
5. WRAP WITH MYLAR AND DRAIN (UNINSULATED) WIRE.
6. TAPE OVER WHOLE BUNDLE TO SECURE AS BEFORE.

1. LOCATE DAMAGED WIRE.
2. REMOVE INSULATION AS REQUIRED.
3. SPLICE TWO WIRES TOGETHER USING SPLICE CLIPS AND ROSIN CORE SOLDER.
4. COVER SPLICE WITH TAPE TO INSULATE FROM OTHER WIRES.
5. RETWIST AS BEFORE AND TAPE WITH ELECTRICAL TAPE AND HOLD IN PLACE.

Figure 5 - Wiring Harness Repair



1. METRI-PACK SERIES 150 FEMALE TERMINAL
2. LOCKING TANG
3. TOOL J 35689-A OR BT-8446
4. CONNECTOR BODY
5. SEAL

V1706

Figure 6 - Metri-Pack Series 150 Terminal Removal

With the low current and voltage levels found in the system, it is important that the best possible bond be made at all wire splices by soldering the splices as shown.

Use care when probing a connector or replacing connector terminals. It is possible to short between opposite terminals. If this happens, certain components can be damaged. Always use jumper wires between connectors for circuit checking. **NEVER** probe through connector seals, wire insulation, secondary ignition wires, boots, nipples, or covers. Even microscopic damage or holes may result in eventual water intrusion, corrosion and/or component or circuit failure.

WIRING CONNECTOR SERVICE

Most connectors in the engine compartment are protected against moisture and dirt which could create oxidation and deposits on the terminals. This protection is important because of the very low voltage and current levels found in the electronic system. The connectors have a lock which secures the male and female terminals together. A secondary lock holds the seal and terminal into the connector.

When diagnosing, open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor or in the wiring harness may locate the open circuit condition. This should always be considered when an open circuit or failed sensor is indicated. Intermittent problems may also be caused by oxidized or loose connections.

Before making a connector repair, be certain of the type of connector. Weather-Pack and Compact Three connectors look similar but are serviced differently. Replacement connectors and terminals are listed in Group 8.965 of the Standard Parts Catalog.

Metri-Pack Series 150 Terminals

Some ECM harness connectors contain terminals called Metri-Pack (Figure 6). These may be used at the coolant sensors as well as at ignition modules.

Metri-Pack terminals are also called Pull-To-Seat terminals because to install a terminal on a wire, the wire is first inserted through the seal (5) and connector (4). The terminal is then crimped on the wire, and the terminal pulled back into the connector to seat it in place.

To remove a terminal:

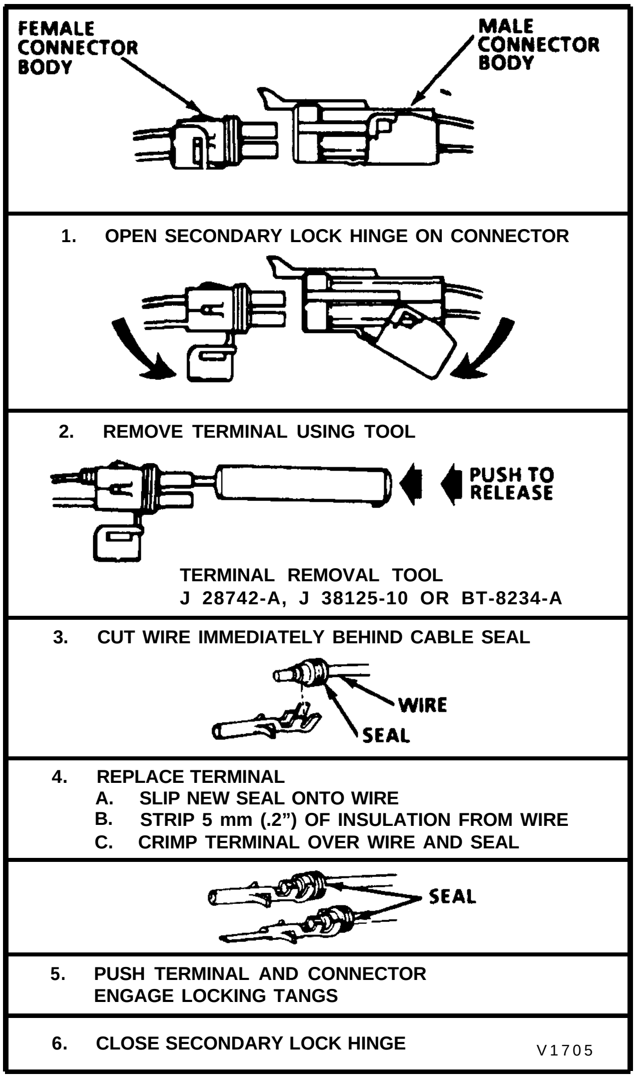
1. Slide the seal back on the wire.
2. Insert tool (3) BT-8446, J 35689-A, or equivalent as shown in insert A and B to release the terminal locking tang (2).
3. Push the wire and terminal out through the connector.

If the terminal is being reused, reshape the locking tang (2).

Weather-Pack Connectors

Figure 7 shows a Weather-Pack connector and the tool (J 28742-A, J 38125-10, BT-8234-A or equivalent) required to service it. This tool is used to remove the pin and sleeve terminals. If terminal removal is attempted with an ordinary pick, there is a good chance that the terminal will be bent or deformed, and unlike standard blade type terminals, these terminals cannot be straightened once they are bent.

Make certain that the connectors are properly seated and all of the sealing rings in place when connecting leads. The hinge-type flap provides a secondary locking feature for the connector. It improves the connector reliability by retaining the terminals if the small terminal lock tangs are not positioned properly.



1. OPEN SECONDARY LOCK HINGE ON CONNECTOR
2. REMOVE TERMINAL USING TOOL

TERMINAL REMOVAL TOOL
J 28742-A, J 38125-10 OR BT-8234-A

3. CUT WIRE IMMEDIATELY BEHIND CABLE SEAL
4. REPLACE TERMINAL
   - A. SLIP NEW SEAL ONTO WIRE
   - B. STRIP 5 mm (.2”) OF INSULATION FROM WIRE
   - C. CRIMP TERMINAL OVER WIRE AND SEAL
5. PUSH TERMINAL AND CONNECTOR ENGAGE LOCKING TANGS
6. CLOSE SECONDARY LOCK HINGE

Figure 7 - Weather-Pack Terminal Repair

Weather-Pack connections cannot be replaced with standard connections. Instructions are provided with Weather-Pack connector and terminal packages.

Micro-Pack Connectors

Micro-Pack terminal (Figure 8) replacement requires the use of special tool J 33095, J 38125-12, BT-8234-A or equivalent.

TOOLS NEEDED TO SERVICE THE SYSTEM

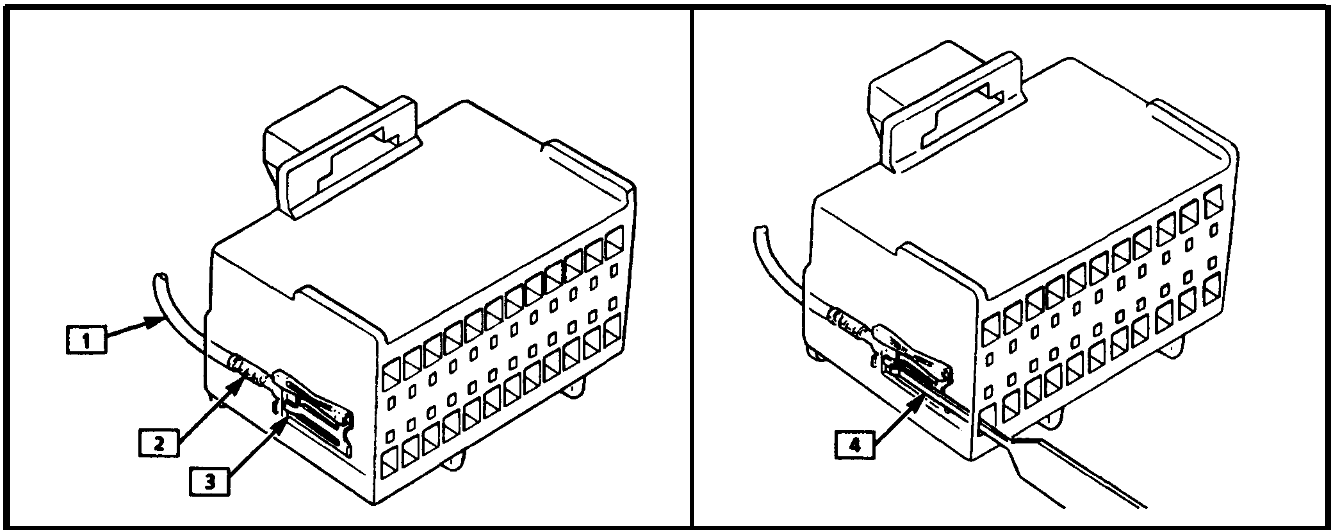
The system requires a Tech 1 Diagnostic Computer or equivalent Scan tool, tachometer, test light, ohmmeter, digital voltmeter with 10 megohms impedance (J 34029-A or equivalent), vacuum gage and jumper wires for diagnosis. A test light or voltmeter must be used when specified in the procedures. See Page 6E-12 through Page 6E-15 for Special Tools needed to diagnose or repair a system. For more complete information on the operation of these tools, consult the tool manufacturer s instructions.

T-100 - GM CAMS

The T-100 - GM CAMS (Computerized Automotive Maintenance System) is a computerized technician s terminal unit. When connected to a vehicle, performs engine, electronic circuit and systems tests to find possible vehicle problems in the engine system or the Electronic Control Module (ECM).

The terminal diagnoses as follows:

- Circuit diagnostic procedures provide information on how to isolate a problem and repair requirements.
- If no problem exists, engine performance problems are diagnosed.
- Error codes stored in the ECM are read and diagnosed by the system.

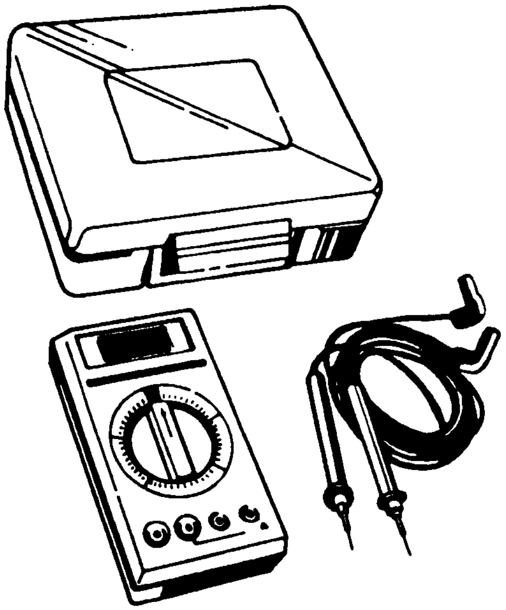


1 CABLE
2 TERMINAL
3 LOCKING TANG
4 TOOL J 33095 OR J 38125-12

1. GRASP CABLE AND PUSH TERMINAL TO THE MOST FORWARD POSITION.
2. INSERT TOOL J 33095 OR J 38125-12 STRAIGHT INTO THE FRONT OF THE CONNECTOR CAVITY. DO NOT USE CONVENTIONAL PICK TO REMOVE TERMINAL.
3. WITH TOOL IN PLACE, GENTLY PULL ON THE CABLE TO REMOVE TERMINAL.
4. VISUALLY CHECK TERMINAL AND REPLACE IF TERMINAL CAVITY OR TANG IS DAMAGED.
5. INSTALL TERMINAL INTO CONNECTOR CAVITY UNTIL LOCKING TANG HAS SNAPPED INTO POSITION.

5S 1418-6E

Figure 8 - Micro-Pack Terminal Replacement



HIGH IMPEDANCE MULTIMETER
(DIGITAL VOLTMETER-DVM)
J 34029-A

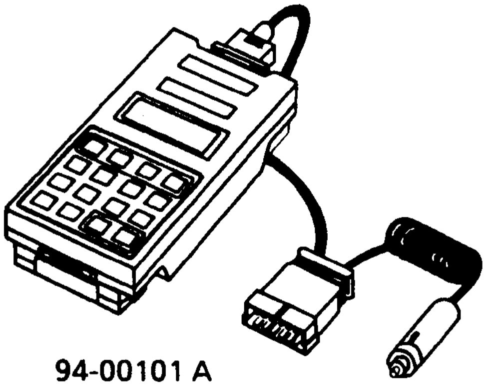
VOLTMETER - Voltage Position Measures amount of voltage. When connected in parallel to an existing circuit. A digital voltmeter with 10 megohm input impedance is used because some circuits require accurate low voltage readings, and some circuits in the ECM have a very high resistance.

AMMETER - When used as ammeter, this meter also accurately measures extremely low current flow. Refer to meter instructions for more information.

- Selector must be set properly for both function and range. DC is used for most automotive measurements.

OHMMETER - Measures resistance of circuit directly in ohms. Refer to meter for more information.

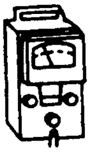
- OL Display in all ranges indicates open circuit.
- Zero display in all ranges indicates a short circuit.
- Intermittent connection in circuit may be indicated by digital reading that will not stabilize on circuit.
- Range Switch.
  - 200Ω – Reads ohms directly
  - 2K,20K,200KΩ – Reads ohms in thousands
  - 2M and 20MΩ - Reads ohms in millions



94-00101 A

TECH 1 DIAGNOSTIC COMPUTER

A hand-held "SCAN" tool used to analyze and diagnose fuel and emission system. Also can be used to analyze other computer system.



TACHOMETER

Use inductive trigger signal pickup type to check RPM.

J 35616

CONNECTOR TEST ADAPTER KIT

Used to make electrical test connections in current Weather Pack, Metri - Pack and Micro-Pack style terminals.

5-24-90
7S 3534-6E

Figure 9 - Special Tools (1 of 4)

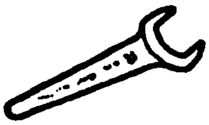
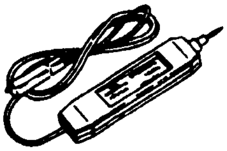
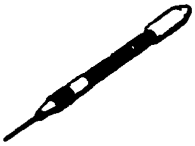
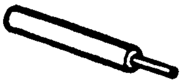
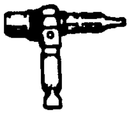
 J 29533-A/BT8127	**OXYGEN SENSOR WRENCH** Used to remove or install the oxygen sensor.
 J 33031/BT8130	**IDLE AIR CONTROL WRENCH** Used to remove or install IAC valve on throttle body.
 J 34730-2A	**INJECTOR TEST LIGHT** Used for checking the electrical circuit to a port fuel injector. Part of Diagnostic Kit J 34730-C.
 J 35748	**OIL PRESSURE SENDING UNIT SOCKET** Used to remove and install oil pressure sending unit.
 J 34636/BT8405	**CIRCUIT TESTER** Used to check all relays and solenoids before connecting them to a new ECM. Measures the circuit resistance and indicates pass or fail via green or red LED. Amber LED indicates current polarity. Can also be used as a non-powered continuity checker.
 J 35689-A	**METRI-PACK TERMINAL REMOVER** Used to remove 150 series Metri-Pack "pull-to-seat" terminals from connectors. Refer to wiring harness service in this section for removal procedure.
 J 28742-A	**WEATHER PACK TERMINAL REMOVER** Used to remove terminals from Weather Pack connectors. Refer to wiring harness service in this section for removal procedure.
 J 33095/BT8234-A	**ECM CONNECTOR TERMINAL REMOVER** Used to remove terminal from Micro-Pack connectors. Refer to wiring harness service in this section for removal procedure.
 J 26792/BT-7220-1	**SPARK TESTER** Used to check available secondary ignition voltage. Also called an ST125. V1662

Figure 10 - Special Tools (2 of 4)

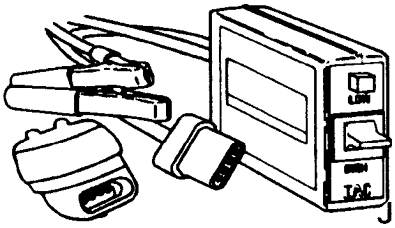
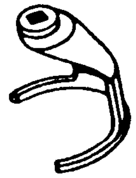
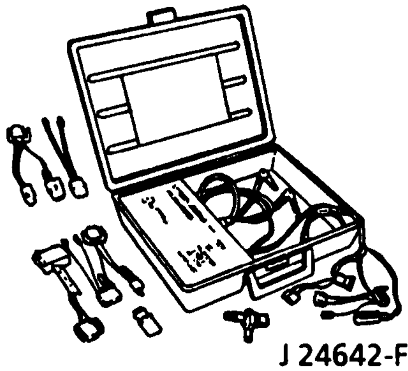
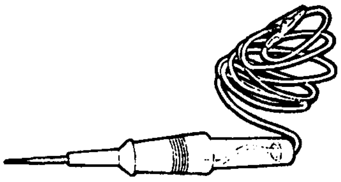
 J 37027-A	**IAC SYSTEM MONITOR** Used to test IAC motors for correct functioning and proper response to commands.
 J 36608	**FUEL TANK SENDING AND PUMP UNIT** Used to remove and install cam lock nut on the fuel tank sending and pump unit in Section 6C.
 J 24642-F/BT-7220	**IGNITION MODULE TESTER** Used to test ignition module in Section 6E3-C4.
 J 23738-A	**VACUUM PUMP (20 IN. HG. MINIMUM)** Use gage to monitor manifold engine vacuum and check vacuum sensor, solenoids and valves.
 J 34142-B	**UNPOWERED TEST LIGHT** Used to check wiring for complete circuit and short to ground or voltage. V1663

Figure 11 - Special Tools (3 of 4)

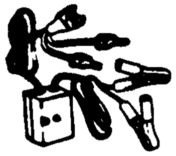
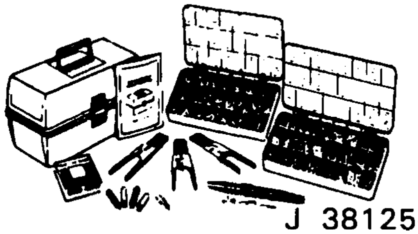
 J 34730-3A	**INJECTOR TESTER** Used for energizing each fuel injector for a precise amount of time to perform injector balance test. Part of Diagnostic Kit J 34730-C.
 J 36101	**MASS AIR FLOW (MAF) SENSOR TESTER** Used for static test of MAF Sensor on vehicles equipped with an AC type MAF Sensor.
 J 34730-C	**PORT FUEL INJECTION DIAGNOSTIC KIT** Used to diagnose port fuel injection systems. The kit includes: ● Fuel Pressure Gage - used for checking fuel pump pressure and compare injector pressure drop for equal fuel distribution. ● Injector Test Light - used for checking electrical circuit to an injector. ● Injector Tester - used for energizing each fuel injector for a precise amount of time to perform injector balance test.
 J 34730-1	**FUEL PRESSURE GAGE** Used for checking and monitoring fuel line pressure of port fuel system. Part of Diagnostic Kit J 34730-C.
 J 38125-A	**TERMINAL REPAIR KIT** Contains proper tools and components to achieve reliable wiring repairs including SIR.

Figure 12 - Special Tools (4 of 4)

ABBREVIATIONS AND GLOSSARY OF TERMS

Abbreviations used in this manual are listed below in alphabetical order with an explanation of the abbreviation. There are some variations in the use of periods and in capitalization (as mph, m.p.h., Mph, and MPH) for abbreviations used in this section but all types are acceptable.

A/F - AIR/FUEL (A/F RATIO) - The amount of air-to-fuel for combustion of fuel. Ideal ratio is 14.7 parts of air to 1 part of fuel.

ALDL - ASSEMBLY LINE DIAGNOSTIC LINK - Used at assembly to evaluate Computer Command Control and for service to flash the Check Engine light if there are trouble codes. Also used by Scan tools to obtain ECM serial data.

ANALOG SIGNAL - An electrical signal that varies in voltage within a given parameter.

Bat + - Battery Positive Terminal (12 Volts)

BLOCK LEARN - ECM memory that adjusts the air/fuel ratio on a semipermanent basis.

CAC - CHARGE AIR COOLER - Cools air from the turbocharger using coolant.

CAPACITOR - An electrical device used to store a temporary charge.

CAL-PAK - A device used with fuel injection to allow fuel delivery in the event of a PROM or ECM malfunction.

CALIBRATOR - (PROM) - An electronic component which can be specifically programmed to meet engine operating requirements for each vehicle model. It plugs into the Engine Control Module (ECM).

CCC - COMPUTER COMMAND CONTROL - has an electronic control module to control air/fuel and emission systems.

CCP - CONTROLLED CANISTER PURGE - ECM controlled solenoid valve that permits manifold vacuum to purge the evaporative emissions from the charcoal canister.

CHECK ENGINE LIGHT - Lights when a malfunction occurs in Computer Command Control system.

CID - CUBIC INCH DISPLACEMENT - Used to describe engine size.

C/LOOP - CLOSED LOOP - Designed with feedback information to the ECM to maintain an optimum air/fuel ratio (14.7:1), output.

COOLANT TEMPERATURE SENSOR (CTS) - Device that senses the engine coolant temperature, and passes that information to the electronic control module.

CONV. - CATALYTIC CONVERTER - Containing platinum and palladium to speed up conversion of HC and CO.

CO - CARBON MONOXIDE - One of the pollutants found in engine exhaust.

CURRENT OR AMPERAGE - The rate of flow of electrons is similar to gallons of water per minute flowing in a water pipe.

DIAGNOSTIC CODE - Pair of numbers obtained from flashing Check Engine light, or displaying on a Scan tool. This code can be used to determine the system malfunction.

DIAGNOSTIC TERMINAL - Grounding terminal B of ALDL connector will flash or display a code. When grounded with the engine running will enter the Field Service Mode.

DIGITAL SIGNAL - An electrical signal that is either ON or OFF with no in between.

DIODE - An electrical device that restricts current flow in one direction.

DRIVER - An electrical device, usually a power transistor, that operates like a switch; that is, it turns something ON or OFF.

DVM (10 Meg.) - Digital Voltmeter with 10 Million ohms resistance - used for measurement in electronic systems.

ECM - ELECTRONIC ENGINE CONTROL MODULE - A metal case (located in passenger compartment) containing electronic circuitry which electrically controls and monitors air/fuel and emission systems on Computer Command Control, and turns ON the Check Engine light when a malfunction occurs in the system.

EFI - ELECTRONIC FUEL INJECTION - Computer Command Control using throttle body fuel injection.

EGR - EXHAUST GAS RECIRCULATION - Method of reducing NOx emission levels.

EECS - EVAPORATIVE EMISSIONS CONTROL SYSTEM - Used to prevent gasoline vapors in the fuel tank from entering the atmosphere.

EMI OR NOISE - An unwanted signal interfering with another needed signal; like an electrical razor upsets a television picture, or driving under high voltage power lines upsets the AM radio in a vehicle.

ENERGIZE/DE-ENERGIZE - When current is passed through a coil (energized) such as a solenoid, a plunger is pulled or pushed. When the voltage to the solenoid is turned OFF (de-energized), a spring raises or lowers the plunger.

ESC - ELECTRONIC SPARK CONTROL - Used to sense detonation and retard spark advance when detonation occurs.

EST - ELECTRONIC SPARK TIMING - ECM controlled timing of ignition spark.

EVRV - ELECTRONIC VACUUM REGULATOR VALVE - Controls EGR vacuum.

FED - FEDERAL - Vehicle/Engine available in all states except California.

FI - FUEL INJECTION - Computer Command Control using throttle body fuel injection.

GROUND - A wire shorted to ground. A common return path for an electrical circuit. A reference point from which voltage measurements may be made.

HC - HYDROCARBONS - One of the pollutants found in engine exhaust. Hydrogen and carbon in gasoline.

HIGH - A voltage more than ground or 0, like the output wire of an oxygen sensor is called voltage high, as compared to the ground, which is called voltage low. In digital signals, high is ON and low is OFF.

HIGH IMPEDANCE VOLTMETER - Has high opposition to the flow of electrical current. Good for reading circuits with low current flow, such as found in electronic systems.

HEI - HIGH ENERGY IGNITION - A distributor that uses an electronic module and pick-up coil in place of contact points.

Hg - MERCURY - A calibration material used as a standard for vacuum measurement.

IAC - IDLE AIR CONTROL - Installed in the throttle body of a fuel injected system and controlled by the ECM to regulate idle speed.

IDEAL MIXTURE - The air/fuel ratio which provides the best performance, while maintaining maximum conversion of exhaust emissions, typically 14.7/1.

IGN - IGNITION - Refers to ignition switch and lock.

INPUTS - Information from sources (such as, coolant temperature sensors, exhaust oxygen sensor, etc.) that tell the ECM how the systems are performing.

INTERMITTENT - Occurs now and then; not continuously. In electrical circuits, refers to occasional open, short, or ground.

I/P - INSTRUMENT PANEL - Contains instrument gages and indicator lights to indicate performance of the vehicle.

KM/H - KILOMETER PER HOUR - A metric unit measuring distance (1000 meters) in one hour.

L - LITER - A metric unit of capacity.

LOW - Operates the same as ground and may, or may not, be connected to chassis ground.

MALFUNCTION - A problem that causes the system to operate incorrectly. Typical malfunctions are; wiring harness opens or shorts, failed sensors, or circuit components.

MAP - MANIFOLD ABSOLUTE PRESSURE SENSOR - Reads pressure changes in intake manifold with reference to zero pressure. It puts out a voltage which is highest when the pressure is highest. The maximum voltage is between 4-5 volts.

MAT - MANIFOLD (INTAKE) AIR TEMPERATURE SENSOR - Measures temperature of air in the intake manifold.

MODE - A particular state of operation.

MPFI - MULTI-PORT FUEL INJECTION - Applies to engines which have a fuel injector in the intake manifold near the intake valve for each cylinder.

MPH - MILES PER HOUR - A unit measuring distance (5280 feet) in one hour.

N.C. - NORMALLY CLOSED - State of relay contacts or solenoid plunger when no voltage is applied.

N•m - NEWTON METERS (TORQUE) - A metric unit which measures force.

N.O. - NORMALLY OPEN - State of relay contacts or solenoid plunger when no voltage is applied.

NOx - NITROGEN, OXIDES OF - One of the pollutants found in engine exhaust. Nitrogen that combines with oxygen to form oxides of nitrogen.

O_2 - OXYGEN (SENSOR) - Monitors the oxygen content of the exhaust system and generates a voltage signal to the ECM.

O LOOP - OPEN LOOP - Describes ECM fuel control without use of oxygen sensor information.

OUTPUT - Functions, typically solenoids, that are controlled by the ECM.

OXYGEN SENSOR, EXHAUST - Device that detects the amount of Oxygen (O_2) in the exhaust stream.

POSITIVE CRANKCASE VENTILATION - Prevent fumes in crankcase from passing into atmosphere.

P/N - PARK/NEUTRAL - Refers to switch used to indicate to the ECM the position of the automatic transmission.

PORT - Exhaust or intake port.

PROM - PROGRAMMABLE READ ONLY MEMORY - an electronic term used to describe the engine calibration unit.

PULSE WIDTH MODULATED - A device operated by a digital signal that is controlled by the time duration the device is turned ON or OFF.

QUAD DRIVER - A chip device that is capable of operating four separate outputs. Some have digital and some have pulse width modulated outputs.

RESISTANCE - The ability of a circuit to limit current flow; like a restriction in a water pipe.

RPM - REVOLUTIONS PER MINUTE - A measure of rotational speed.

SELF-DIAGNOSTIC CODE - The ECM can detect malfunctions in the system. If a malfunction occurs, the ECM turns ON the Check Engine light. A diagnostic code can be obtained from the ECM through the Check Engine light. This code will indicate the area of the malfunction.

TACH - TACHOMETER - A device for indicating speed for rotation.

TBI - THROTTLE BODY INJECTION (UNIT) - Is controlled by the ECM to supply precise air/fuel mixture into the intake manifold.

TCC - TRANSMISSION/TRANSAXLE CONVERTER CLUTCH - ECM controlled solenoid in transmission which positively couples the transmission to the engine.

THERMAC - THERMOSTATIC AIR CLEANER - Provides preheated air to intake manifold to provide better driveability when engine is cold.

TPS - THROTTLE POSITION SENSOR - Device that tells the ECM the throttle position.

TVS - THERMAL VACUUM SWITCH - Used to control vacuum in relationship to engine temperature.

V - VOLT - A measurement of electrical pressure.

VOLTAGE - The pressure of force pushing the current in a circuit; like pressure in a water pipe.

V-6 - SIX CYLINDER ENGINE - Arranged in a V .

VACUUM - Negative pressure; less than atmospheric pressure.

VACUUM, MANIFOLD - Vacuum source in manifold below throttle plate.

VACUUM, PORTED - A vacuum source above (atmospheric side) of closed throttle plate.

VIN - VEHICLE IDENTIFICATION NUMBER - Appears on a plate attached to the windshield pillar.

VSS - VEHICLE SPEED SENSOR - Sensor which sends vehicle speed information to the ECM.

WASTEGATE - A means of controlling the amount of boost available for a turbo charged engine.

WOT - WIDE OPEN THROTTLE - Refers to the throttle valve or accelerator pedal when fully open or depressed.

GENERAL SPECIFICATIONS

Many of the specifications used in this section are located on the Vehicle Emission Control Information label under the hood.

Listed on the chart below are locations of specifications used in this Section

SPECIFICATION	LOCATION OF INFORMATION
Engine Timing	Vehicle Emission Control information label
Idle Speed, ECM Controlled	Not adjustable. ECM controls idle.
Spark Plug Type	Owner’s Manual, Section “6”.
Spark Plug Gap	Vehicle Emission Control Information Label.
Engine Code	8th digit of VIN number. Also Owner’s Manual, Section “6”.
Engine Family	Vehicle Emission Control Information label
Filter Part Numbers	Owner’s Manual, Section “6”.
Part Numbers of Major Components	GMSPO Parts Book
Replacement of Vehicle Emission Control Information Label	GMSPO Label Catalog

SECTION 6E3

DRIVEABILITY AND EMISSIONS

FUEL INJECTION (PORT)

THIS SECTION APPLIES TO:

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON

CONTENTS

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON

ALL NEW GENERAL MOTORS VEHICLES ARE CERTIFIED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AS CONFORMING TO THE REQUIREMENTS OF THE REGULATIONS FOR THE CONTROL OF AIR POLLUTION FROM NEW MOTOR VEHICLES. THIS CERTIFICATION IS CONTINGENT ON CERTAIN ADJUSTMENTS BEING SET TO FACTORY STANDARDS. IN MOST CASES, THESE ADJUSTMENT POINTS EITHER HAVE BEEN PERMANENTLY SEALED AND/OR MADE INACCESSIBLE, TO PREVENT INDISCRIMINATE OR ROUTINE ADJUSTMENT IN THE FIELD. FOR THIS REASON, THE FACTORY PROCEDURE FOR TEMPORARILY REMOVING PLUGS, CAPS, ETC., FOR PURPOSES OF SERVICING THE PRODUCT, MUST BE STRICTLY FOLLOWED AND, WHEREVER PRACTICABLE, RETURNED TO THE ORIGINAL INTENT OF THE DESIGN.

INTRODUCTION

GENERAL DESCRIPTION

This section applies to engines with “Port Fuel Injection” (PFI) fuel delivery systems. PFI engines have a fuel injector in the intake manifold near the intake valve for each cylinder.

PFI engines have controls that reduce exhaust emissions, and maintain good driveability and fuel economy.

The Electronic Control Module (ECM) is the heart of this control system. A network of sensors provides the ECM with information about engine operation and the various systems it controls. Details of basic operation, diagnosis, functional checks, and on-vehicle service are covered in Section “C,” component systems.

The ECM has the ability to do some diagnosis of itself, as well as other parts of the system. When the ECM finds a problem, it lights a “Check Engine” light on the instrument panel and a trouble code is stored in the ECM memory. The “Check Engine” light does not indicate that the engine should be stopped right away, but that the vehicle should be checked as soon as reasonably possible.

DIAGNOSIS PROCEDURE

The following sections are written for specific engine applications and are clearly identified. Be sure to use only the section which applies to the engine family being diagnosed.

Before using this section of the manual, you should be familiar with the information and the proper diagnosing procedures that are described in Section “6E.” If the proper diagnosis procedures are not followed, as described in Section “6E,” it may result in unnecessary replacement of good parts.

Trouble tree charts incorporate diagnosis procedures using an ALDL “Scan” tool whenever possible. Using a “Scan” tool saves time in diagnosis and prevents the replacement of good parts.

The key to using a Scan tool successfully for diagnosis lies in the technician s ability to understand the system he is trying to diagnose, as well as having an understanding of the Scan tool s limitations. See Section 6E for more information.

SECTION A

DIAGNOSTIC CIRCUIT CHECK

The Diagnostic Circuit Check verifies that the engine control system is functioning correctly. Special consideration to observe while performing the Diagnostic Circuit Check is:

Blocking Drive Wheels

The vehicle drive wheels should always be blocked while checking the system.

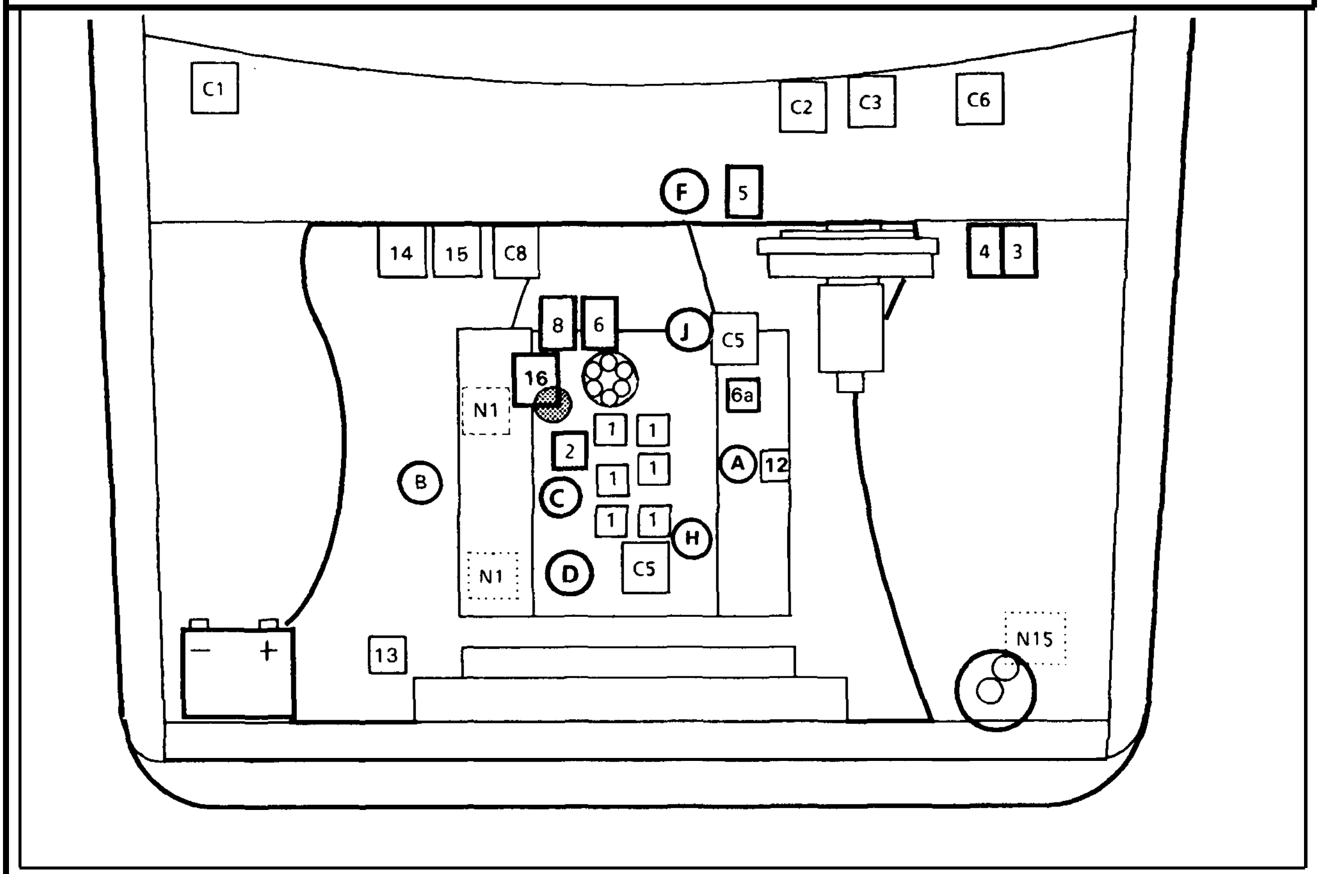
BASIC PROCEDURE

If the basic information on using the diagnostic procedures contained in this section has not been reviewed, refer to the introduction of this section.

SECTION A

ENGINE COMPONENTS/WIRING DIAGRAMS / DIAGNOSTIC CHARTS

SYCLONE **ENGINE CODE: Z** **4.3L V6**



☐ COMPUTER COMMAND CONTROL

C1	Electronic Control Module (ECM)
C2	ALDL diagnostic connector
C3	“CHECK ENGINE” light
C5	ECM harness ground
C6	Fuse panel
C8	Fuel pump test connector

☐ ECM CONTROLLED COMPONENTS

1	Fuel injectors
2	Idle Air Control (IAC)
3	Fuel pump relay
4	AC relay
5	Transmission Converter Clutch (TCC) Connector
6	Electronic Spark Timing (EST) Distributor
6a	Remote ignition coil
8	Oil pressure switch
12	Exhaust Gas Recirculation Vacuum Solenoid (EVRV)
13	Wastegate Solenoid
14	Turbo Boost Cut-Out Relay
15	Charge Air Cooler (CAC) Pump Control Relay
16	EGR Valve

○ ECM INFORMATION SENSORS

A	Manifold Absolute Pressure (MAP)
B	Exhaust Oxygen (O_2) Sensor
C	Throttle Position Sensor (TPS)
D	Coolant Temperature Sensor (CTS)
F	Vehicle Speed Sensor (VSS)
H	Manifold Air Temperature (MAT) Sensor
J	Electronic Spark Control (ESC) Knock Sensor

⬚ EMISSION COMPONENTS (NOT ECM CONTROLLED)

N1	Crankcase Vent Valves (PCV)
N15	Fuel Vapor Canister

V1818

Figure A-1 - Engine Component Locations 4.3L TURBO (VIN Z)

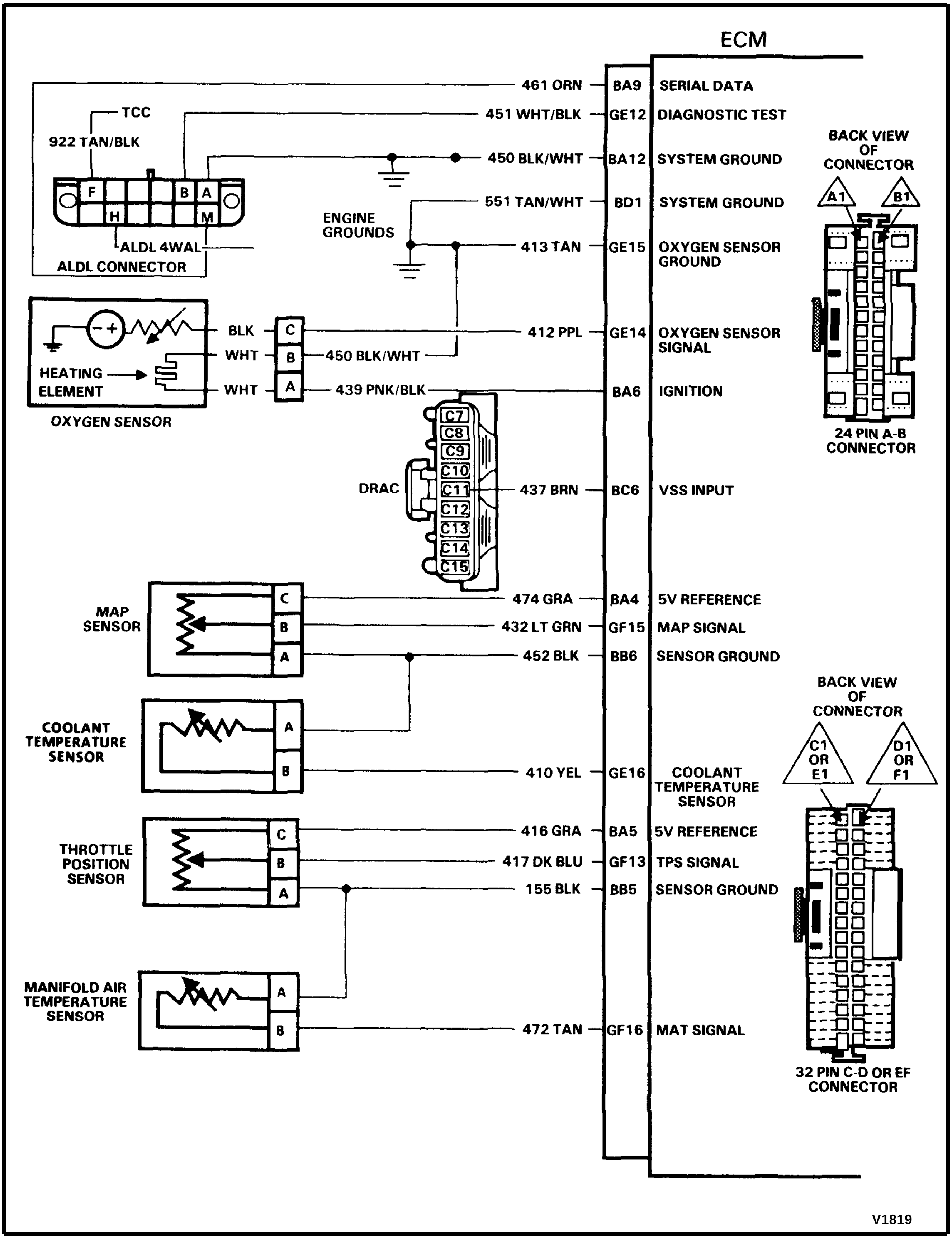


Figure A-2 - ECM Wiring Diagram 4.3L TURBO (VIN Z) (1 of 3)

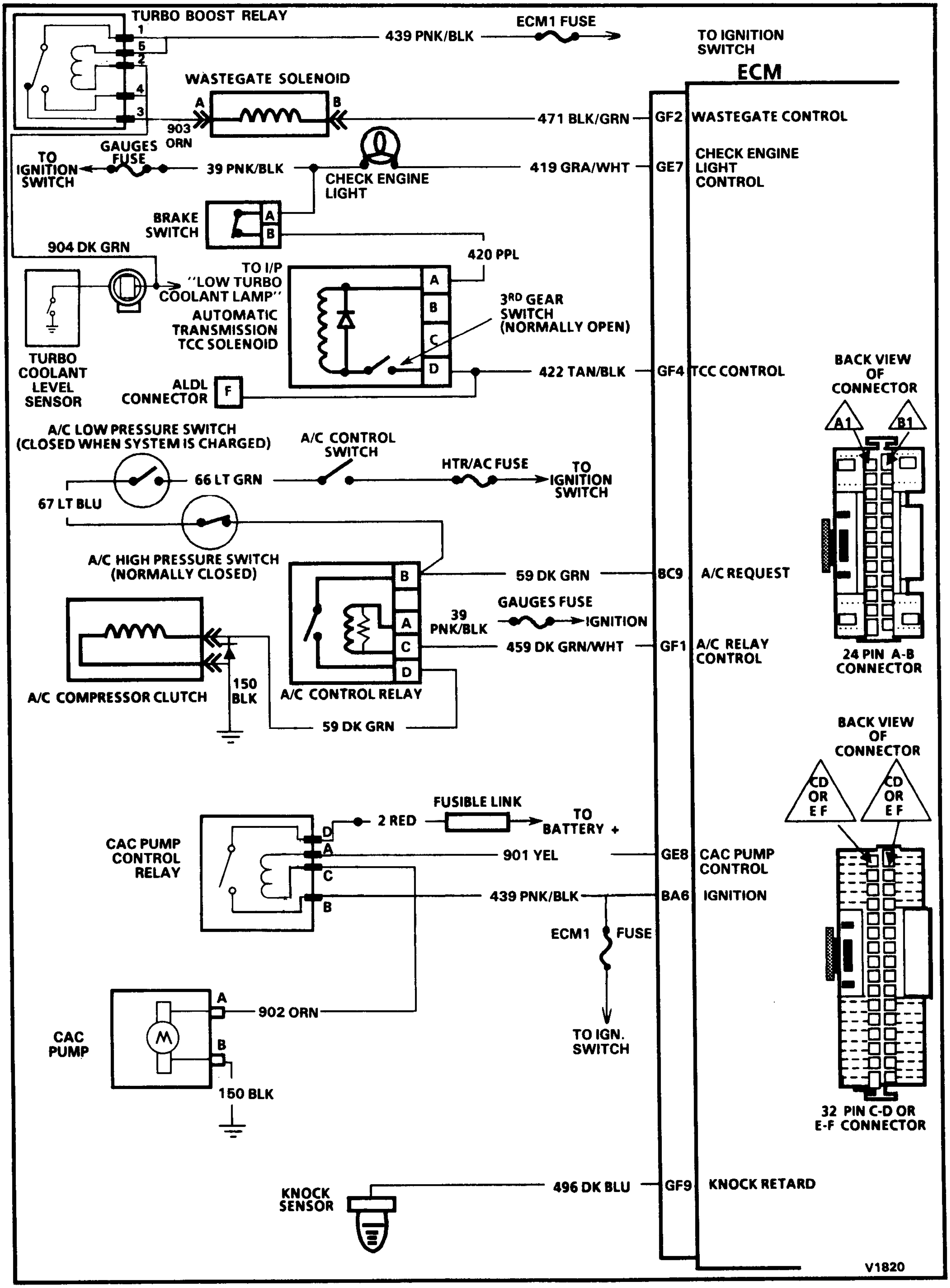


Figure A-3 - ECM Wiring Diagram 4.3L TURBO (VIN Z) (2 of 3)

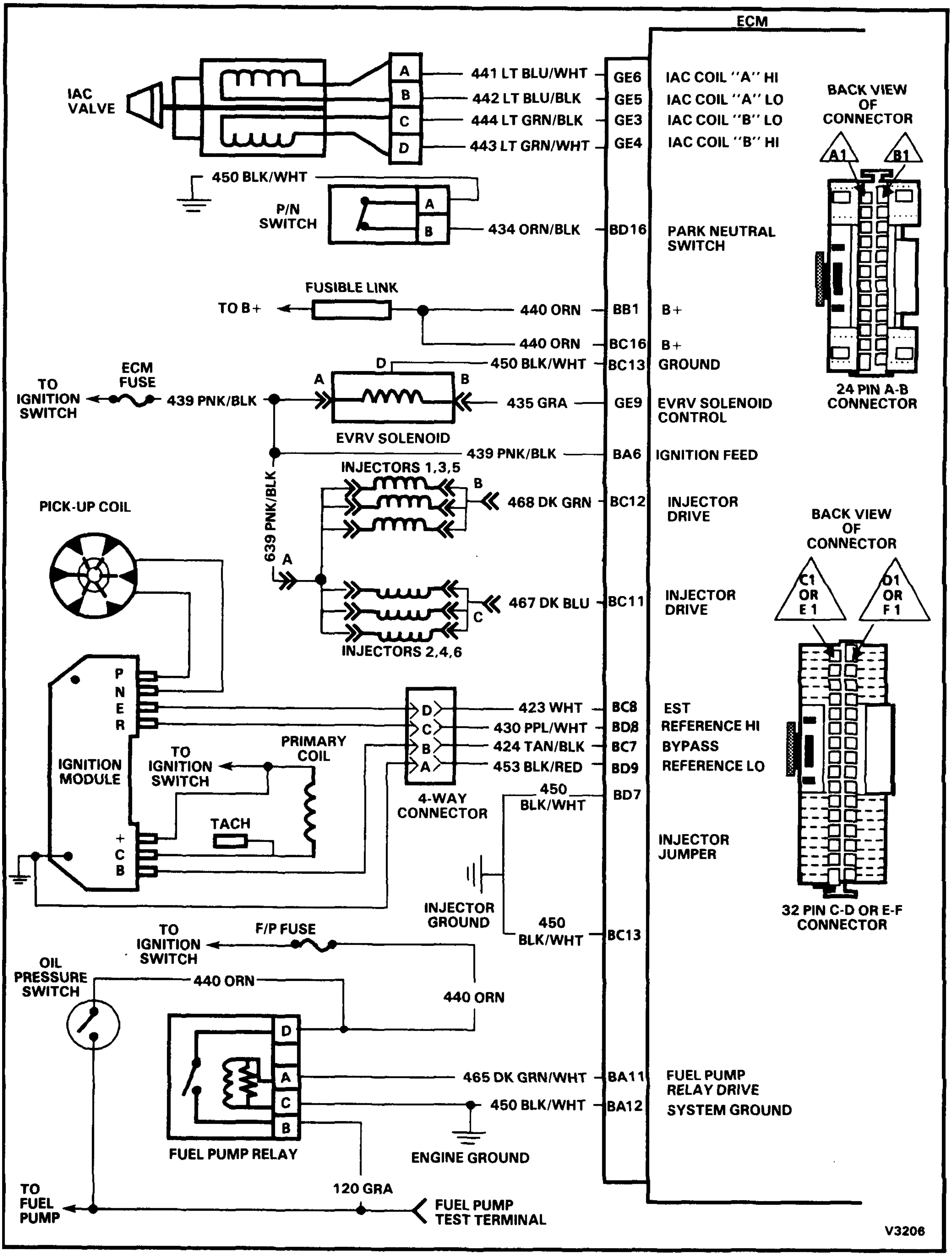


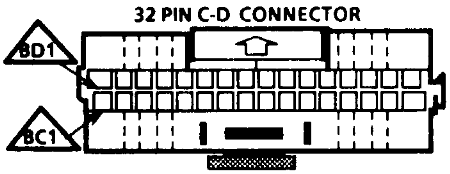
Figure A-4 - ECM Wiring Diagram 4.3L TURBO (VIN Z) (3 of 3)

PORT FUEL INJECTION ECM CONNECTOR IDENTIFICATION

This ECM voltage chart is for use with a digital voltmeter to further aid in diagnosis. The voltages you get may vary due to low battery charge or other reasons, but they should be very close.

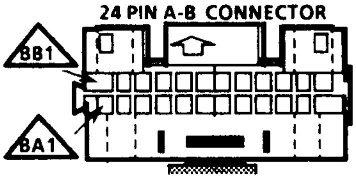
THE FOLLOWING CONDITIONS MUST BE MET BEFORE TESTING:

- **Engine at operating temperature ● Engine idling in "Closed Loop" (For "Engine Run" column) in park or neutral ● Test terminal not grounded ● "Scan" tool not installed**
- **B + indicates battery or charging system voltage**



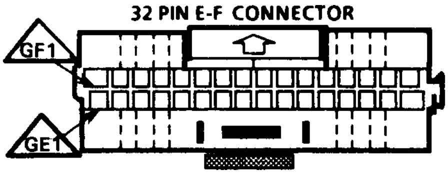
BACK VIEW OF CONNECTOR

(BLACK)



BACK VIEW OF CONNECTOR

(BLACK)



BACK VIEW OF CONNECTOR

(LT GRN)

BLACK 24 PIN A-B CONNECTOR

VOLTAGE KEY "ON"	VOLTAGE ENG. RUN	CIRCUIT	PIN	WIRE COLOR
		NOT USED	BA1	
		NOT USED	BA2	
		NOT USED	BA3	
5.0	5.0	5 VOLTS REFERENCE	BA4	GRA
5.0	5.0	5 VOLTS REFERENCE	BA5	GRA
B +	B +	IGN POWER	BA6	PNK/BLK
		NOT USED	BA7	
		NOT USED	BA8	
4.8	4.8	SERIAL DATA	BA9	ORN
		NOT USED	BA10	
B + 2 sec.	B +	FUEL PUMP RELAY	BA11	DK GRN/WHT
0	0	ECM GROUND	BA12	BLK/ WHT

WIRE COLOR	PIN	CIRCUIT	VOLTAGE KEY "ON"	VOLTAGE ENG RUN
ORN	BB1	BATTERY	B +	B +
	BB2	NOT USED		
	BB3	NOT USED		
	BB4	NOT USED		
BLK	BB5	MAT & TPS GROUND	0	0
BLK	BB6	MAP & COOLANT GROUND	0	0
	BB7	NOT USED		
	BB8	NOT USED		
	BB9	NOT USED		
	BB10	NOT USED		
	BB11	NOT USED		
	BB12	NOT USED		

* Less than .5 Volt.
∇ Less than 1 Volt.
① A/C, Fan "OFF."

ENGINE 4.3L TURBO

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Figure A-5 - ECM Terminal Connector End View 4.3L TURBO (VIN Z) (1 of 2)

BLACK 32 PIN C-D CONNECTOR

VOLTAGE				
KEY "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
		NOT USED	BC1	
		NOT USED	BC2	
		NOT USED	BC3	
		NOT USED	BC4	
		NOT USED	BC5	
B+	B+	DRAC SIGNAL	BC6	BRN
0*	4.7	BYPASS	BC7	TAN/BLK
0*	varies 1.2	EST	BC8	WHT
① 0	0	A/C REQUEST	BC9	DK GRN
		NOT USED	BC10	
B+	B+	INJECTOR DRIVER	BC11	BLU
B+	B+	INJECTOR DRIVER	BC12	GRN
0*	0*	INJECTOR GROUND	BC13	BLK/WHT
		NOT USED	BC14	
		NOT USED	BC15	
B+	B+	BATTERY	BC16	ORN

			VOLTAGE	
WIRE COLOR	PIN	CIRCUIT	KEY "ON"	ENG RUN
TAN/WHT	BD1	ECM GROUND	0	0
	BD2	NOT USED		
	BD3	NOT USED		
	BD4	NOT USED		
	BD5	NOT USED		
	BD6	NOT USED		
BLK/WHT	BD7	INJECTOR GROUND	0	0
PPL/WHT	BD8	DIST. REFERENCE HI	0*	varies 1.0
BLK/RED	BD9	DIST. REFERENCE LO	0*	0*
	BD10	NOT USED		
	BD11	NOT USED		
	BD12	NOT USED		
	BD13	NOT USED		
	BD14	NOT USED		
	BD15	NOT USED		
ORN/BLK	BD16	PARK/NEUTRAL	0*	0*

LIGHT GREEN 32 PIN E-F CONNECTOR

VOLTAGE				
KEY "ON"	ENG. RUN	CIRCUIT	PIN	WIRE COLOR
		NOT USED	GE1	
		NOT USED	GE2	
NOT	USEABLE	IAC "B" LOW	GE3	LT GRN/ WHT
NOT	USEABLE	IAC "B" HIGH	GE4	LT GRN/ BLK
NOT	USEABLE	IAC "A" LOW	GE5	BLU/BLK
NOT	USEABLE	IAC "A" HIGH	GE6	LT BLU/ WHT
.1	B+	CHECK ENGINE LAMP	GE7	GRA/WHT
B+	B+	CAC PUMP CONTROL	GE8	YEL
B+	.1	EVRV CONTROL	GE9	GRA
		NOT USED	GE10	
		NOT USED	GE11	
5.0	5.0	ALDL DIAG. ENABLE	GE12	WHT/BLK
		NOT USED	GE13	
.1-.3	varies .1-.9	0^2 SENSOR SIGNAL	GE14	PPL
0*	0*	0^2 SENSOR GROUND	GE15	TAN
varies 1.5	varies 1.5	COOLANT SIGNAL	GE16	YEL

			VOLTAGE	
WIRE COLOR	PIN	CIRCUIT	KEY "ON"	ENG RUN
DK GRN/ WHT	GF1	A/C CONTROL RELAY	B+	B+ ①
BLK/GRN	GF2	WASTEGATE SOL.	B+	.5
	GF3	NOT USED		
TAN/ BLK	GF4	TCC SOLENOID	B+	B+
	GF5	NOT USED		
	GF6	NOT USED		
	GF7	NOT USED		
	GF8	NOT USED		
DK BLU	GF9	ESC SIGNAL	2.4	2.4
	GF10	NOT USED		
	GF11	NOT USED		
	GF12	NOT USED		
DK BLU	GF13	TPS SIGNAL	.84	.84
	GF14	NOT USED		
LT GRN	GF15	MAP SIGNAL	2.2	varies .8
TAN	GF16	MAT SIGNAL	varies 2.4	varies 2.2

* LESS THAN .5 VOLT ▽ LESS THAN 1 VOLT ① A/C. FAN OFF

V1822

Figure A-6 - ECM Terminal Connector End View 4.3L TURBO (VIN Z) (2 of 2)

DIAGNOSTIC CIRCUIT CHECK

The Diagnostic Circuit Check is an organized approach to identifying a problem created by an electronic engine control system malfunction. It must be the starting point for any driveability complaint diagnosis because it directs the service technician to the next logical step in diagnosing the complaint.

The Scan data listed in the table may be used for comparison after completing the diagnostic circuit check and finding the on-board diagnostics functioning properly with no trouble codes displayed. The Typical Data Values are an average of display values recorded from normally operating vehicles and are intended to represent what a normally functioning system would typically display.

A “SCAN” TOOL THAT DISPLAYS FAULTY DATA SHOULD NOT BE USED, AND THE PROBLEM SHOULD BE REPORTED TO THE MANUFACTURER. THE USE OF A FAULTY “SCAN” TOOL CAN RESULT IN MISDIAGNOSIS AND UNNECESSARY PARTS REPLACEMENT.

Only the parameters listed below are used in this manual for diagnosis. If a Scan tool reads other parameters, the values are not recommended by General Motors for use in diagnosis. For more description on the values and use of the Scan tool to diagnosis ECM inputs, refer to the applicable component diagnosis section in Section C. If all values are within the range illustrated, refer to symptoms in Section B.

“SCAN” TOOL DATA

Test Under Following Conditions: **Idle, Upper Radiator Hose Hot, Closed Throttle, Park or Neutral, “Closed Loop,” All Accessories “OFF.”**

“SCAN” Position	Units Displayed	Typical Data Value
Engine Speed	RPM	+ 50 RPM from desired rpm in drive (AUTO)
Desired Idle	RPM	ECM idle command (varies with temperature)
Coolant Temperature	Degrees Celsius	85 - 105
MAT Temperature	Degrees Celsius	10 - 90 (varies with underhood temperature and sensor location)
MAP	kPa/Volts	.5-1 Volts (varies with manifold and barometric pressures)
Baro	kPa/Volts	Varies with barometric pressure
Throttle Position	Volts	.4 - 1.25
Throttle Angle	0 - 100%	0
Oxygen Sensor	Millivolts	100 - 1000
Injector Pulse width	Milliseconds	.8 - 3.0
Spark Advance	Degrees	Varies
Fuel Integrator	Counts	110 - 145
Block Learn	Counts	118 - 138
Open/Closed Loop	Open/Closed	“Closed Loop”
Knock Retard	Degrees	0
Knock Signal	Yes/No	No
Exhaust Recirculation	0 - 100%	0
Boost Pressure	kPa	0
Wastegate Duty Cycle	0 - 100%	100
Idle Air Control	Counts (Steps)	1 - 50
Park/Neutral Switch	P/N and R-D-L	Park/Neutral (P/N)
VSS	MPH/kPa	0
Torque Conv. Clutch	“ON”/“OFF”	“OFF”
Battery Voltage	Volts	13.5 - 14.5
A/C Request	Yes/No	No
A/C Clutch	“ON”/“OFF”	“OFF”
CAC Pump Relay	“ON”/“OFF”	“OFF”

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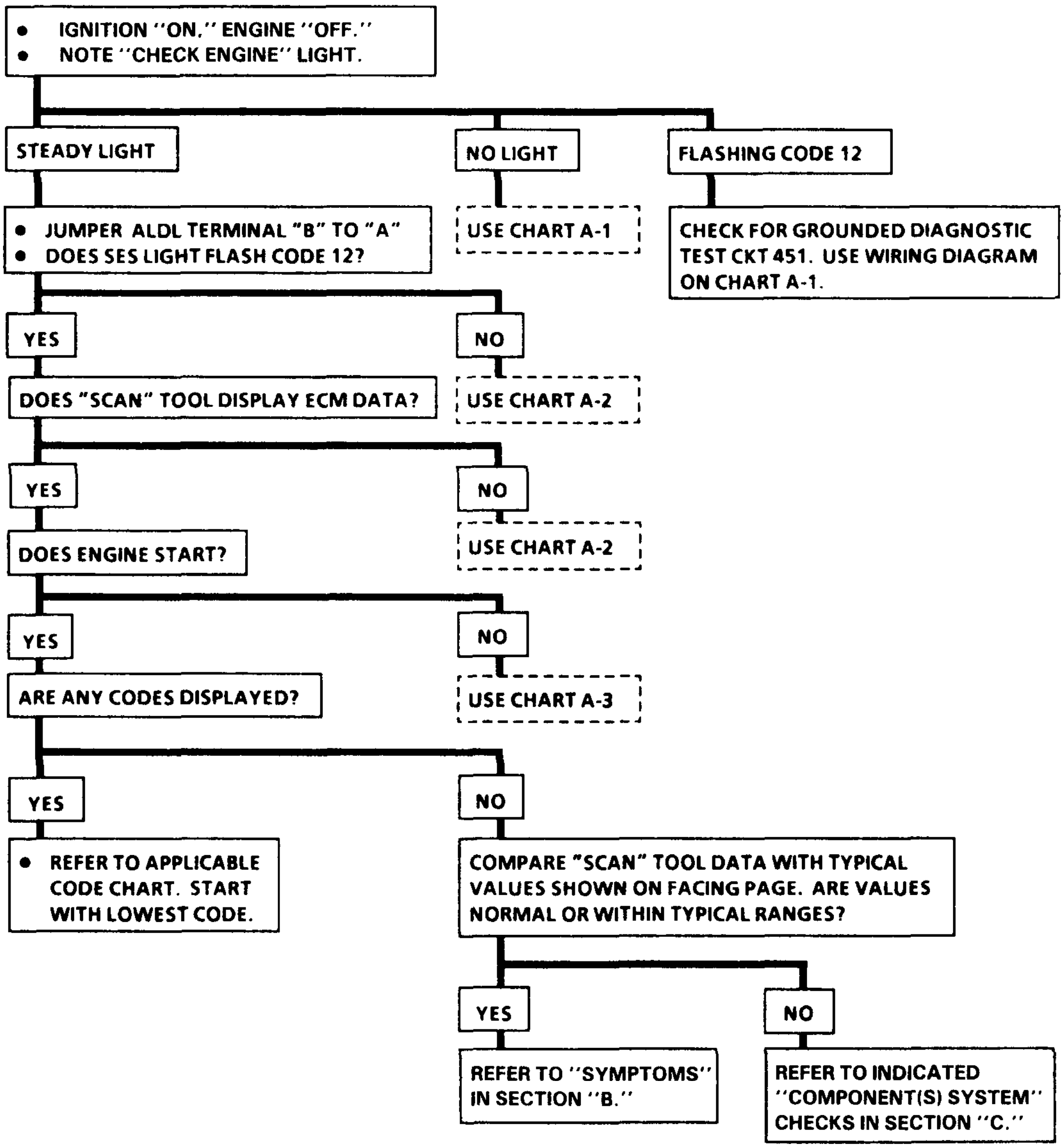
DIAGNOSTIC CIRCUIT CHECK

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



V1875

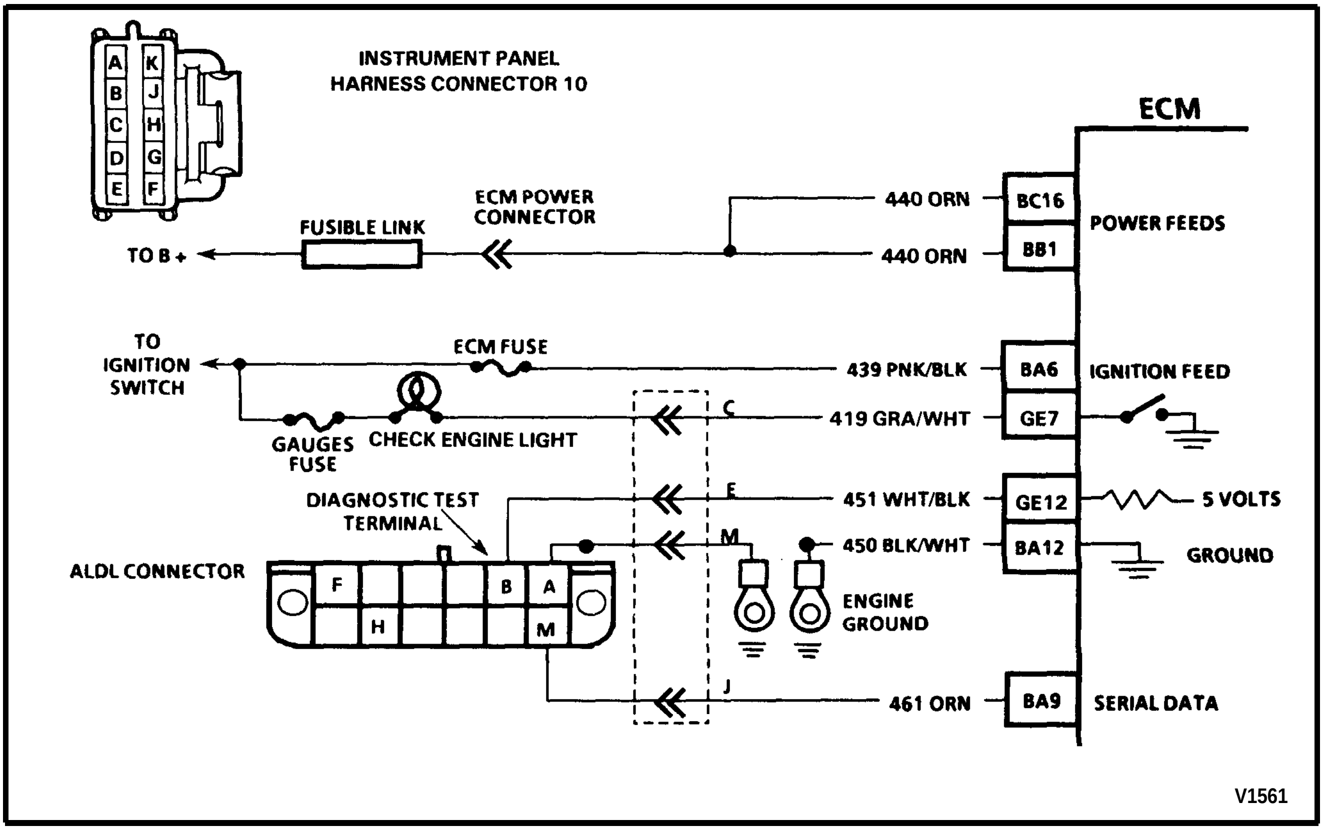


CHART A-l

NO “CHECK ENGINE” LIGHT

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

There should always be a steady Check Engine light when the ignition is ON and the engine is OFF. Battery voltage is supplied directly to the light bulb. The electronic control module (ECM) controls the light and turns it ON by providing a ground path through CKT 419 to the ECM.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Probing CKT 419 to ground creates an alternate ground. If the Check Engine light illuminates, this verifies that the trouble is not in the lamp portion of the circuit.

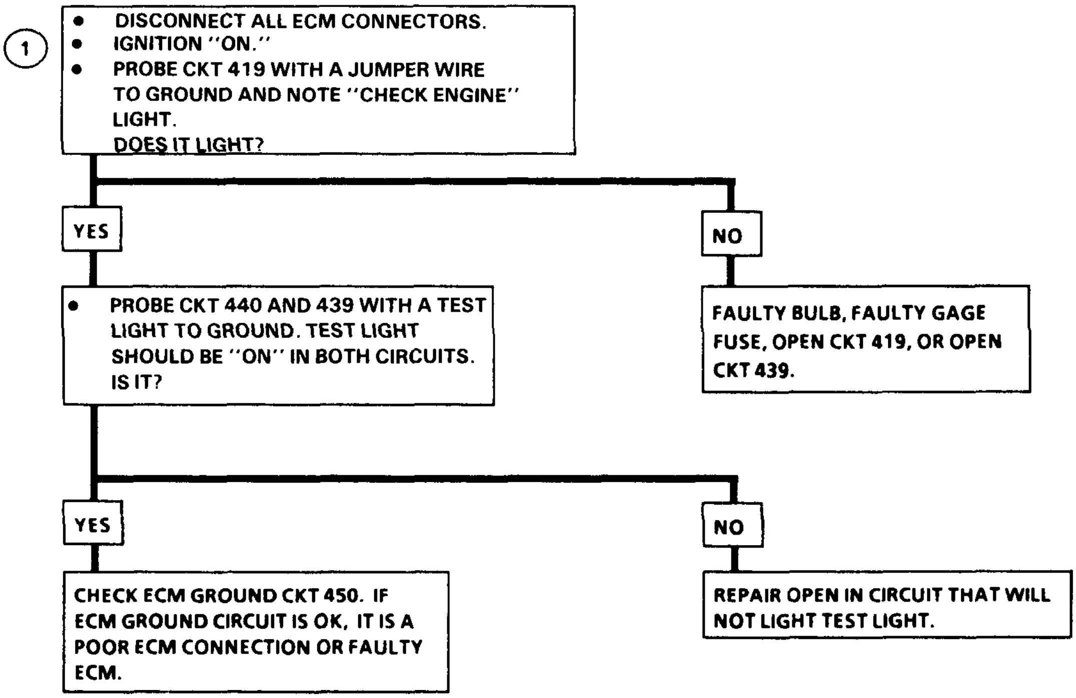
Diagnostic Aids:

If engine runs OK, check the following:

- Faulty light bulb.
- CKT 419 open.
- Gage fuse blown. This will result in no oil or generator lights, seat belt reminder, etc.

If Engine Cranks But Won t Run, use CHART A-3.

CHART A-1
NO "CHECK ENGINE" LIGHT
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1876

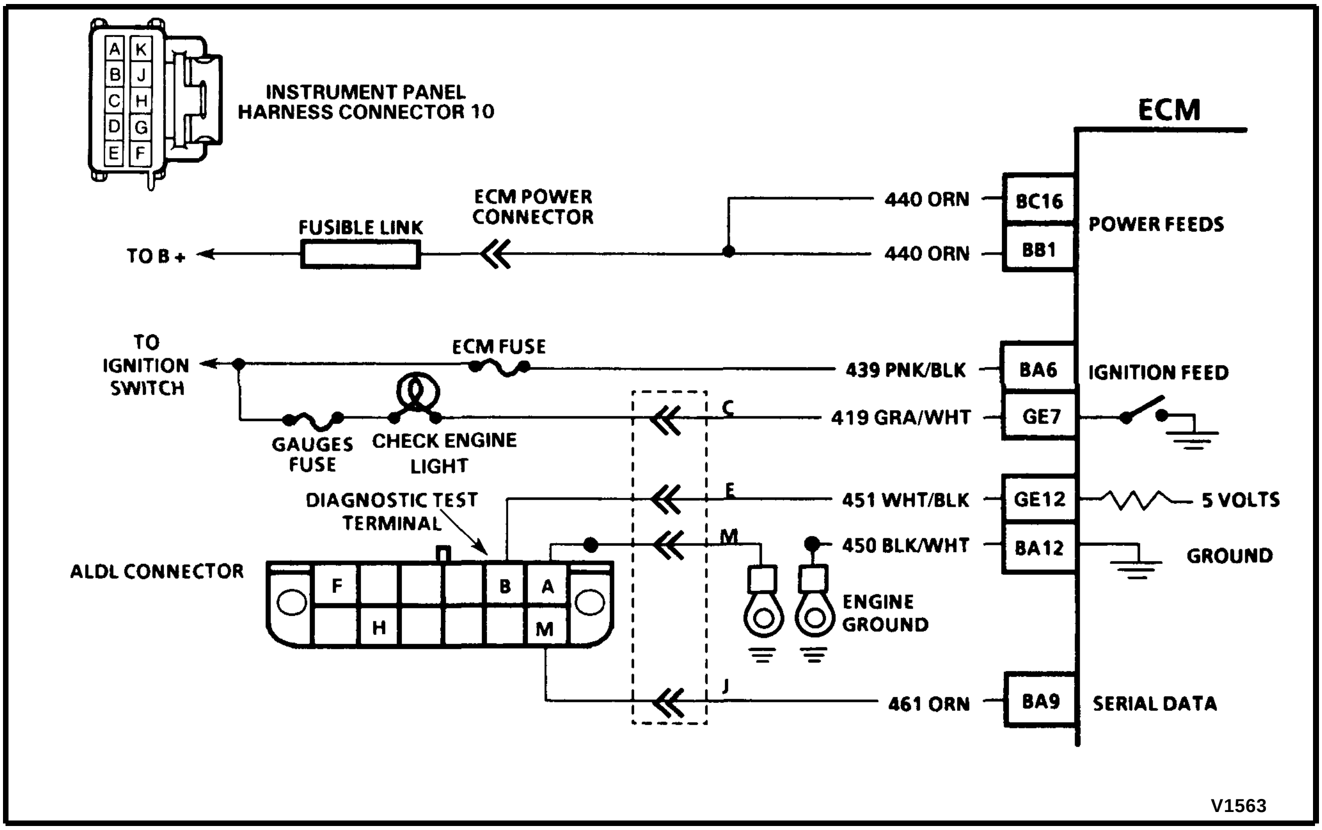


CHART A-2

WON'T FLASH CODE 12

"CHECK ENGINE" LIGHT "ON" STEADY

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

There should always be a steady "Check Engine" light when the ignition is "ON" and the engine stopped. Battery voltage is supplied directly to the light bulb. The electronic control module (ECM) will turn the light "ON" by grounding CKT 419 at the ECM.

With the diagnostic terminal grounded, the light should flash a Code 12 followed by any trouble code(s) stored in memory.

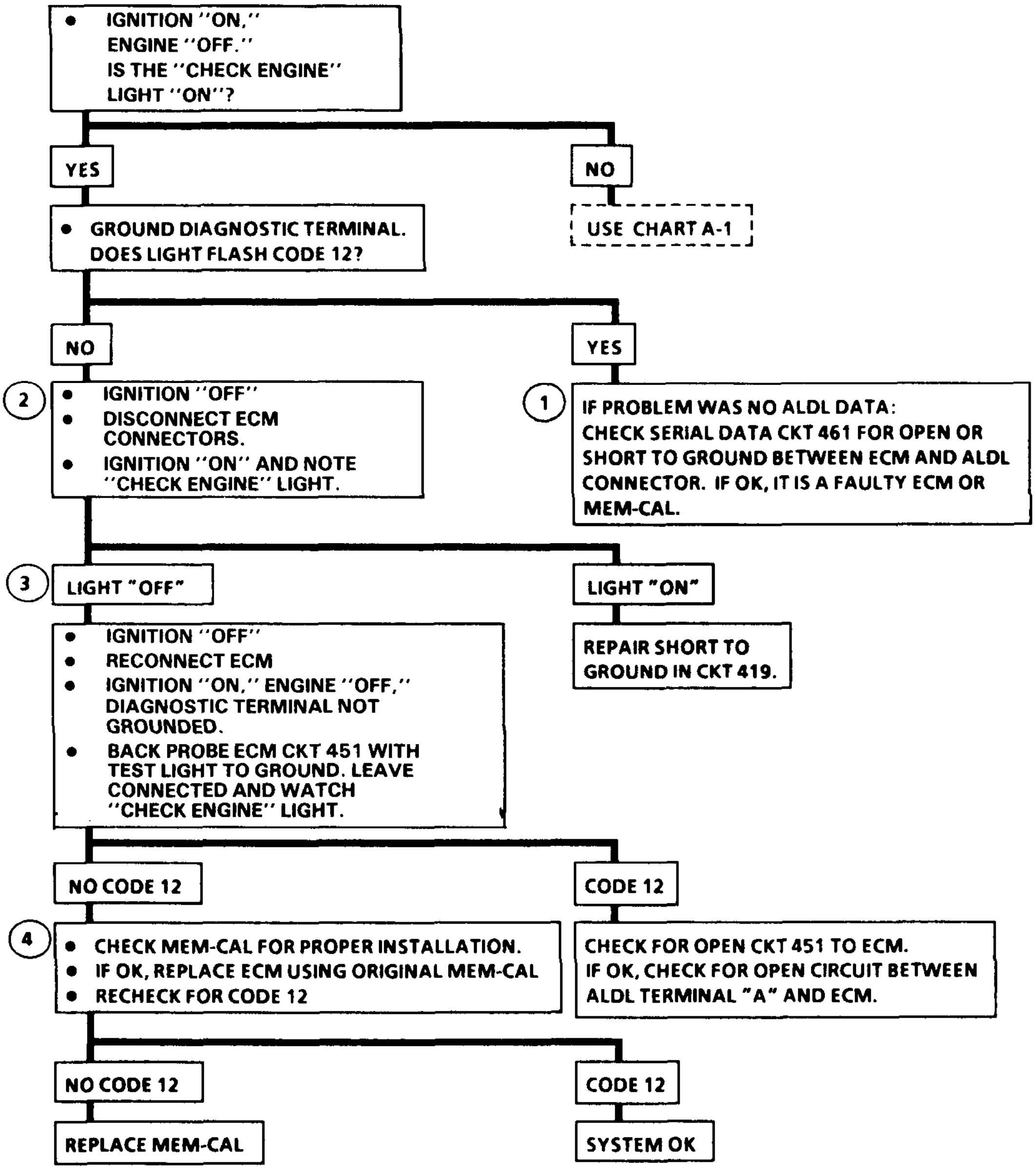
A steady light suggests a short to ground in the light control CKT 419 or an open in diagnostic CKT 451.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. If there is a problem with the ECM that causes a "Scan" tool to not read serial data, then the ECM should not flash a Code 12. If Code 12 does flash, be sure that the "Scan" tool is working properly on another vehicle. If the "Scan" is functioning properly and CKT 461 is OK, the Mem-Cal or ECM may be at fault for the no ALDL symptom.
2. If the light goes "OFF" when the ECM connector is disconnected, then CKT 419 is not shorted to ground.
3. This step will check for an open diagnostic CKT 451.
4. At this point the "Check Engine" light wiring is OK. The problem is a faulty ECM or Mem-Cal. If Code 12 does not flash, the ECM should be replaced using the original Mem-Cal. Replace the Mem-Cal only after trying an ECM, as a defective Mem-Cal is an unlikely cause of the problem.

CHART A-2

WON'T FLASH CODE 12
"CHECK ENGINE" LIGHT "ON" STEADY
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



- IGNITION "ON," ENGINE "OFF." IS THE "CHECK ENGINE" LIGHT "ON"?

YES

- GROUND DIAGNOSTIC TERMINAL. DOES LIGHT FLASH CODE 12?

NO

USE CHART A-1

NO

②
- IGNITION "OFF"
- DISCONNECT ECM CONNECTORS.
- IGNITION "ON" AND NOTE "CHECK ENGINE" LIGHT.

YES

① IF PROBLEM WAS NO ALDL DATA: CHECK SERIAL DATA CKT 461 FOR OPEN OR SHORT TO GROUND BETWEEN ECM AND ALDL CONNECTOR. IF OK, IT IS A FAULTY ECM OR MEM-CAL.

③ LIGHT "OFF"

- IGNITION "OFF"
- RECONNECT ECM
- IGNITION "ON," ENGINE "OFF," DIAGNOSTIC TERMINAL NOT GROUNDED.
- BACK PROBE ECM CKT 451 WITH TEST LIGHT TO GROUND. LEAVE CONNECTED AND WATCH "CHECK ENGINE" LIGHT.

LIGHT "ON"

REPAIR SHORT TO GROUND IN CKT 419.

NO CODE 12

④
- CHECK MEM-CAL FOR PROPER INSTALLATION.
- IF OK, REPLACE ECM USING ORIGINAL MEM-CAL
- RECHECK FOR CODE 12

CODE 12

CHECK FOR OPEN CKT 451 TO ECM. IF OK, CHECK FOR OPEN CIRCUIT BETWEEN ALDL TERMINAL "A" AND ECM.

NO CODE 12

REPLACE MEM-CAL

CODE 12

SYSTEM OK

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1877

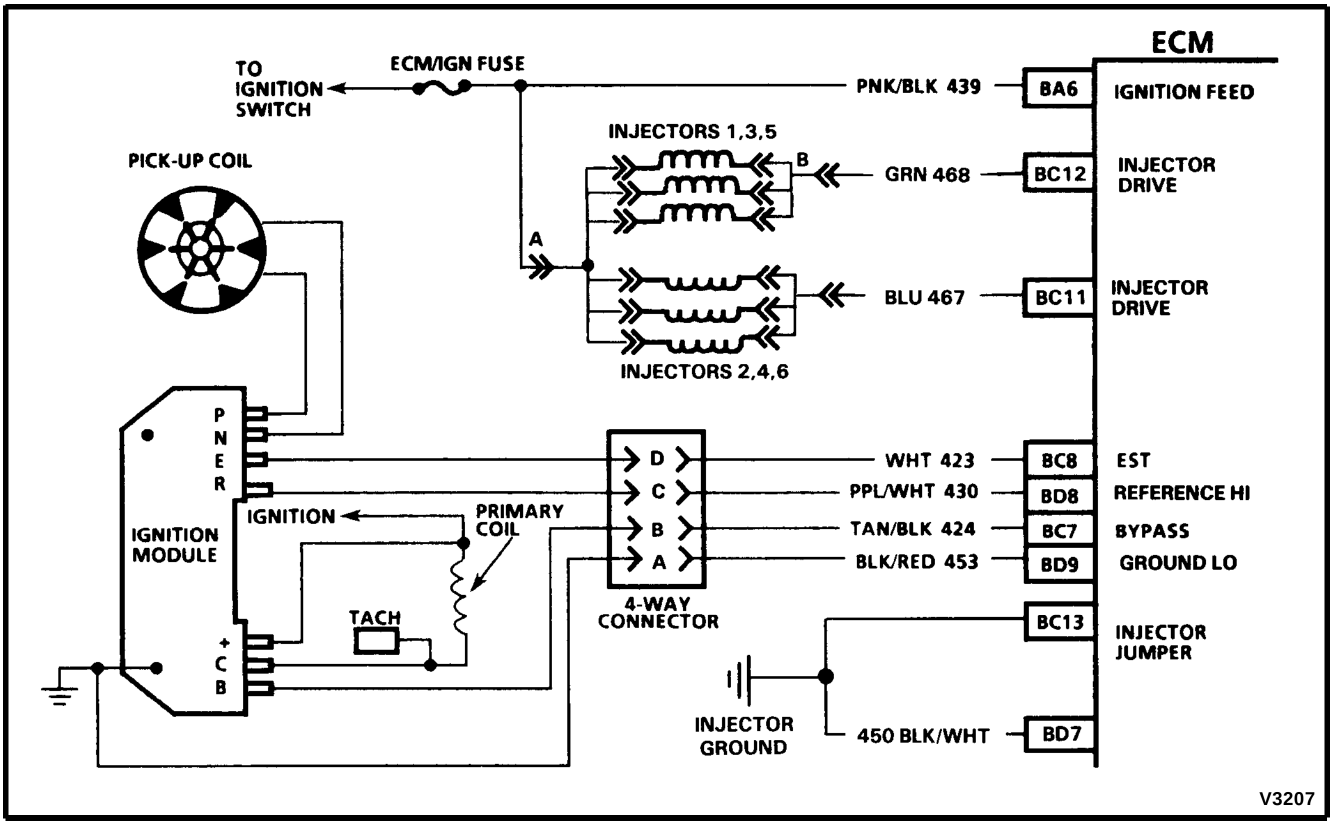


CHART A-3

(Page 1 of 2)

ENGINE CRANKS BUT WON'T RUN

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

Before using this chart, battery condition, engine cranking speed, and fuel quantity should be checked and verified as being OK.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. A "Check Engine" light "ON" is a basic test to determine if there is battery voltage and ignition voltage supplied to the ECM. No ALDL data may be due to an ECM problem. CHART A-2 will diagnose the ECM. If TPS voltage is over 2.5 volts, the engine may be in the "clear flood" mode, which will cause starting problems. The engine will not start without reference pulses and, therefore, the "Scan" tool should indicate engine speed during cranking.
2. If engine speed was indicated during crank, the ignition module is receiving a crank signal, but "no spark" at this test indicates the ignition module is not triggering the coil or there is a secondary ignition problem.
3. The test light should flash, indicating the ECM is controlling the injectors. The brightness of the light is not important. However, the test light should be a J 34730 or equivalent.
4. This test will determine if the ignition module is not generating the reference pulse, or if the wiring or ECM are at fault. By touching and removing a test light to battery voltage on CKT 430, a reference pulse should be generated. If engine speed is indicated, the ECM and wiring are OK.

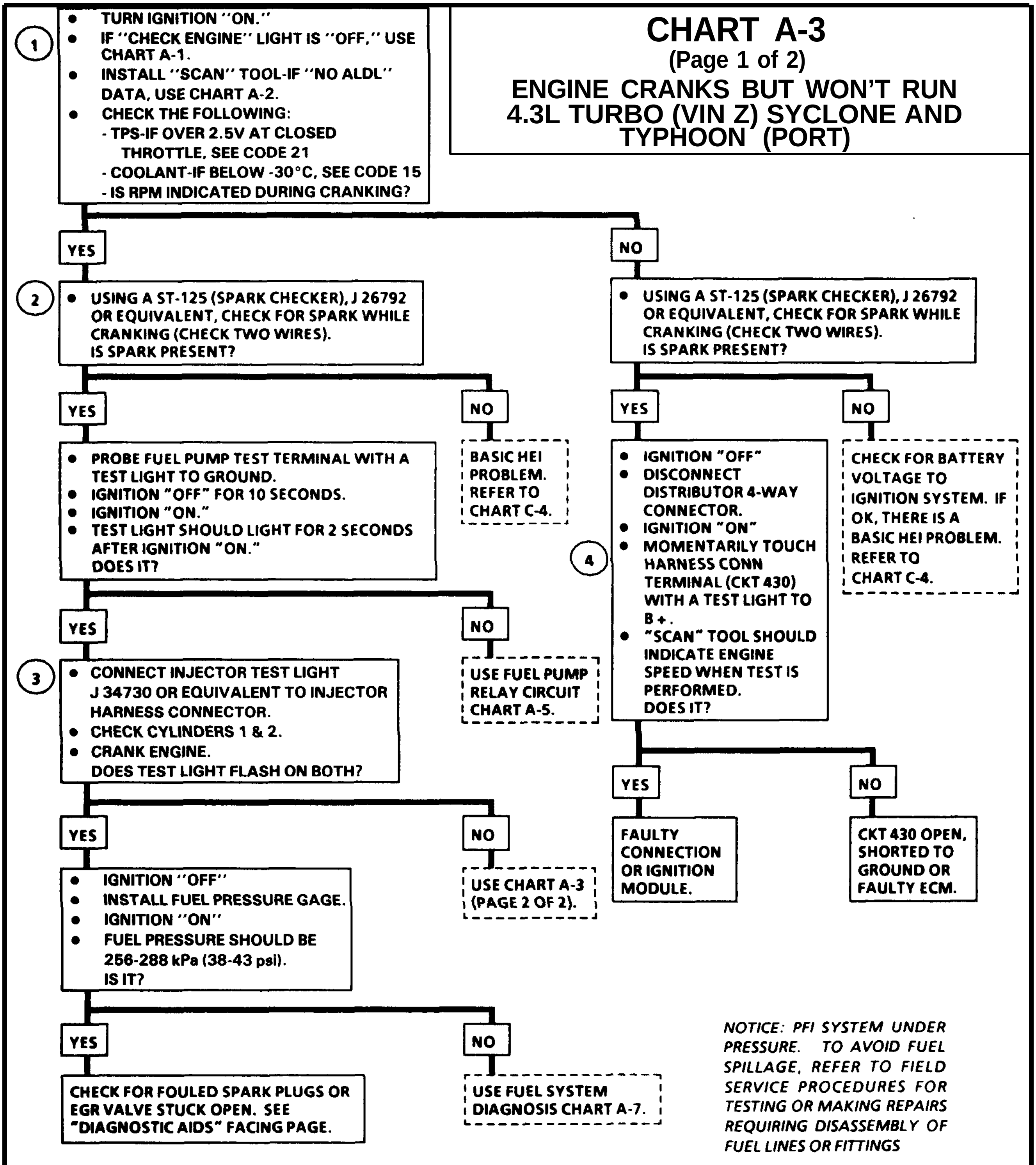
Diagnostic Aids:

- Water or foreign material can cause a no start condition during freezing weather. The engine may start after 5 or 6 minutes in a heated shop. The problem may recur after an overnight park in freezing temperatures.
- An EGR sticking open can cause a low air/fuel ratio during cranking. Unless the system enters "clear flood" at the first indication of a flooding condition it can result in a no start.
- Fuel pressure: Low fuel pressure can result in a very lean air/fuel ratio. See CHART A-7.

CHART A-3

(Page 1 of 2)

ENGINE CRANKS BUT WON'T RUN 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- TURN IGNITION "ON."
- IF "CHECK ENGINE" LIGHT IS "OFF," USE CHART A-1.
- INSTALL "SCAN" TOOL-IF "NO ALDL" DATA, USE CHART A-2.
- CHECK THE FOLLOWING:
  - TPS-IF OVER 2.5V AT CLOSED THROTTLE, SEE CODE 21
  - COOLANT-IF BELOW -30°C, SEE CODE 15
  - IS RPM INDICATED DURING CRANKING?

②
- USING A ST-125 (SPARK CHECKER), J 26792 OR EQUIVALENT, CHECK FOR SPARK WHILE CRANKING (CHECK TWO WIRES). IS SPARK PRESENT?

- PROBE FUEL PUMP TEST TERMINAL WITH A TEST LIGHT TO GROUND.
- IGNITION "OFF" FOR 10 SECONDS.
- IGNITION "ON."
- TEST LIGHT SHOULD LIGHT FOR 2 SECONDS AFTER IGNITION "ON." DOES IT?

③
- CONNECT INJECTOR TEST LIGHT J 34730 OR EQUIVALENT TO INJECTOR HARNESS CONNECTOR.
- CHECK CYLINDERS 1 & 2.
- CRANK ENGINE. DOES TEST LIGHT FLASH ON BOTH?

- IGNITION "OFF"
- INSTALL FUEL PRESSURE GAGE.
- IGNITION "ON"
- FUEL PRESSURE SHOULD BE 256-288 kPa (38-43 psi). IS IT?

CHECK FOR FOULED SPARK PLUGS OR EGR VALVE STUCK OPEN. SEE "DIAGNOSTIC AIDS" FACING PAGE.

USE FUEL SYSTEM DIAGNOSIS CHART A-7.

USE CHART A-3 (PAGE 2 OF 2).

USE FUEL PUMP RELAY CIRCUIT CHART A-5.

BASIC HEI PROBLEM. REFER TO CHART C-4.

- USING A ST-125 (SPARK CHECKER), J 26792 OR EQUIVALENT, CHECK FOR SPARK WHILE CRANKING (CHECK TWO WIRES). IS SPARK PRESENT?

④
- IGNITION "OFF"
- DISCONNECT DISTRIBUTOR 4-WAY CONNECTOR.
- IGNITION "ON"
- MOMENTARILY TOUCH HARNESS CONN TERMINAL (CKT 430) WITH A TEST LIGHT TO B+.
- "SCAN" TOOL SHOULD INDICATE ENGINE SPEED WHEN TEST IS PERFORMED. DOES IT?

FAULTY CONNECTION OR IGNITION MODULE.

CKT 430 OPEN, SHORTED TO GROUND OR FAULTY ECM.

CHECK FOR BATTERY VOLTAGE TO IGNITION SYSTEM. IF OK, THERE IS A BASIC HEI PROBLEM. REFER TO CHART C-4.

NOTICE: PFI SYSTEM UNDER PRESSURE. TO AVOID FUEL SPILLAGE, REFER TO FIELD SERVICE PROCEDURES FOR TESTING OR MAKING REPAIRS REQUIRING DISASSEMBLY OF FUEL LINES OR FITTINGS

CLEAR CODES AND CONFIRM "CLOSE LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1878

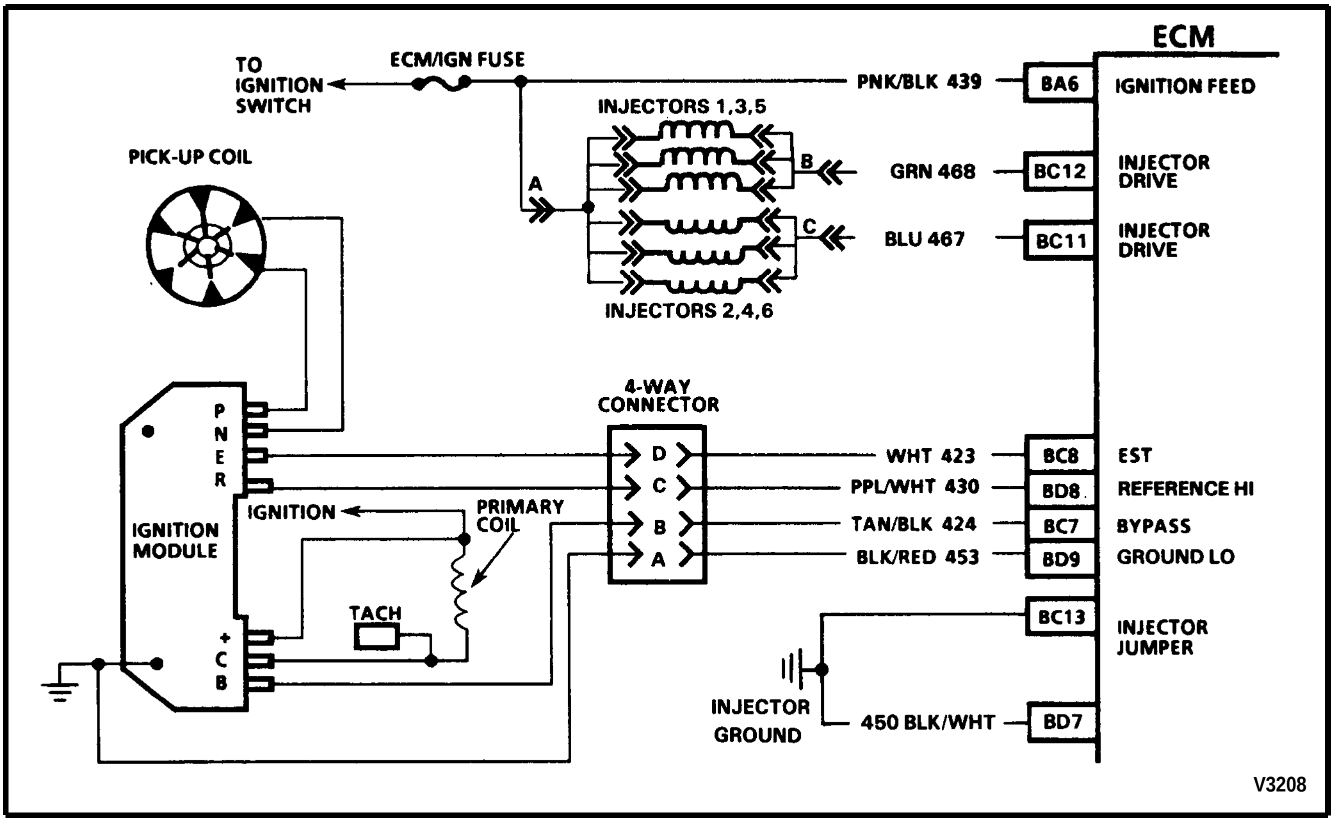


CHART A-3

(Page 2 of 2)

ENGINE CRANKS BUT WON'T RUN
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

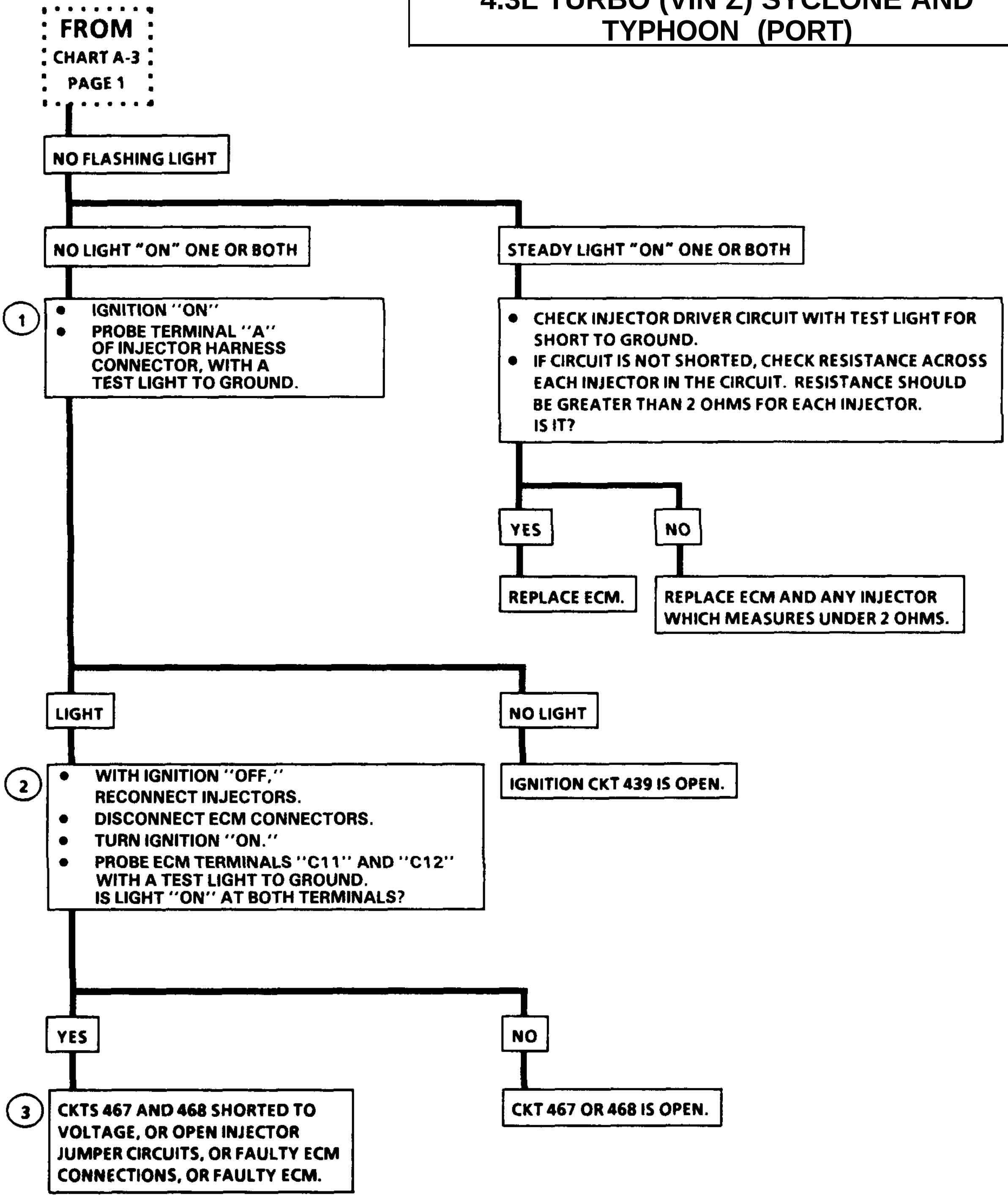
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This step checks for ignition voltage at the injector harness connector. Disconnect harness connector before probing terminal A. Reconnect connector after test.
2. Checks for open CKT 467 or 468 from connector to ECM. Be sure injector harness is connected.
3. Disconnect ECM C-D connector and check injector jumper circuits with a DVM.

CHART A-3

(Page 2 of 2)

ENGINE CRANKS BUT WON'T RUN 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT

V1879

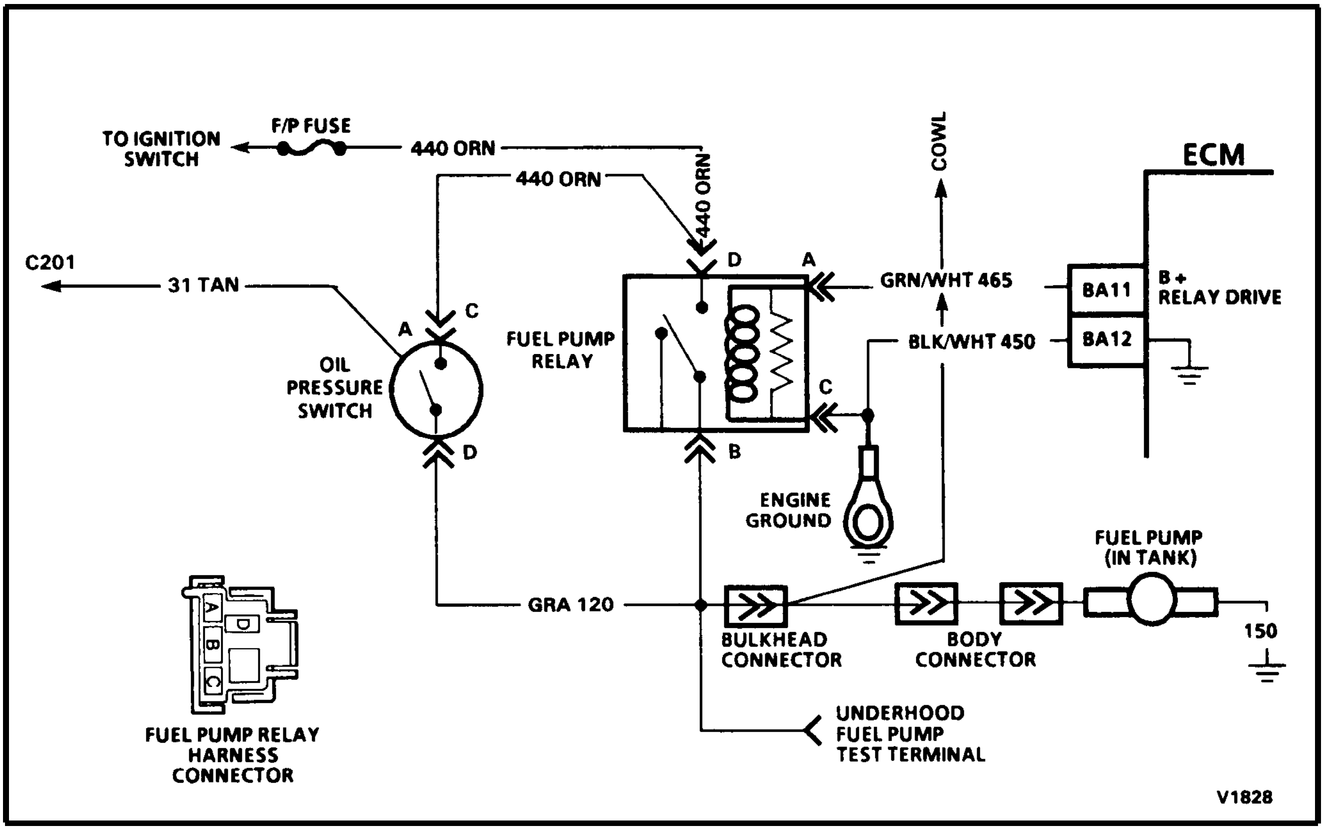


CHART A-5
FUEL PUMP RELAY CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

When the ignition switch is turned “ON,” the Electronic Control Module (ECM) will activate the fuel pump relay and run the in-tank fuel pump. The fuel pump will operate as long as the engine is cranking or running and the ECM is receiving ignition reference pulses.

If there are no reference pulses, the ECM will shut “OFF” the fuel pump within 2 seconds after key “ON.”

Should the fuel pump relay or the 12V relay drive from the ECM fail, the fuel pump will be run through an oil pressure switch back-up circuit.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

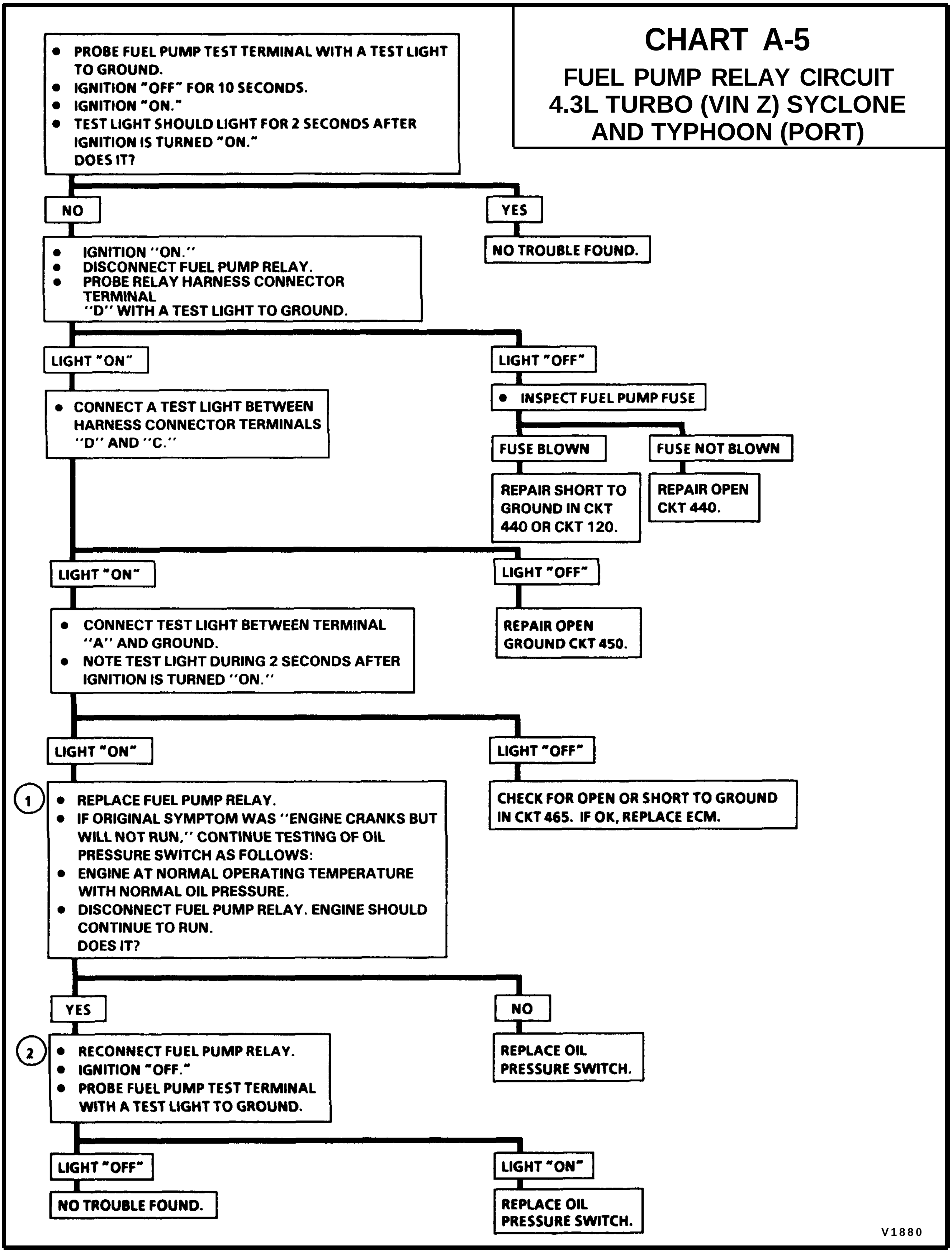
1. This test will determine if the oil pressure switch is closing and supplying voltage to the fuel pump when the relay is not functioning.
2. This test will determine if the oil pressure switch is stuck open.

Diagnostic Aids:

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold or engine oil pressure is low. The extended crank period is caused by the time necessary for oil pressure to build enough to close the oil pressure switch and turn “ON” the fuel pump.

CHART A-5

FUEL PUMP RELAY CIRCUIT
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



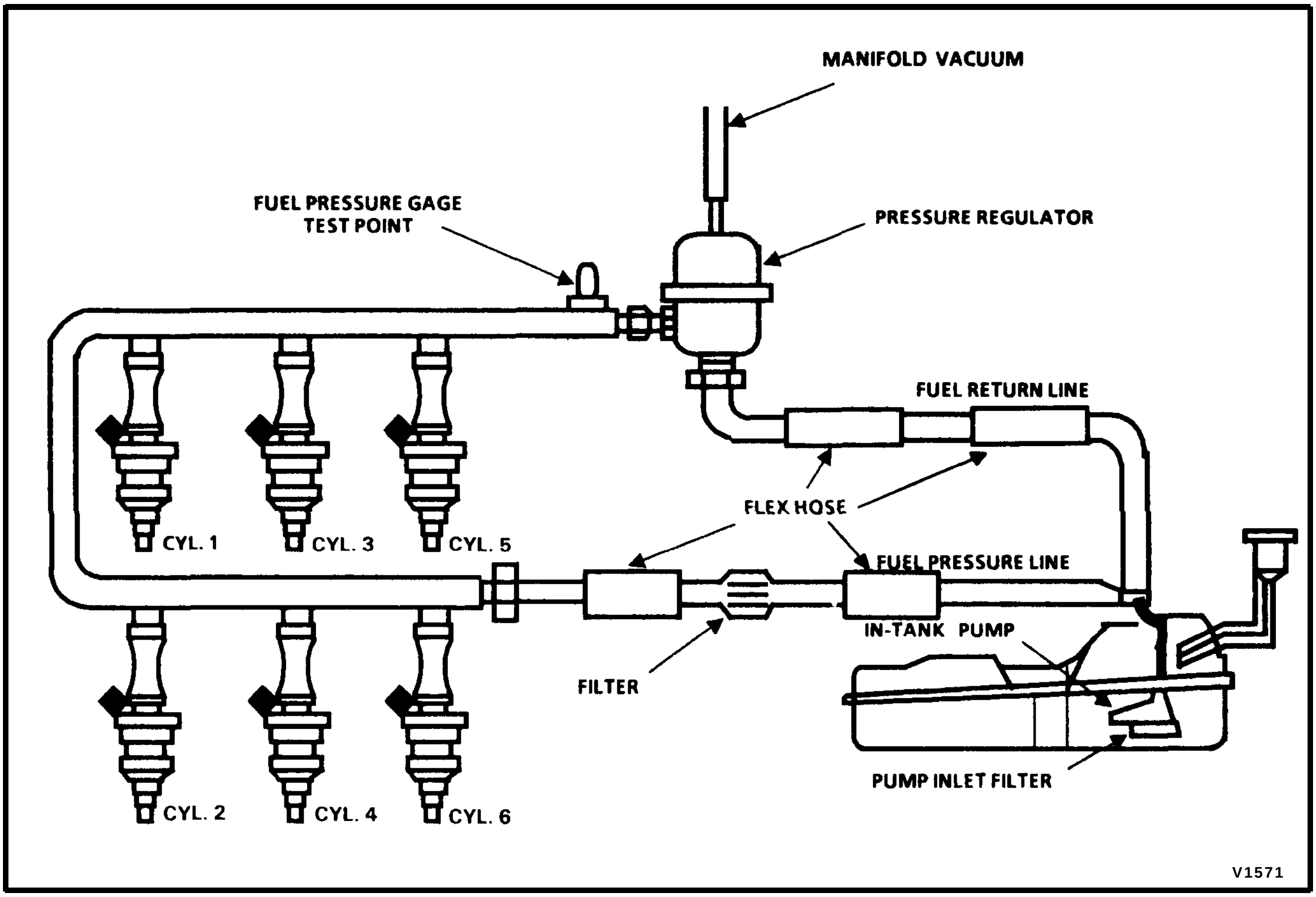


CHART A-7

(Page 1 of 2)

FUEL SYSTEM PRESSURE TEST

4.3 L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The fuel pump delivers fuel to the fuel rail and injectors, where the system pressure is controlled to 245 to 409 kPa (35 to 61 psi) by the pressure regulator. Excess fuel is returned to the fuel tank. When the engine is stopped, the pump can be energized by applying battery voltage to the test terminal located in the engine compartment.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Use pressure gage J 34730-1. Wrap a shop towel around the fuel pressure tap to absorb any small amount of fuel leakage that may occur when installing the gage. (The pressure will not leak down after the fuel pump is stopped on a correctly functioning system.)
2. While the engine is idling, manifold pressure is low (vacuum). When applied to the fuel regulator diaphragm, the pressure will result in a lower fuel pressure at about 190-200 kPa (25-30 psi).
3. The application of vacuum to the pressure regulator should result in a fuel pressure drop.
4. Pressure leak-down may be caused by one of the following:
   - In-tank fuel pump check valve not holding
   - Pump coupling hose leaking
   - Fuel pressure regulator valve leaking
   - Injector sticking open

Diagnostic Aids:

Improper fuel system pressure may contribute to one or all of the following symptoms:

- Cranks but won t run
- Code 44 or 45
- Cutting out (May feel like ignition problem)
- Hesitation, loss of power or poor fuel economy Refer to Symptoms in Section B.

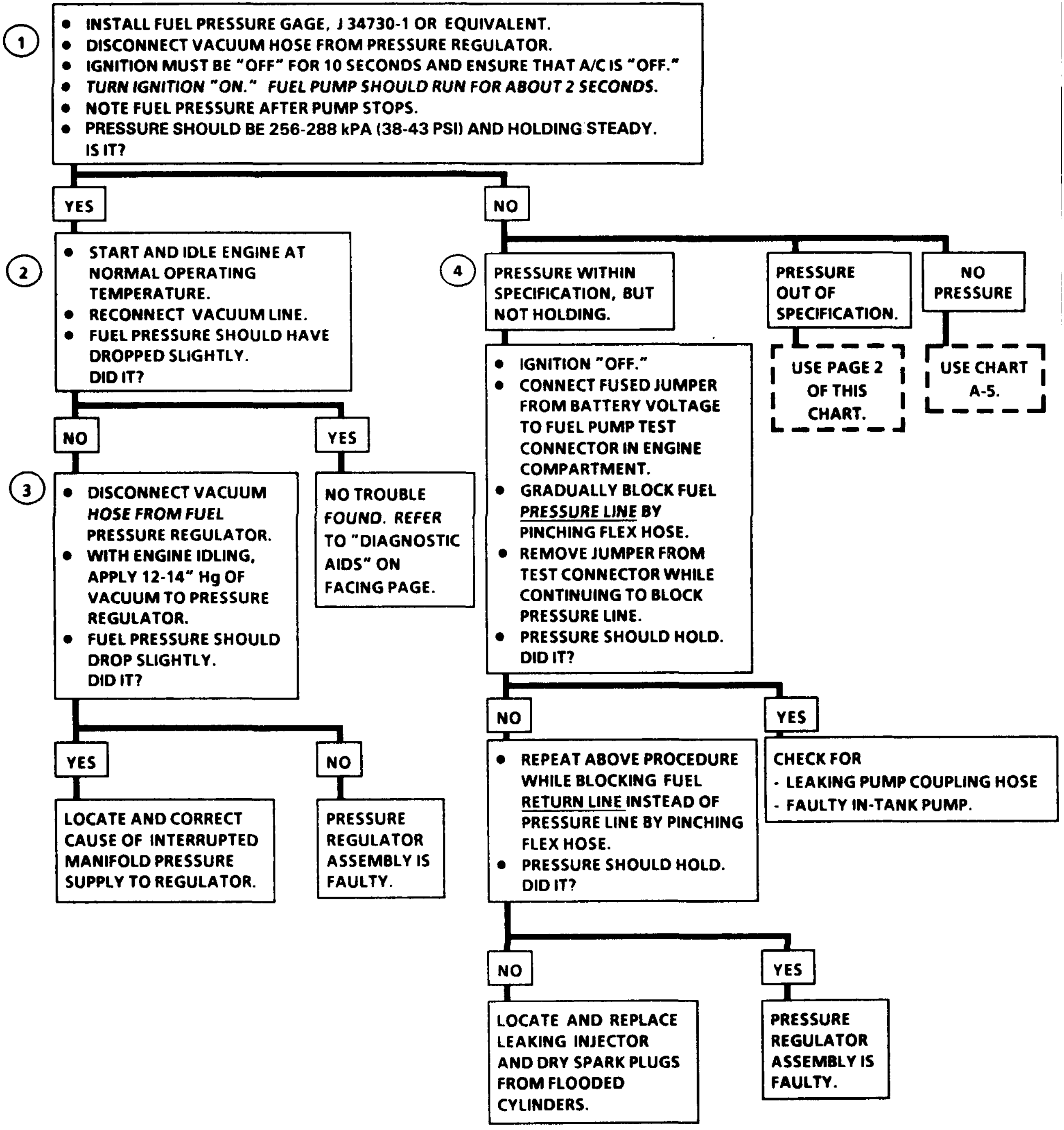
NOTICE: FUEL SYSTEM IS UNDER PRESSURE. TO AVOID FUEL SPILLAGE, REFER TO FIELD SERVICE PROCEDURES FOR TESTING OR REPAIRS REQUIRING DISASSEMBLY OF FUEL LINES OR FITTINGS.

CHART A-7

(Page 1 of 2)

FUEL SYSTEM PRESSURE TEST

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- INSTALL FUEL PRESSURE GAGE, J 34730-1 OR EQUIVALENT.
- DISCONNECT VACUUM HOSE FROM PRESSURE REGULATOR.
- IGNITION MUST BE "OFF" FOR 10 SECONDS AND ENSURE THAT A/C IS "OFF."
- *TURN IGNITION "ON." FUEL PUMP SHOULD RUN FOR ABOUT 2 SECONDS.*
- NOTE FUEL PRESSURE AFTER PUMP STOPS.
- PRESSURE SHOULD BE 256-288 kPA (38-43 PSI) AND HOLDING STEADY. IS IT?

②
- START AND IDLE ENGINE AT NORMAL OPERATING TEMPERATURE.
- RECONNECT VACUUM LINE.
- FUEL PRESSURE SHOULD HAVE DROPPED SLIGHTLY. DID IT?

③
- DISCONNECT VACUUM *HOSE FROM FUEL* PRESSURE REGULATOR.
- WITH ENGINE IDLING, APPLY 12-14" Hg OF VACUUM TO PRESSURE REGULATOR.
- FUEL PRESSURE SHOULD DROP SLIGHTLY. DID IT?

NO TROUBLE *FOUND. REFER* TO "DIAGNOSTIC AIDS" ON FACING PAGE.

LOCATE AND CORRECT CAUSE OF INTERRUPTED MANIFOLD PRESSURE SUPPLY TO REGULATOR.

PRESSURE REGULATOR ASSEMBLY IS FAULTY.

④ PRESSURE WITHIN SPECIFICATION, BUT NOT HOLDING.

PRESSURE OUT OF SPECIFICATION.

NO PRESSURE

USE PAGE 2 OF THIS CHART.

USE CHART A-5.

- IGNITION "OFF."
- CONNECT FUSED JUMPER FROM BATTERY VOLTAGE TO FUEL PUMP TEST CONNECTOR IN ENGINE COMPARTMENT.
- GRADUALLY BLOCK FUEL PRESSURE LINE BY PINCHING FLEX HOSE.
- REMOVE JUMPER FROM TEST CONNECTOR WHILE CONTINUING TO BLOCK PRESSURE LINE.
- PRESSURE SHOULD HOLD. DID IT?

CHECK FOR
- LEAKING PUMP COUPLING HOSE
- FAULTY IN-TANK PUMP.

- REPEAT ABOVE PROCEDURE WHILE BLOCKING FUEL RETURN LINE INSTEAD OF PRESSURE LINE BY PINCHING FLEX HOSE.
- PRESSURE SHOULD HOLD. DID IT?

LOCATE AND REPLACE LEAKING INJECTOR AND DRY SPARK PLUGS FROM FLOODED CYLINDERS.

PRESSURE REGULATOR ASSEMBLY IS FAULTY.

V1881

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

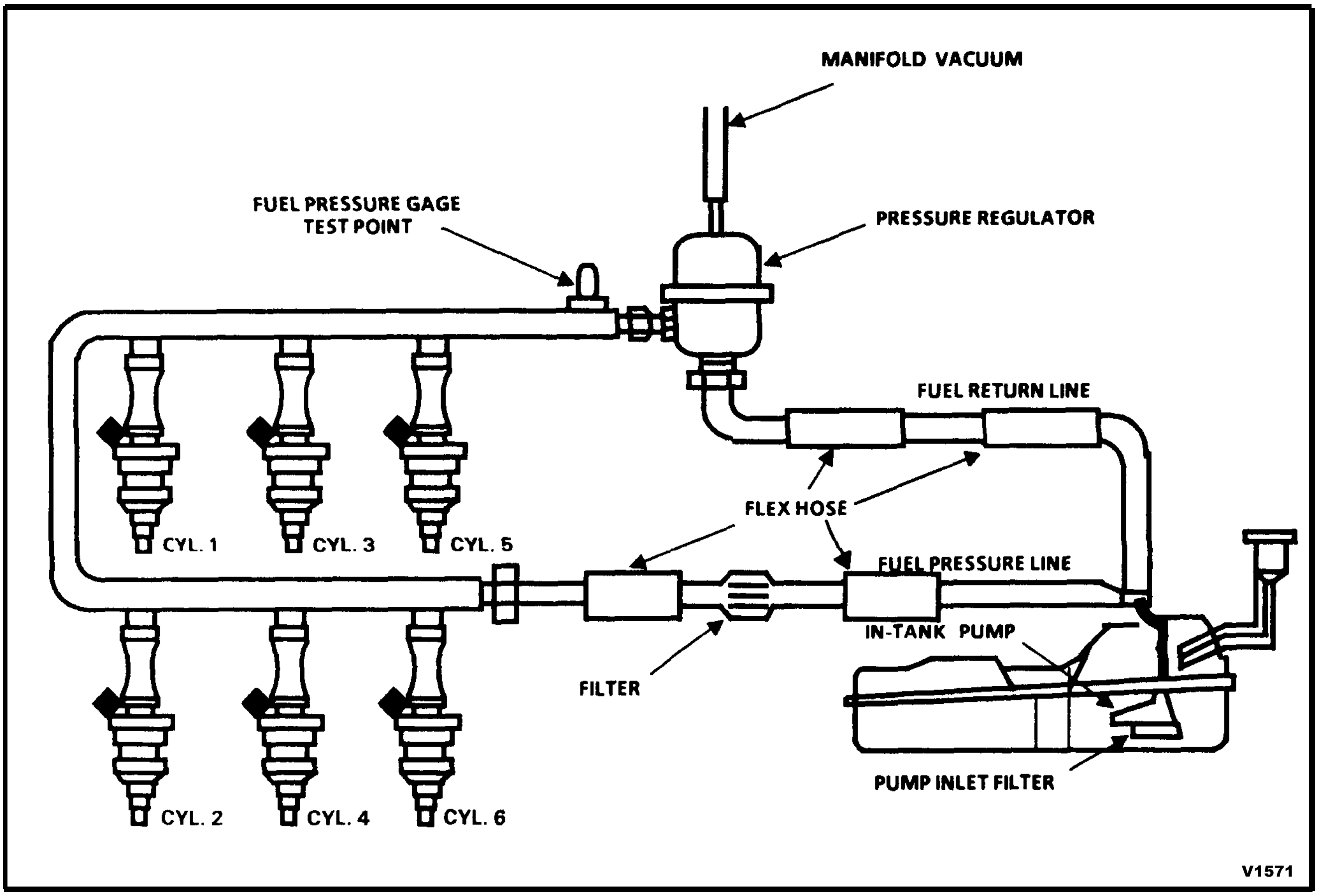


CHART A-7

(Page 2 of 2)

FUEL SYSTEM PRESSURE TEST

4.3 L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

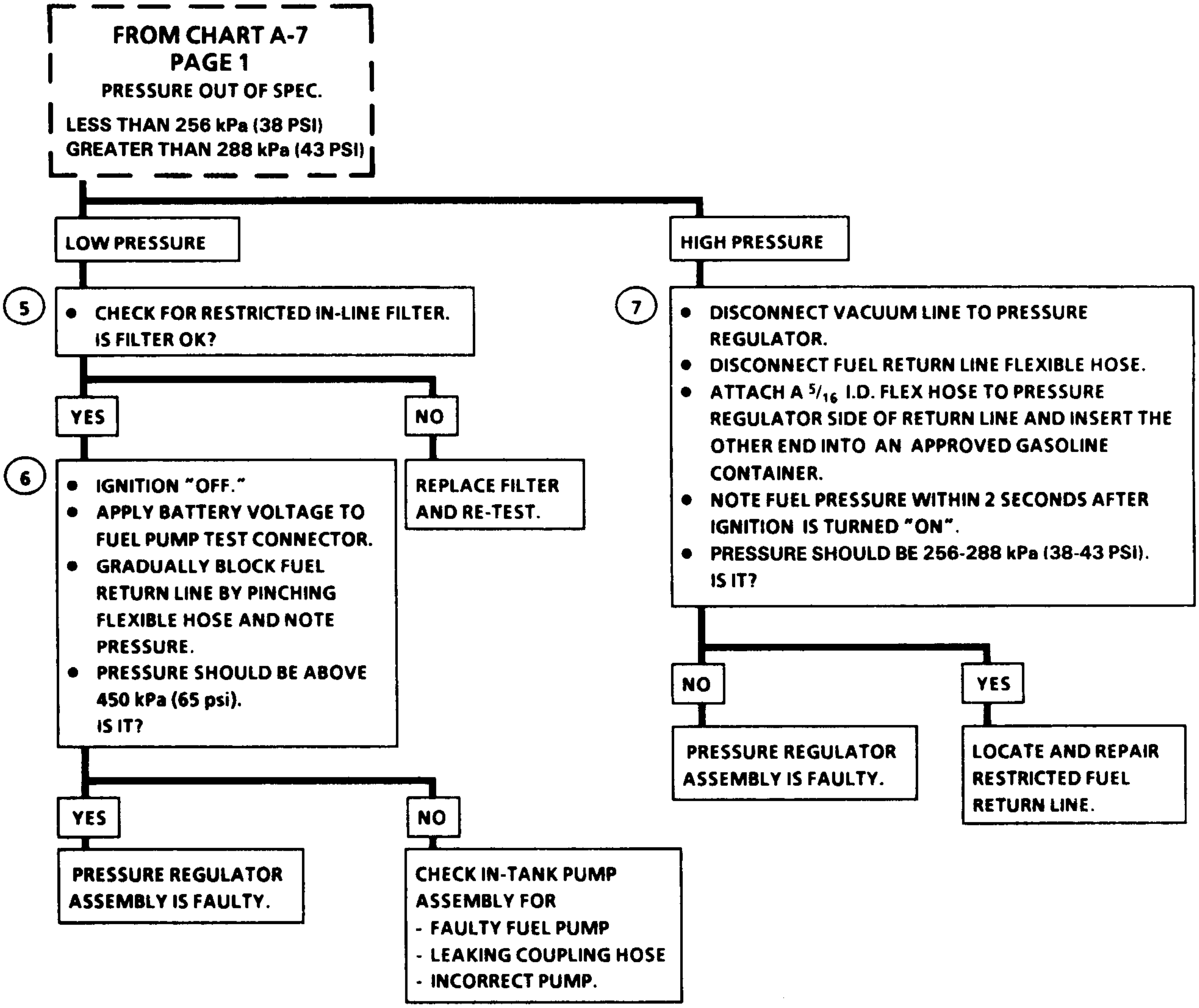
The fuel pump delivers fuel to the fuel rail and injectors, where the system pressure is controlled to 245 to 409 kPa (35 to 61 psi) by the pressure regulator. Excess fuel is returned to the fuel tank. When the engine is stopped, the pump can be energized by applying battery voltage to the test terminal located in the engine compartment.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

5. Pressure less than 245 kPa (35 psi) may be caused by one of two problems.
   - The regulated fuel pressure is too low. The system will be running lean and may set Code 44. Also, hard cold starting and overall poor performance is possible.
   - Restricted flow is causing a pressure drop. Normally, a vehicle with a fuel pressure loss at idle will not be driveable. However, if the pressure drop occurs only while driving, the engine will surge and then stop as pressure begins to drop rapidly.
6. Restricting the fuel return line allows the fuel pump to build above regulated pressure. When battery voltage is applied to the pump test terminal, pressure should be above 450 kPa (65 psi).
7. This test determines if the high fuel pressure is due to a restricted fuel return line or a pressure regulator problem.

NOTICE; FUEL SYSTEM IS UNDER PRESSURE. TO AVOID FUEL SPILLAGE, REFER TO FIELD SERVICE PROCEDURES FOR TESTING OR REPAIRS REQUIRING DISASSEMBLY OF FUEL LINES OR FITTINGS.

CHART A-7
(Page 2 of 2)
FUEL SYSTEM PRESSURE TEST 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



FROM CHART A-7
PAGE 1
PRESSURE OUT OF SPEC.
LESS THAN 256 kPa (38 PSI)
GREATER THAN 288 kPa (43 PSI)

LOW PRESSURE

⑤
- CHECK FOR RESTRICTED IN-LINE FILTER. IS FILTER OK?

NO: REPLACE FILTER AND RE-TEST.

YES:

⑥
- IGNITION "OFF."
- APPLY BATTERY VOLTAGE TO FUEL PUMP TEST CONNECTOR.
- GRADUALLY BLOCK FUEL RETURN LINE BY PINCHING FLEXIBLE HOSE AND NOTE PRESSURE.
- PRESSURE SHOULD BE ABOVE 450 kPa (65 psi). IS IT?

YES: PRESSURE REGULATOR ASSEMBLY IS FAULTY.

NO: CHECK IN-TANK PUMP ASSEMBLY FOR
- FAULTY FUEL PUMP
- LEAKING COUPLING HOSE
- INCORRECT PUMP.

HIGH PRESSURE

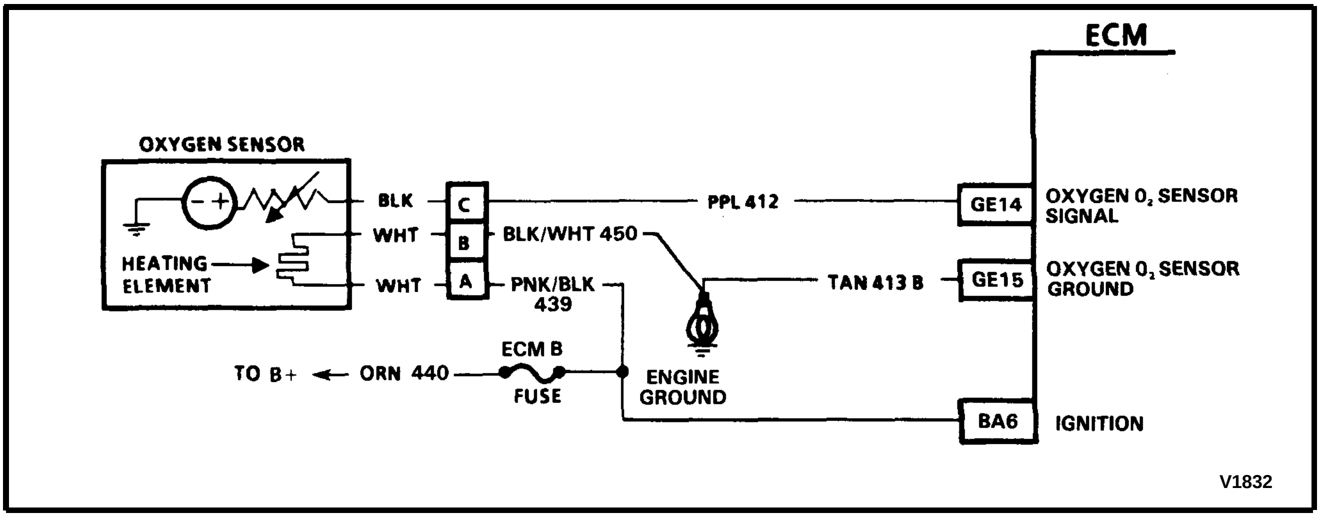
⑦
- DISCONNECT VACUUM LINE TO PRESSURE REGULATOR.
- DISCONNECT FUEL RETURN LINE FLEXIBLE HOSE.
- ATTACH A $^5/_{16}$ I.D. FLEX HOSE TO PRESSURE REGULATOR SIDE OF RETURN LINE AND INSERT THE OTHER END INTO AN APPROVED GASOLINE CONTAINER.
- NOTE FUEL PRESSURE WITHIN 2 SECONDS AFTER IGNITION IS TURNED "ON".
- PRESSURE SHOULD BE 256-288 kPa (38-43 PSI). IS IT?

NO: PRESSURE REGULATOR ASSEMBLY IS FAULTY.

YES: LOCATE AND REPAIR RESTRICTED FUEL RETURN LINE.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1882



CODE 13

OXYGEN (0_2) SENSOR CIRCUIT

(OPEN CIRCUIT)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM applies a bias voltage of approximately 450 millivolts (350-550 mV is normal bias voltage) between terminals “GE14” and “GE15.” The oxygen (0_2) sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean. Code 13 is set when the voltage does not vary on CKT 412 within a predetermined amount of time.

The sensor is like an open circuit and produces no voltage when it is below 360°C (680°F). An open sensor circuit causes “Open Loop” operation

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 13 will set:
   - Engine coolant temperature greater than 70°C (168°F).
   - At least 2 minutes engine run time after start.
   - 0_2 signal voltage steady between .35 and .55 volt.
   - Throttle position sensor signal above 5% (about .3 volt above closed throttle voltage).
   - All conditions must be met for about 60 seconds.

     If the conditions for a Code 13 exist,
     the system will not go “Closed Loop.”
2. This test checks the oxygen sensor’s heating element. The heating element resistance should be 3.5 ohms at 20°C (68°F) or 14 ohms at 350°C (562°F).
3. This will determine if the sensor is at fault or the wiring or ECM is the cause of the Code 13.
4. For this test use only a high impedance digital volt ohmmeter (DVM). This test checks the continuity of CKT 412 and CKT 413. If CKT 413 is open, the ECM voltage on CKT 412 will be over .6 volt (600 mV).
5. If the A/C fuse was blown check the A/C control circuit or generator for short circuits.

Diagnostic Aids:

Both the oxygen sensor and heater must be working properly to enable “Closed Loop” operation.

Normal “Scan” voltage varies between 100 mV to 999 mV (.l and 1.0 volt), while in “Closed Loop.” Code 13 sets in one minute, if voltage remains between .35 and .55 volt, but the system will go “Open Loop” in about 15 seconds.

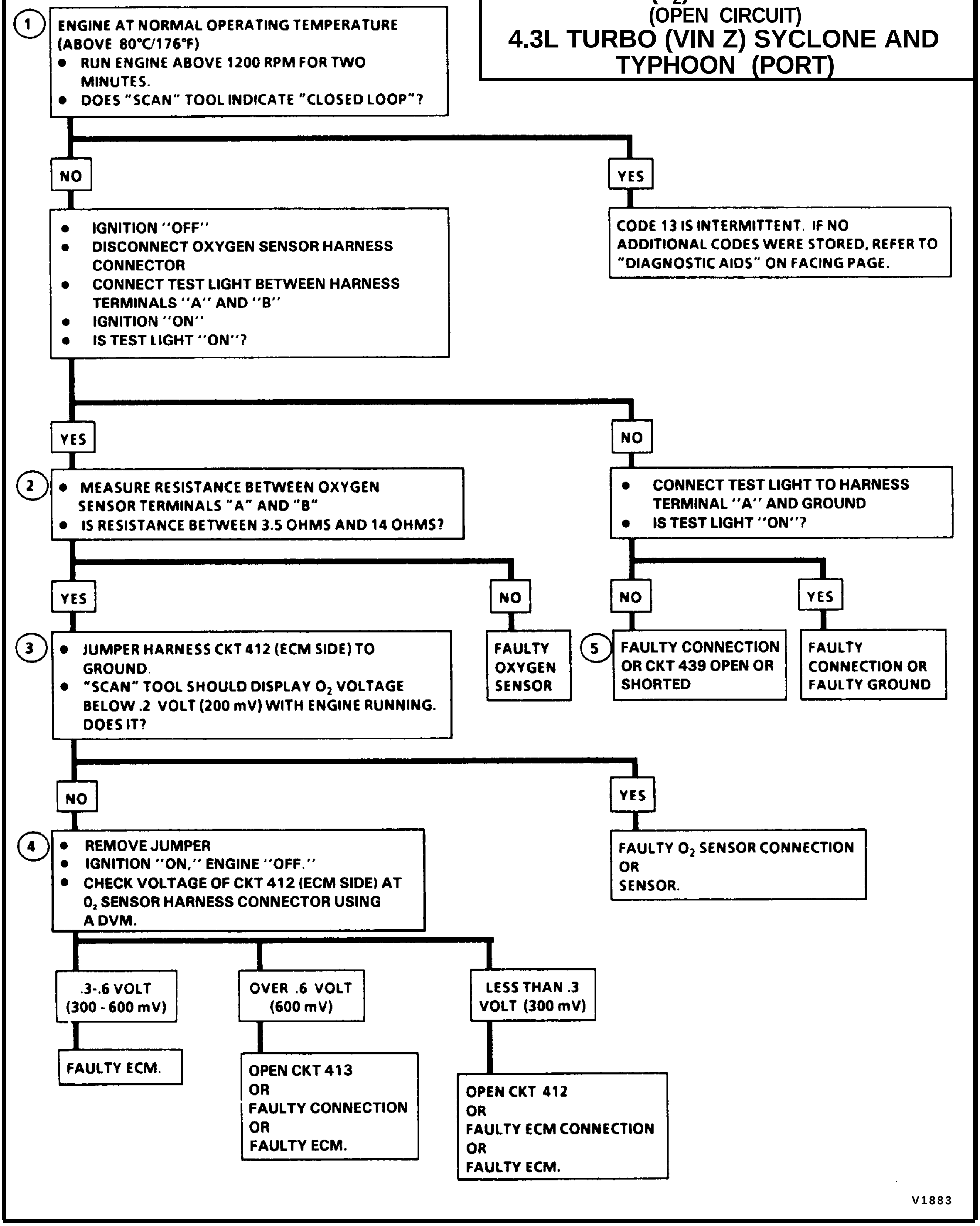
Refer to “Intermittents” in Section “B.”

CODE 13

OXYGEN (0_2) SENSOR CIRCUIT

(OPEN CIRCUIT)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



① ENGINE AT NORMAL OPERATING TEMPERATURE (ABOVE 80°C/176°F)
- RUN ENGINE ABOVE 1200 RPM FOR TWO MINUTES.
- DOES "SCAN" TOOL INDICATE "CLOSED LOOP"?

NO:
- IGNITION "OFF"
- DISCONNECT OXYGEN SENSOR HARNESS CONNECTOR
- CONNECT TEST LIGHT BETWEEN HARNESS TERMINALS "A" AND "B"
- IGNITION "ON"
- IS TEST LIGHT "ON"?

YES: CODE 13 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES:

②
- MEASURE RESISTANCE BETWEEN OXYGEN SENSOR TERMINALS "A" AND "B"
- IS RESISTANCE BETWEEN 3.5 OHMS AND 14 OHMS?

NO:
- CONNECT TEST LIGHT TO HARNESS TERMINAL "A" AND GROUND
- IS TEST LIGHT "ON"?

YES:

③
- JUMPER HARNESS CKT 412 (ECM SIDE) TO GROUND.
- "SCAN" TOOL SHOULD DISPLAY O_2 VOLTAGE BELOW .2 VOLT (200 mV) WITH ENGINE RUNNING. DOES IT?

NO: FAULTY OXYGEN SENSOR

NO: ⑤ FAULTY CONNECTION OR CKT 439 OPEN OR SHORTED

YES: FAULTY CONNECTION OR FAULTY GROUND

NO:

④
- REMOVE JUMPER
- IGNITION "ON," ENGINE "OFF."
- CHECK VOLTAGE OF CKT 412 (ECM SIDE) AT 0_2 SENSOR HARNESS CONNECTOR USING A DVM.

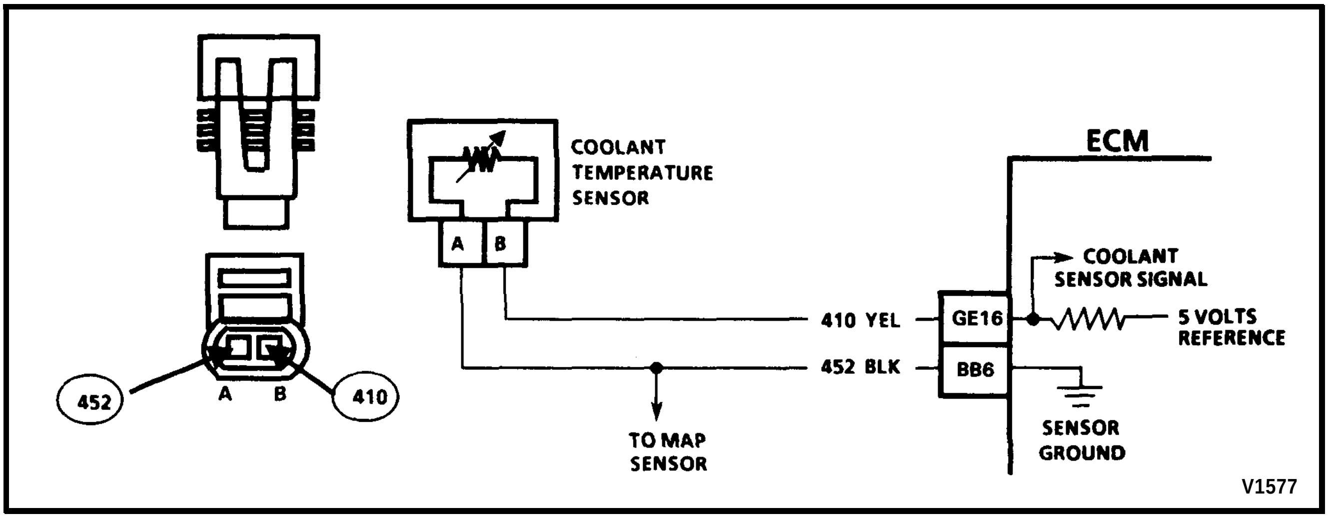
YES: FAULTY O_2 SENSOR CONNECTION OR SENSOR.

.3-.6 VOLT (300 - 600 mV): FAULTY ECM.

OVER .6 VOLT (600 mV): OPEN CKT 413 OR FAULTY CONNECTION OR FAULTY ECM.

LESS THAN .3 VOLT (300 mV): OPEN CKT 412 OR FAULTY ECM CONNECTION OR FAULTY ECM.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.



CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT

(HIGH TEMPERATURE INDICATED)

4.3L TURBO (VIN Z) SYCLONE (PORT)

Circuit Description:

The Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature, the voltage will measure about 1.5 to 2.0 volts at the ECM terminal “GE16.”

Coolant temperature is one of the inputs used to control:

- Fuel Delivery
- CAC Pump
- Torque Converter Clutch (TCC)
- Idle Air Control (IAC)

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Checks to see if code was set as result of hard failure or intermittent condition,
   Code 14 will set if:
   - Engine has been running for more than 10 seconds.
   - Signal voltage indicates a coolant temperature above 135°C (275°F) for 3 seconds.
2. This test simulates conditions for a Code 15. If the ECM recognizes the open circuit (high voltage), and displays a low temperature, the ECM and wiring are OK.

Diagnostic Aids:

A “Scan” tool reads engine temperature in degrees centigrade.

After the engine is started, the temperature should rise steadily to about 90°, then stabilize, when the thermostat opens.

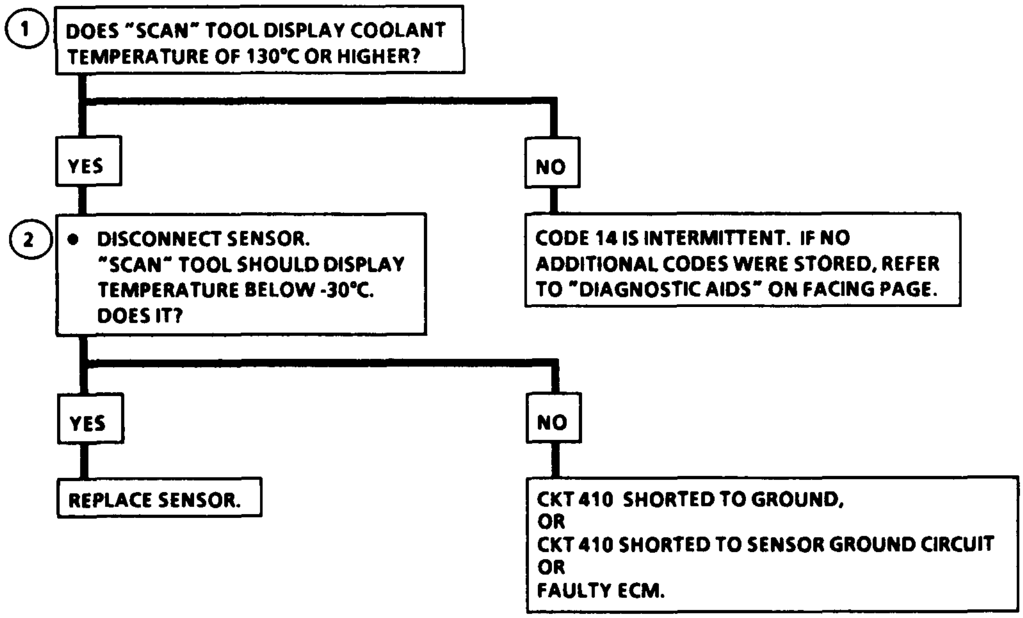
If the engine has been allowed to cool to an ambient temperature (overnight), coolant and MAT temperature may be checked with a “Scan” tool and should read close to each other.

A Code 14 will result if CKT 410 is shorted to ground.

If Code 14 is intermittent, refer to Section “B.”

CODE 14

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(HIGH TEMPERATURE INDICATED)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



① DOES "SCAN" TOOL DISPLAY COOLANT TEMPERATURE OF 130°C OR HIGHER?

YES

② ● DISCONNECT SENSOR. "SCAN" TOOL SHOULD DISPLAY TEMPERATURE BELOW -30°C. DOES IT?

YES

REPLACE SENSOR.

NO

CKT 410 SHORTED TO GROUND,
OR
CKT 410 SHORTED TO SENSOR GROUND CIRCUIT
OR
FAULTY ECM.

NO

CODE 14 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

DIAGNOSTIC AID

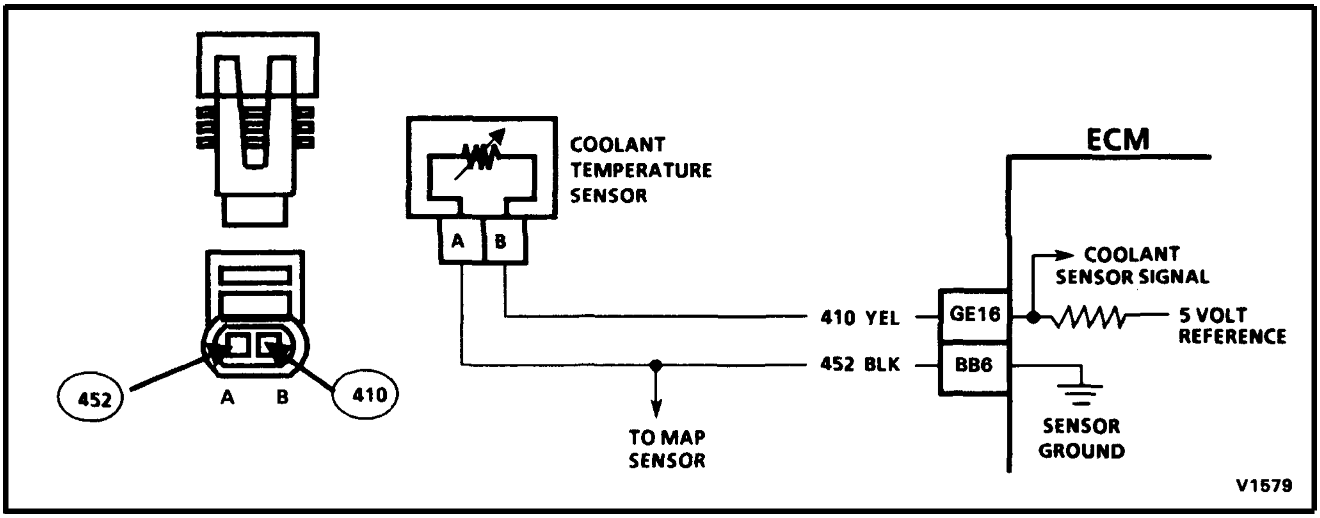
COOLANT SENSOR

TEMPERATURE VS. RESISTANCE VALUES (APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1884



CODE 15

COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Coolant Temperature Sensor (CTS) uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage on CKT 410 to the sensor. When the engine is cold, the sensor (thermistor) resistance is high, therefore, the ECM will see high signal voltage.

As the engine warms, the sensor resistance becomes less and the voltage drops. At normal engine operating temperature, the voltage will measure about 1.5 volts to 2.0 volts at the ECM terminal “GEl6.”

Coolant temperature is one of the inputs used to control:

- Fuel Delivery
- CAC Pump
- Torque Converter Clutch (TCC)
- Idle Air Control (IAC)

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Checks to see if code was set as result of hard failure or intermittent condition.
   Code 15 will set if:
   - Engine has been running for more than 50 seconds.
   - Signal voltage indicates a coolant temperature below -30°C (-22°F).
2. This test, simulates conditions for a Code 14. If the ECM recognizes the grounded circuit (low voltage) and displays a high temperature, the ECM and wiring are OK.
3. This test will determine if there is a wiring problem or a faulty ECM. If CKT 452 is open, there may also be a Code 21 stored.

Diagnostic Aids:

A “Scan” tool reads engine temperature in degrees centigrade.

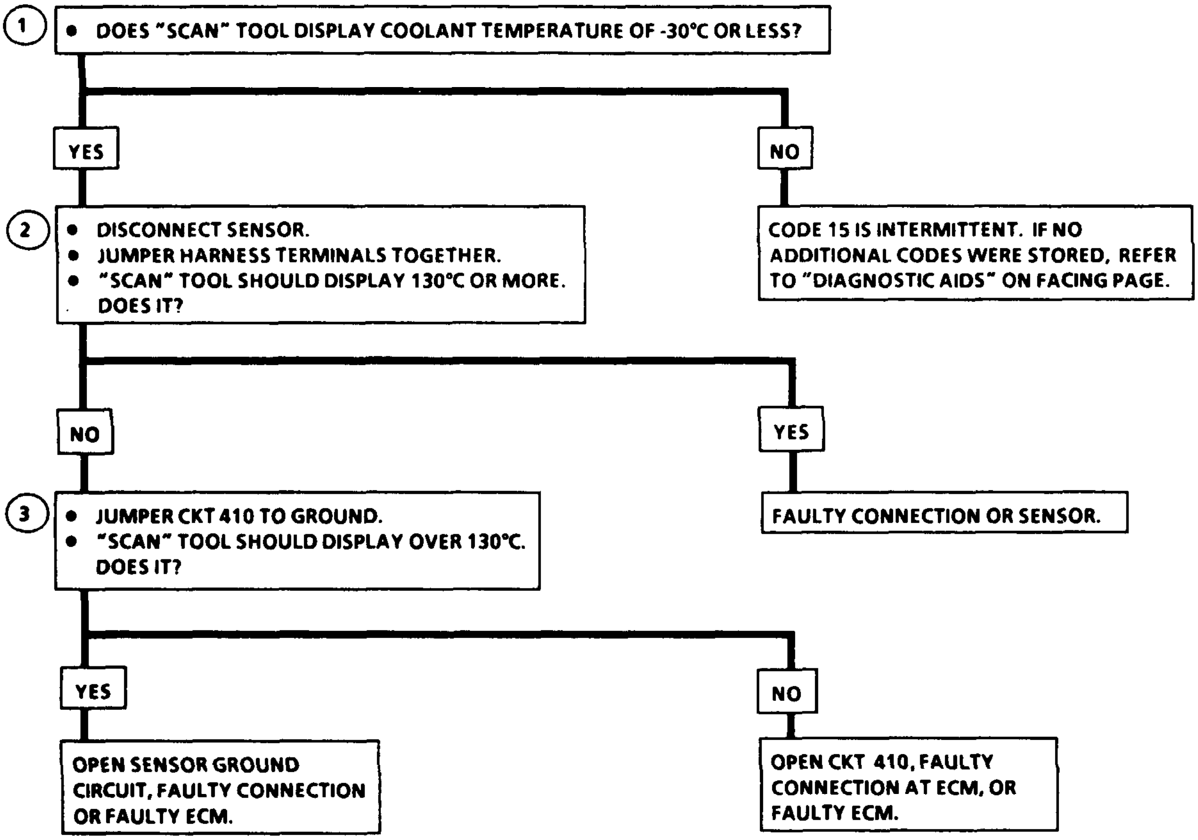
After the engine is started, the temperature should rise steadily to about 90°C (194°F), then stabilize when the thermostat opens.

If the engine has been allowed to cool to an ambient temperature (overnight), coolant and MAT temperature may be checked with a “Scan” tool and should read close to each other.

A Code 15 will result if CKTs 410 or 452 are open.

If Code 15 is intermittent, refer to Section “B.”

CODE 15
COOLANT TEMPERATURE SENSOR (CTS) CIRCUIT
(LOW TEMPERATURE INDICATED)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



① • DOES "SCAN" TOOL DISPLAY COOLANT TEMPERATURE OF -30°C OR LESS?

② • DISCONNECT SENSOR.
• JUMPER HARNESS TERMINALS TOGETHER.
• "SCAN" TOOL SHOULD DISPLAY 130°C OR MORE. DOES IT?

CODE 15 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

③ • JUMPER CKT 410 TO GROUND.
• "SCAN" TOOL SHOULD DISPLAY OVER 130°C. DOES IT?

FAULTY CONNECTION OR SENSOR.

OPEN SENSOR GROUND CIRCUIT, FAULTY CONNECTION OR FAULTY ECM.

OPEN CKT 410, FAULTY CONNECTION AT ECM, OR FAULTY ECM.

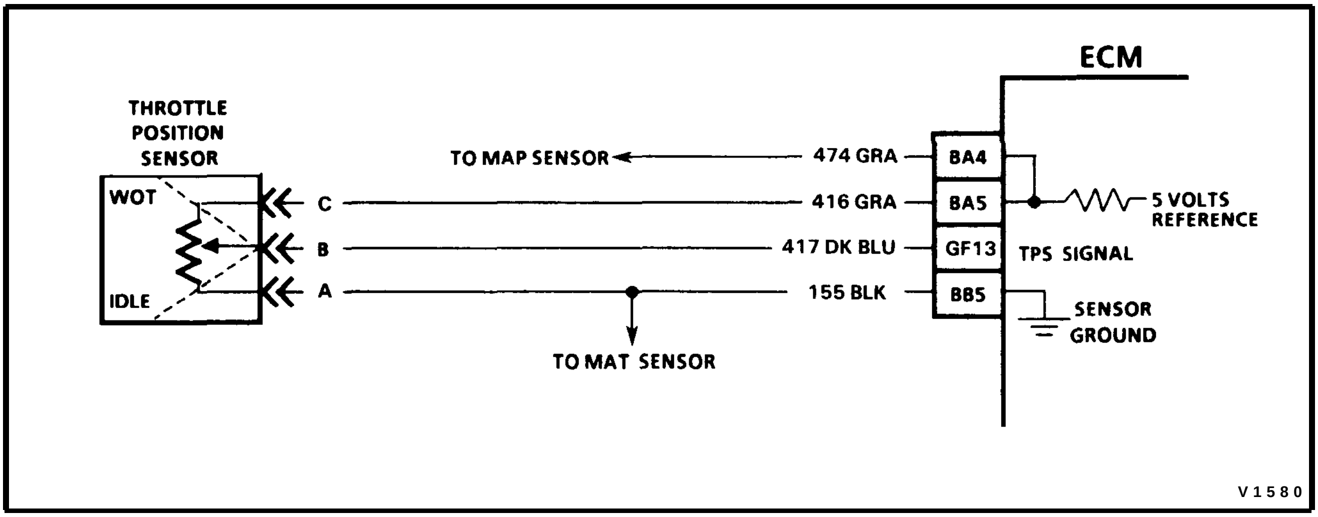
DIAGNOSTIC AID

COOLANT SENSOR
TEMPERATURE TO RESISTANCE VALUES
(APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1885



CODE 21

THROTTLE POSITION SENSOR (TPS) CIRCUIT

(SIGNAL VOLTAGE HIGH)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle valve. Signal voltage will vary from less than 1.0 volt at idle to about 4.6 volts at wide open throttle (WOT).

The TPS signal is one of the most important inputs used by the ECM for fuel control and for many of the ECM controlled outputs.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

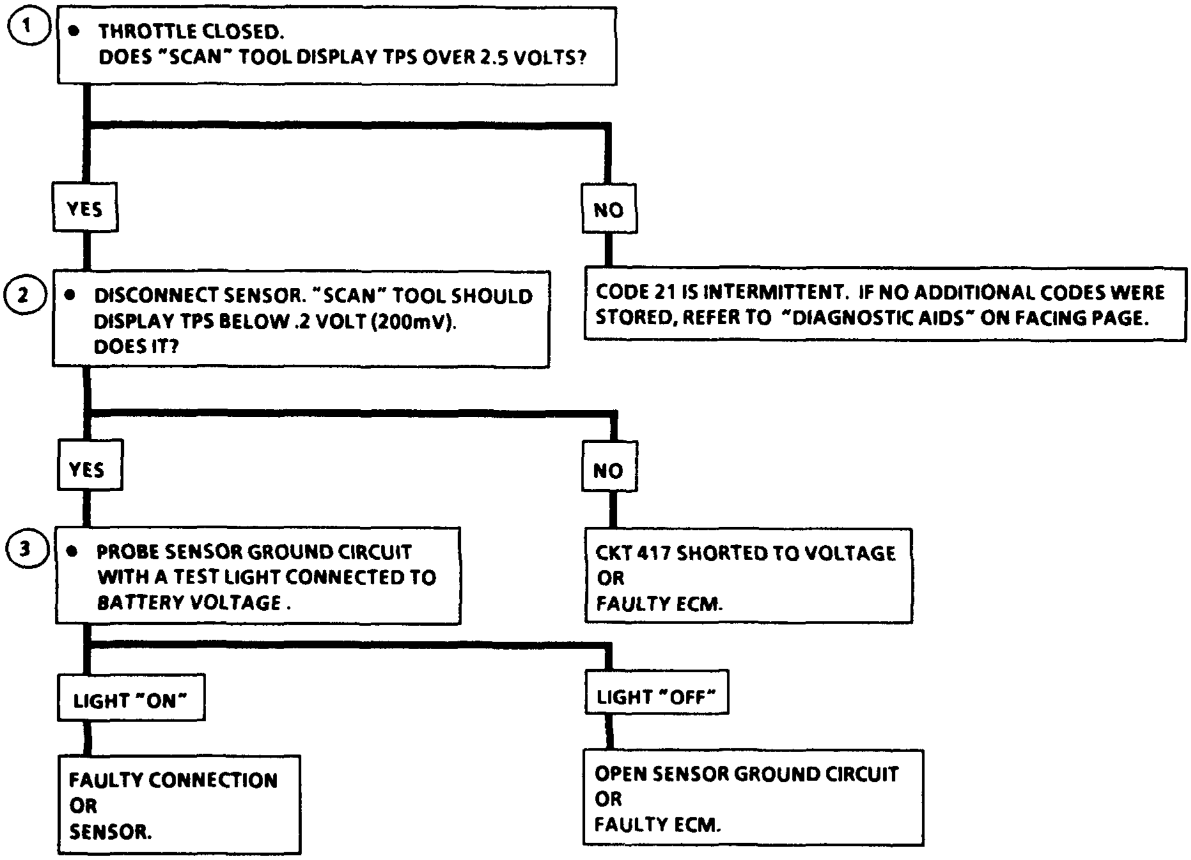
1. This step checks to see if Code 21 is the result of a hard failure or an intermittent condition.
   A Code 21 will set if:
   - TPS reading above 2.5 volts
   - MAP reading below 70 kPa (M/T) or 81 kPa (A/T)
   - Engine speed less than 1300 rpm
   - All of the above conditions are present for 10 seconds
2. This step simulates conditions for a Code 22. If the ECM recognizes the change of state, the ECM and CKTs 416 and 417 are OK.
3. This step isolates a faulty sensor, ECM, or an open CKT 155.

Diagnostic Aids:

A “Scan” tool displays throttle position in volts. Closed throttle voltage should be less than 1.0 volt. TPS voltage should increase at a steady rate as throttle is moved to WOT.

A Code 21 will result if CKT 155 is open or CKT 417 is shorted to voltage. If Code 21 is intermittent, refer to Section “B”.

CODE 21
THROTTLE POSITION SENSOR (TPS) CIRCUIT
(SIGNAL VOLTAGE HIGH)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



① • THROTTLE CLOSED.
DOES "SCAN" TOOL DISPLAY TPS OVER 2.5 VOLTS?

CODE 21 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

② • DISCONNECT SENSOR. "SCAN" TOOL SHOULD DISPLAY TPS BELOW .2 VOLT (200mV).
DOES IT?

CKT 417 SHORTED TO VOLTAGE
OR
FAULTY ECM.

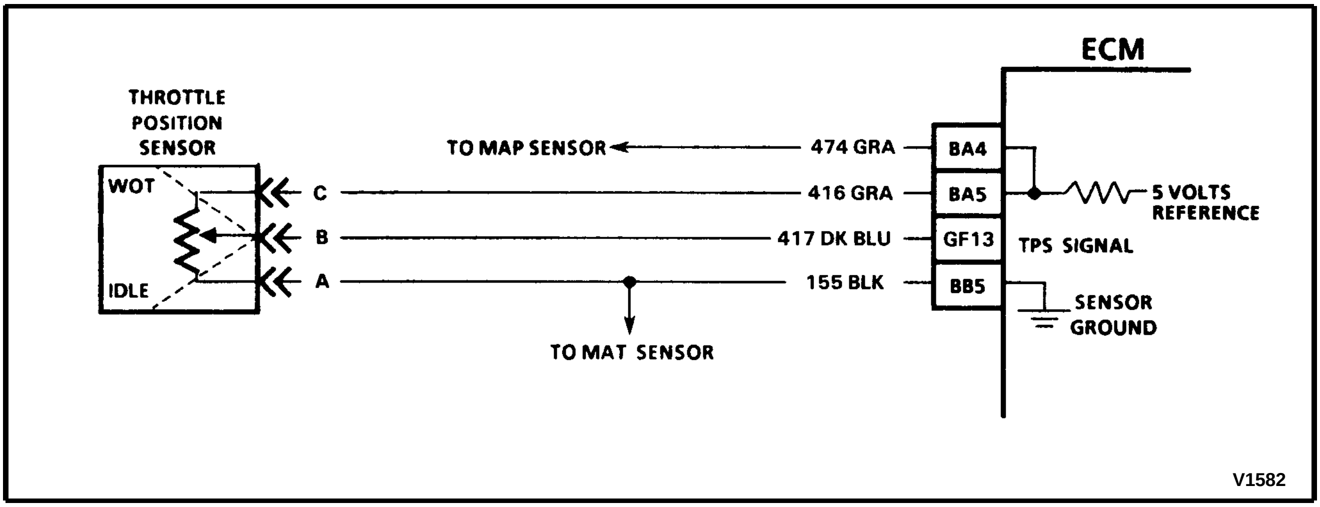
③ • PROBE SENSOR GROUND CIRCUIT WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE.

FAULTY CONNECTION
OR
SENSOR.

OPEN SENSOR GROUND CIRCUIT
OR
FAULTY ECM.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND ND "CHECK ENGINE" LIGHT.

V1886



CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT

(SIGNAL VOLTAGE LOW)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Throttle Position Sensor (TPS) provides a voltage signal that changes relative to the throttle valve. Signal voltage will vary from less than 1.0 volt at idle to about 4.5 volts at wide open throttle (WOT).

The TPS signal is one of the most important inputs used by the ECM for fuel control and for many of the ECM controlled outputs.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 22 will set if:
   - Engine is running
   - TPS signal voltage is less than .2 volt for 4 seconds
2. Simulates Code 21: (high voltage). If ECM recognizes the high signal voltage the ECM and wiring are OK.
3. With closed throttle, ignition “ON” or at idle, voltage at “GF13” should be .36-.44 volt. If not, replace the TPS. See Section “6E3-C2” for replacement procedures.
4. Simulates a high signal voltage. Checks CKT 417 for an open.

Diagnostic Aids:

A “Scan” tool reads throttle position in volts. Voltage should increase at a steady rate as throttle is moved toward WOT.

Also some “Scan” tools will read throttle angle 0% = closed throttle, 100% = WOT.

An open or short to ground in CKTs 416 or 417 will result in a Code 22.

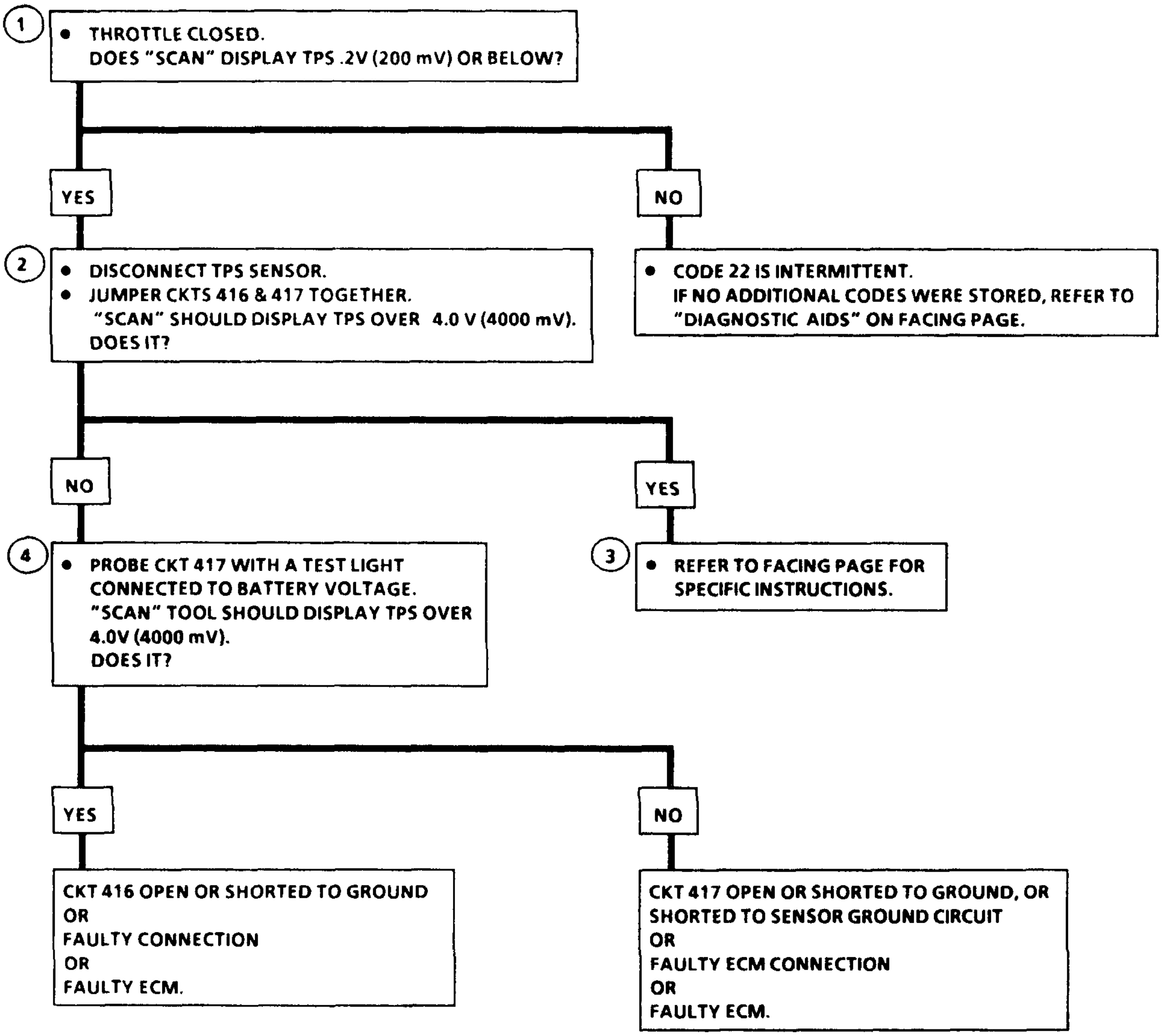
- Poor Connection or Damaged Harness. Inspect ECM harness connectors for backed out terminal “GF13,” improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.
- Intermittent Test. If connections and harness check OK, monitor TPS voltage display while moving related connectors and wiring harness. If the failure is induced, the display will change. This may help to isolate the location of the malfunction.
- TPS Scaling. Observe TPS voltage display while depressing accelerator pedal with engine stopped and ignition “ON.” Display should vary from closed throttle TPS voltage when throttle was closed, to over 4.5 volts (4500 mV) when throttle is held at wide open throttle position.

CODE 22

THROTTLE POSITION SENSOR (TPS) CIRCUIT

(SIGNAL VOLTAGE LOW)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



① • THROTTLE CLOSED.
DOES "SCAN" DISPLAY TPS .2V (200 mV) OR BELOW?

YES → ② • DISCONNECT TPS SENSOR.
• JUMPER CKTS 416 & 417 TOGETHER.
"SCAN" SHOULD DISPLAY TPS OVER 4.0 V (4000 mV).
DOES IT?

NO → • CODE 22 IS INTERMITTENT.
IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

(from ②) NO → ④ • PROBE CKT 417 WITH A TEST LIGHT CONNECTED TO BATTERY VOLTAGE.
"SCAN" TOOL SHOULD DISPLAY TPS OVER 4.0V (4000 mV).
DOES IT?

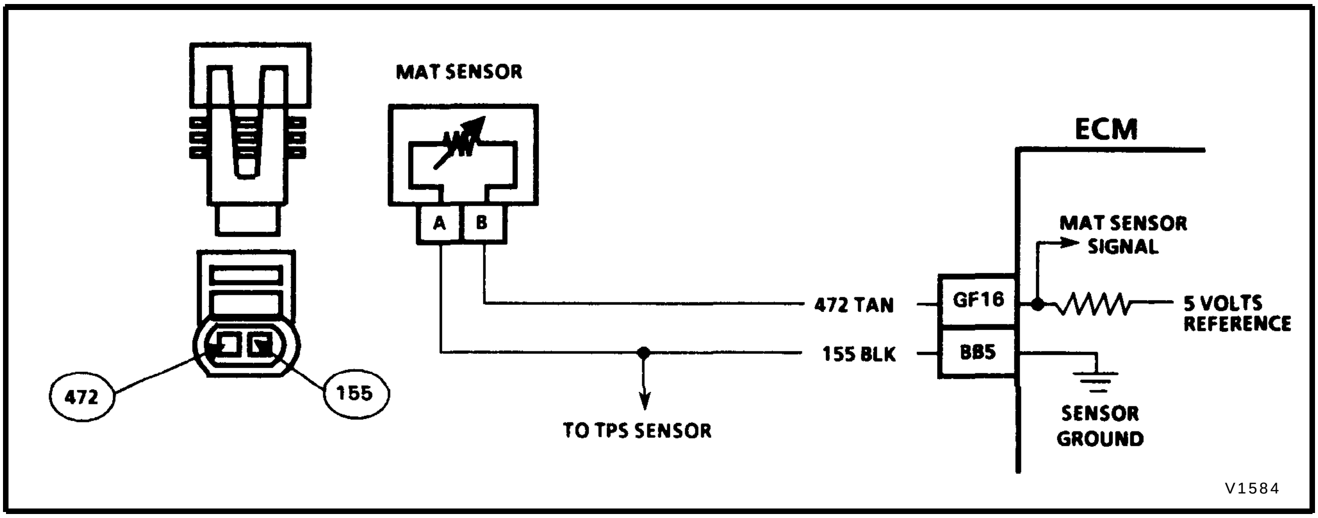
(from ②) YES → ③ • REFER TO FACING PAGE FOR SPECIFIC INSTRUCTIONS.

(from ④) YES → CKT 416 OPEN OR SHORTED TO GROUND
OR
FAULTY CONNECTION
OR
FAULTY ECM.

(from ④) NO → CKT 417 OPEN OR SHORTED TO GROUND, OR SHORTED TO SENSOR GROUND CIRCUIT
OR
FAULTY ECM CONNECTION
OR
FAULTY ECM.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1887



CODE 23

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(LOW TEMPERATURE INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Manifold Air Temperature (MAT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage (about 5 volts) on CKT 472 to the sensor. When the air is cold the sensor (thermistor) resistance is high, therefore the ECM will see a high signal voltage. If the air is warm, the sensor resistance is low, therefore, the ECM will detect a low voltage.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

Code 23 will set if:

- A signal voltage indicates a manifold air temperature below -30°C (-22°F).
- Boost conditions are present.

Due to the conditions necessary to set a Code 23, the "Check Engine" light will only stay "ON" while the fault is present.

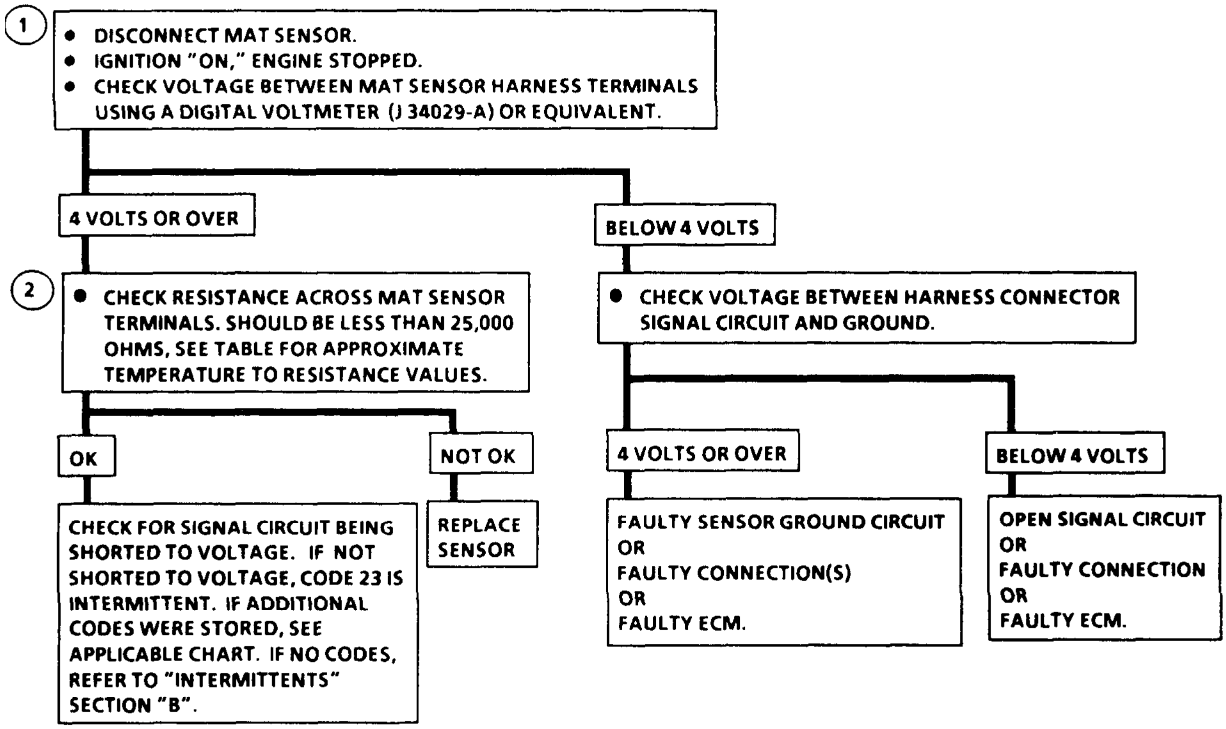
1. A "Scan" tool may not be used to diagnose this fault, due to the ECM transmitting "default" (substitute) values while the fault is present. A Code 23 will set due to an open sensor, wire, or connection. This test will determine if the wiring and ECM are OK.
2. If the resistance is greater than 25,000 ohms, replace the sensor.

CODE 23

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(LOW TEMPERATURE INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- DISCONNECT MAT SENSOR.
- IGNITION "ON," ENGINE STOPPED.
- CHECK VOLTAGE BETWEEN MAT SENSOR HARNESS TERMINALS USING A DIGITAL VOLTMETER (J 34029-A) OR EQUIVALENT.

②
- CHECK RESISTANCE ACROSS MAT SENSOR TERMINALS. SHOULD BE LESS THAN 25,000 OHMS, SEE TABLE FOR APPROXIMATE TEMPERATURE TO RESISTANCE VALUES.

CHECK FOR SIGNAL CIRCUIT BEING SHORTED TO VOLTAGE. IF NOT SHORTED TO VOLTAGE, CODE 23 IS INTERMITTENT. IF ADDITIONAL CODES WERE STORED, SEE APPLICABLE CHART. IF NO CODES, REFER TO "INTERMITTENTS" SECTION "B".

REPLACE SENSOR

- CHECK VOLTAGE BETWEEN HARNESS CONNECTOR SIGNAL CIRCUIT AND GROUND.

FAULTY SENSOR GROUND CIRCUIT
OR
FAULTY CONNECTION(S)
OR
FAULTY ECM.

OPEN SIGNAL CIRCUIT
OR
FAULTY CONNECTION
OR
FAULTY ECM.

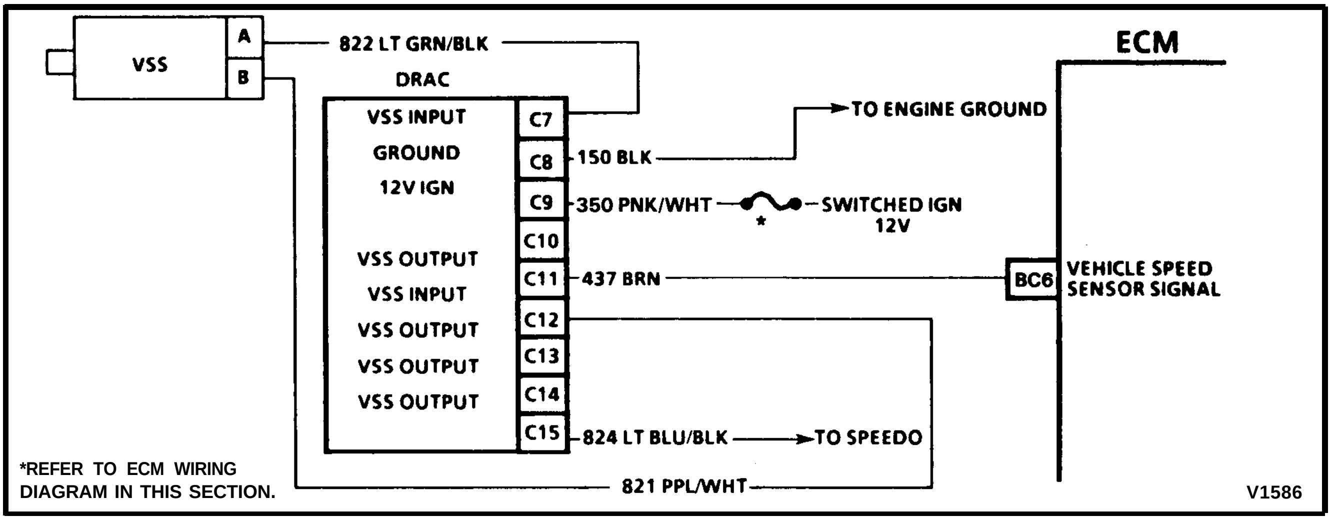
MAT SENSOR

TEMPERATURE TO RESISTANCE VALUES (APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,800
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND ND "CHECK ENGINE" LIGHT.

V1888



CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM applies and monitors 12 volts on CKT 437. CKT 437 connects to the DRAC, which alternately grounds CKT 437, when receiving voltage pulses from Vehicle Speed Sensor (VSS) when drive wheels are turning. This pulsing action takes place about 2000 times per mile and the ECM will calculate vehicle speed based on the time between "pulses."

A "Scan" tool reading should closely match the speedometer reading with drive wheels turning.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Code 24 will set if:
   - CKT 437 voltage is constant.
   - Engine speed is more than 1200 rpm
   - Vehicle speed signal indicates less than 2 mph (3 km/h) on Tech 1.
   - Not in park or neutral.
   - All conditions must be met for 5 seconds.

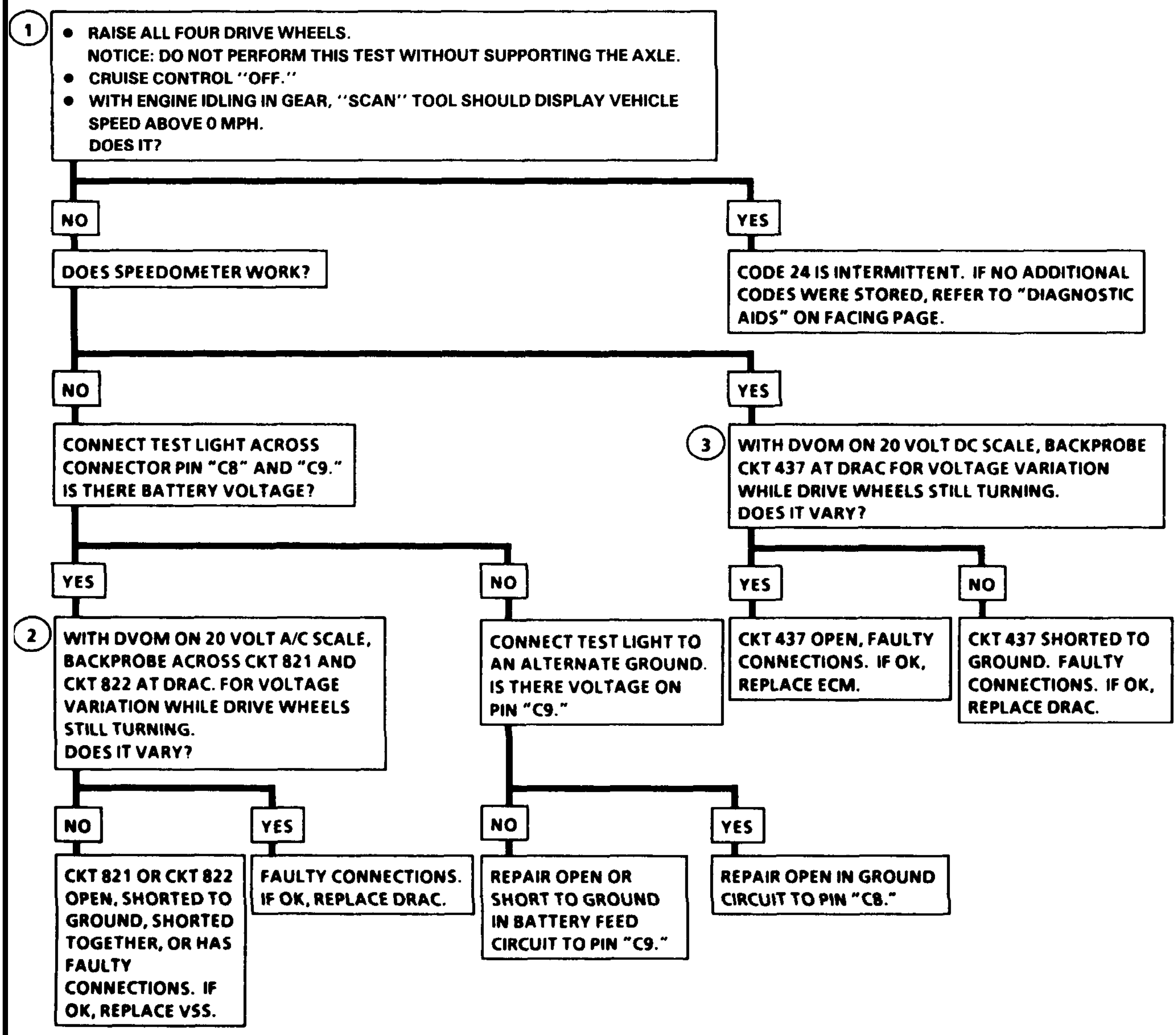
   These conditions are met during a road load deceleration.
2. This test determines if the DRAC is receiving the A/C signal from the VSS.
3. This test monitors the DRAC voltage on CKT 437. With the wheels turning, the pulsing action will result in a varying voltage. The variation will be greater at low wheel speeds to an average of 4-6 volts at about 20 mph (32 km/h).

Diagnostic Aids:

1. "Scan" reading should closely match speedometer reading, with drive wheels turning.
2. Check Park/Neutral (P/N) switch diagnosis chart.
3. If Park/Neutral (P/N) switch is OK, refer to "Intermittents" in "Symptoms," Section "B."

CODE 24

VEHICLE SPEED SENSOR (VSS) CIRCUIT
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- RAISE ALL FOUR DRIVE WHEELS.
  NOTICE: DO NOT PERFORM THIS TEST WITHOUT SUPPORTING THE AXLE.
- CRUISE CONTROL "OFF."
- WITH ENGINE IDLING IN GEAR, "SCAN" TOOL SHOULD DISPLAY VEHICLE SPEED ABOVE 0 MPH.
  DOES IT?

DOES SPEEDOMETER WORK?

CODE 24 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

CONNECT TEST LIGHT ACROSS CONNECTOR PIN "C8" AND "C9."
IS THERE BATTERY VOLTAGE?

③ WITH DVOM ON 20 VOLT DC SCALE, BACKPROBE CKT 437 AT DRAC FOR VOLTAGE VARIATION WHILE DRIVE WHEELS STILL TURNING.
DOES IT VARY?

② WITH DVOM ON 20 VOLT A/C SCALE, BACKPROBE ACROSS CKT 821 AND CKT 822 AT DRAC. FOR VOLTAGE VARIATION WHILE DRIVE WHEELS STILL TURNING.
DOES IT VARY?

CONNECT TEST LIGHT TO AN ALTERNATE GROUND. IS THERE VOLTAGE ON PIN "C9."

CKT 437 OPEN, FAULTY CONNECTIONS. IF OK, REPLACE ECM.

CKT 437 SHORTED TO GROUND. FAULTY CONNECTIONS. IF OK, REPLACE DRAC.

CKT 821 OR CKT 822 OPEN, SHORTED TO GROUND, SHORTED TOGETHER, OR HAS FAULTY CONNECTIONS. IF OK, REPLACE VSS.

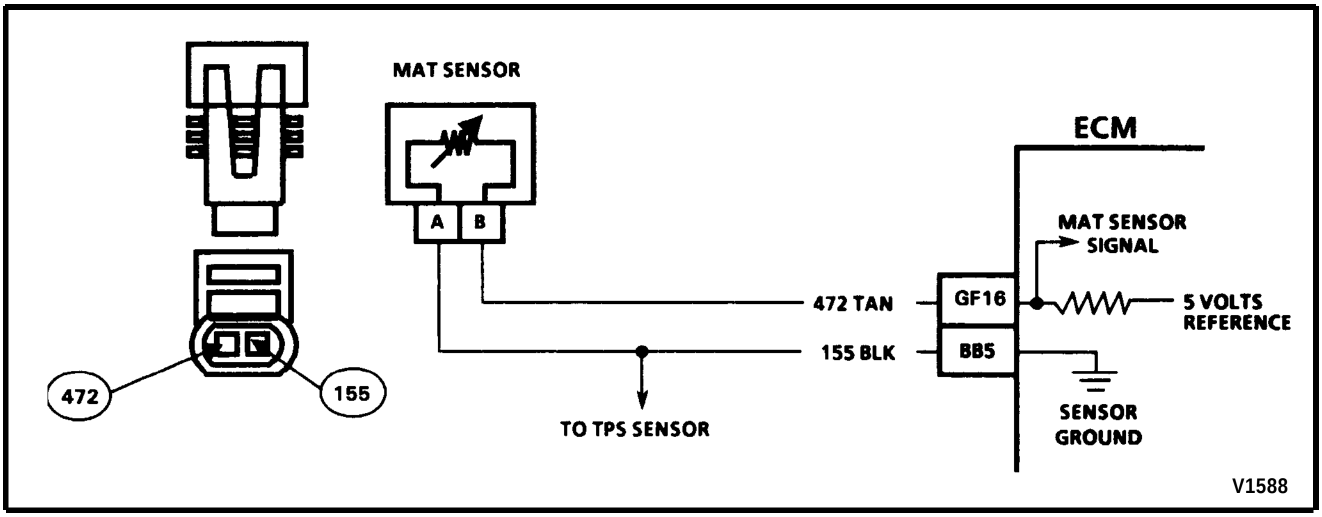
FAULTY CONNECTIONS. IF OK, REPLACE DRAC.

REPAIR OPEN OR SHORT TO GROUND IN BATTERY FEED CIRCUIT TO PIN "C9."

REPAIR OPEN IN GROUND CIRCUIT TO PIN "C8."

"AFTER REPAIRS," REFER TO CODE CRITERIA ON FACING PAGE AND CONFIRM CODE DOES NOT RESET.

V1089



CODE 25

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(HIGH TEMPERATURE INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Manifold Air Temperature (MAT) sensor uses a thermistor to control the signal voltage to the ECM. The ECM applies a voltage (4-6 volts) on CKT 472 to the sensor. When manifold air is cold, the sensor (thermistor) resistance is high, therefore the ECM will detect a high signal voltage. If the air warms, the sensor resistance becomes less, and the voltage drops.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

Code 25 will set if the engine is not experiencing turbocharger boost and the following conditions are met:

- Signal voltage indicates a manifold air temperature greater than 135°C (275°F).
- The above requirement is met for at least 30 seconds.

Due to the conditions necessary to set a Code 25, the “Check Engine” light will only stay “ON” while the fault is present.

1. A “Scan” tool may not be used to diagnose this fault due to the ECM transmitting “default” (substitute) values while the fault is present. If voltage is above 4 volts, the ECM and wiring are OK.
2. If the resistance is less than 100 ohms, replace the sensor.

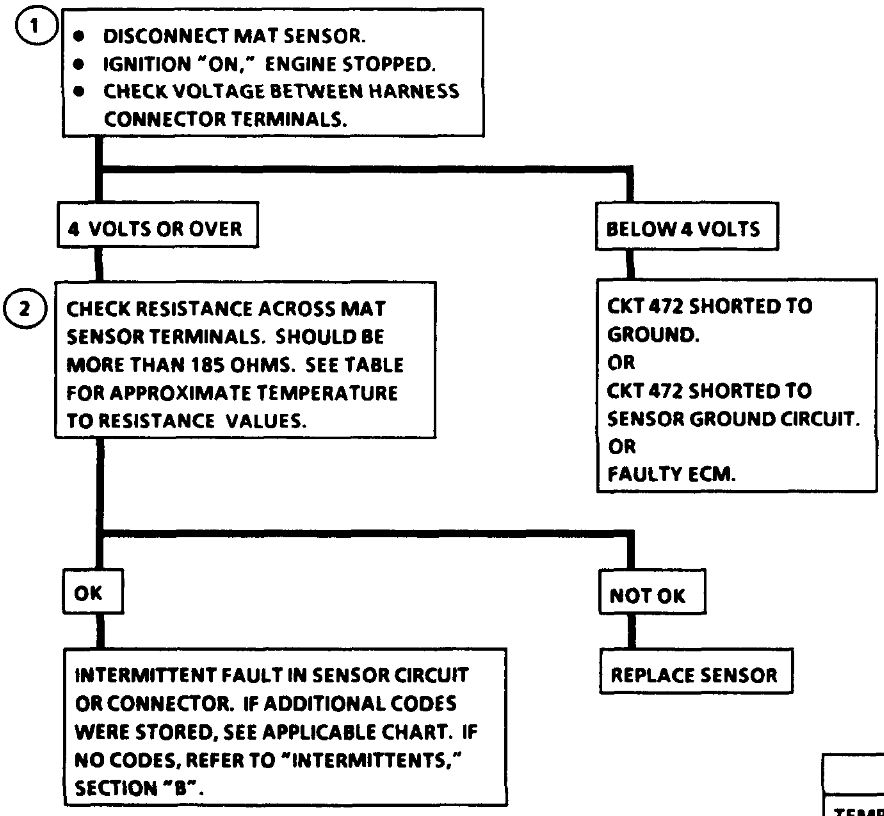
CODE 25

MANIFOLD AIR TEMPERATURE (MAT) SENSOR CIRCUIT

(HIGH TEMPERATURE INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

NOTE: A "SCAN" TOOL MAY NOT BE USED TO DIAGNOSE THIS FAULT, DUE TO THE ECM TRANSMITTING "DEFAULT" (SUBSTITUTE) VALUES WHEN THE FAULT IS PRESENT.



①
- DISCONNECT MAT SENSOR.
- IGNITION "ON," ENGINE STOPPED.
- CHECK VOLTAGE BETWEEN HARNESS CONNECTOR TERMINALS.

4 VOLTS OR OVER

② CHECK RESISTANCE ACROSS MAT SENSOR TERMINALS. SHOULD BE MORE THAN 185 OHMS. SEE TABLE FOR APPROXIMATE TEMPERATURE TO RESISTANCE VALUES.

OK

INTERMITTENT FAULT IN SENSOR CIRCUIT OR CONNECTOR. IF ADDITIONAL CODES WERE STORED, SEE APPLICABLE CHART. IF NO CODES, REFER TO "INTERMITTENTS," SECTION "B".

NOT OK

REPLACE SENSOR

BELOW 4 VOLTS

CKT 472 SHORTED TO GROUND.
OR
CKT 472 SHORTED TO SENSOR GROUND CIRCUIT.
OR
FAULTY ECM.

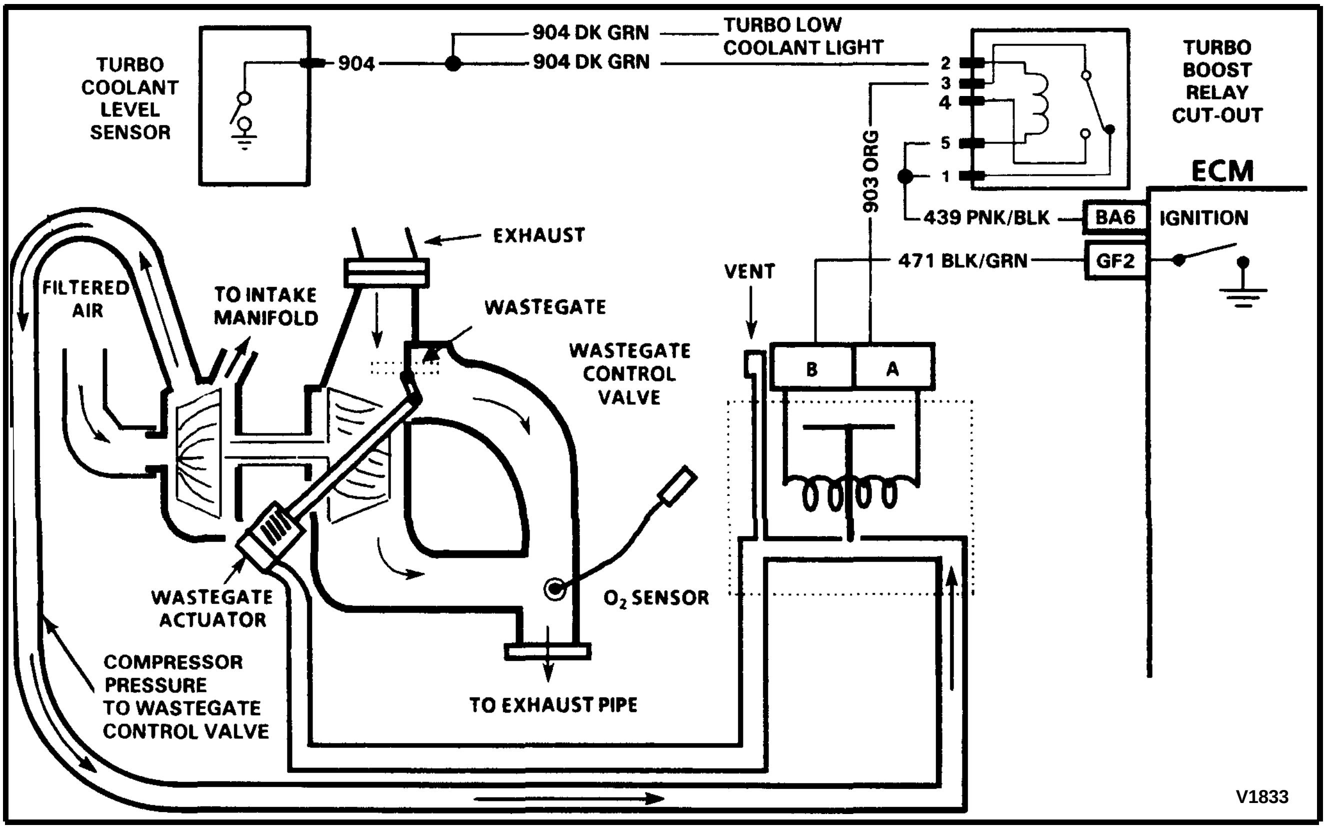
MAT SENSOR

TEMPERATURE TO RESISTANCE VALUES (APPROXIMATE)

°F	°C	OHMS
210	100	185
160	70	450
100	38	1,600
70	20	3,400
40	4	7,500
20	-7	13,500
0	-18	25,000
-40	-40	100,700

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1890



CODE 31

(Page 1 of 2)

TURBO WASTEGATE OVERBOOST

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

On turbo charged engines, the exhaust gases pass from the exhaust manifold through the turbocharger, turning the turbine blades. The compressor side of the turbocharger also turns, pulling air through the air filter and pushing the air into the intake manifold, pressurizing the intake manifold.

The wastegate is normally closed, but opens to bypass exhaust gas to prevent an overboost condition. The wastegate will open when pressure is a lied to the actuator, and is controlled by a wastegate control solenoid valve pulsed “ON” and “OFF” by the ECM. Under normal driving conditions, the control solenoid is energized all the time which closes “OFF” the manifold pressure to the wastegate actuator. This allows for a rapid increase in boost pressure. A boost increase will be detected by the MAP sensor, and the ECM will pulse the wastegate control valve. Manifold pressure will then be allowed to pass to the wastegate actuator, and the actuator will open the wastegate. This will prevent an overboost condition on heavy acceleration. As boost pressure decreases, the ECM closes the control valve and the wastegate actuator pressure bleeds “OFF” through the vent in the control valve. If an overboost does exist as indicated by the MAP sensor, the ECM will reduce fuel delivery to prevent damage to the engine.

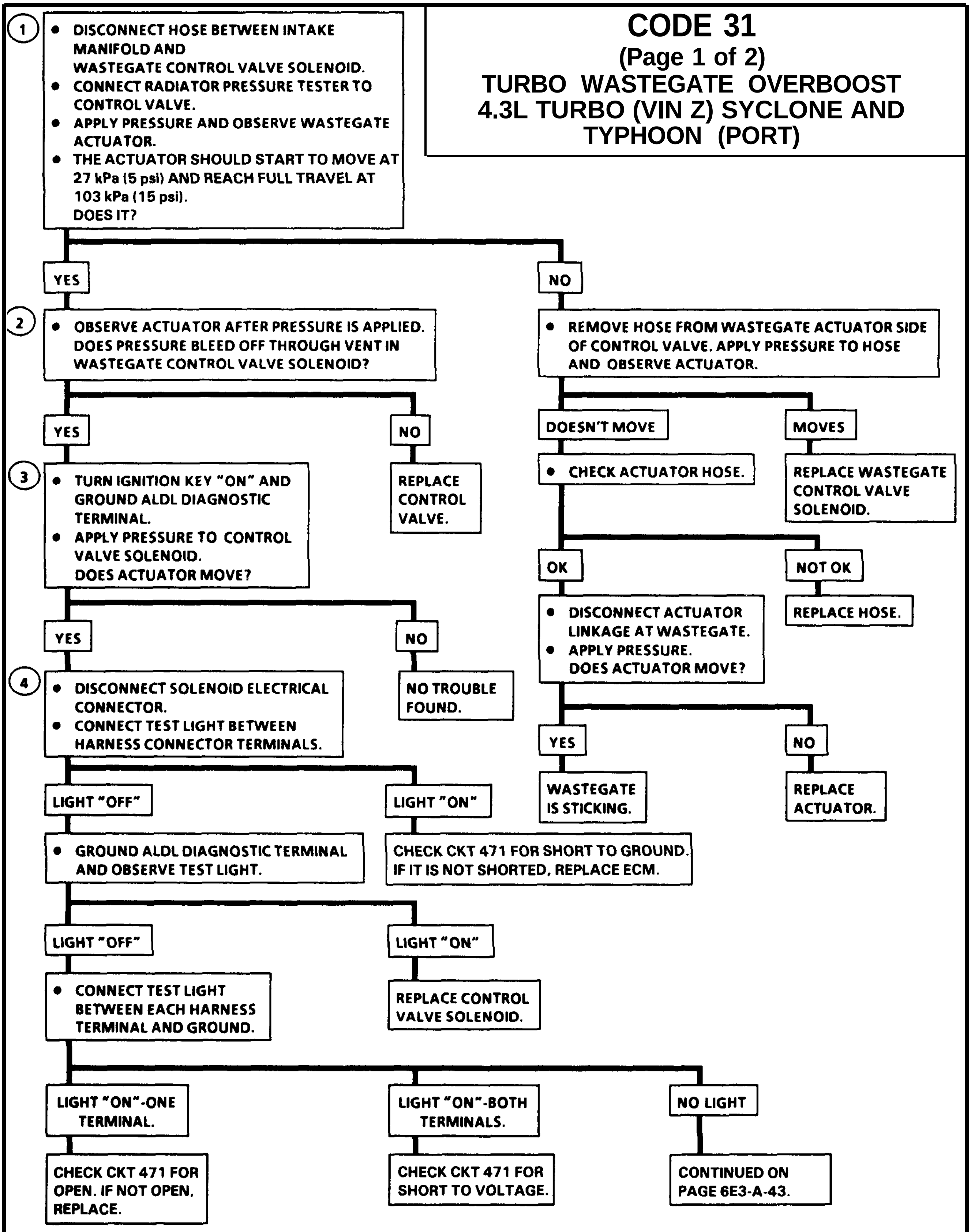
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. A Code 31 will set when the manifold absolute pressure exceeds 205 kPa of boost for two seconds, and a Code 33 has not previously been set. Code 31 will set, but the “Check Engine” light will stay “ON” only while the overboost exists. The light will stay “ON” for 10 seconds after the condition exists and then go “OUT.”

   An overboost condition could be caused by:
   - CKT 471 shorted to ground
   - A sticking wastegate actuator or wastegate
   - A control valve stuck in the closed position
   - A cut or pinched hose
   - A faulty ECM
   - An extremely dirty air filter

   With ignition shut “OFF,” the control valve solenoid is open.
2. After the 103 kPa (15 psi) is applied to valve and then the pressure source is removed, the actuator should slowly move **back** and close the wastegate. If the pressure does not **bleed** “OFF,” the **vent** in the control valve solenoid could be plugged.
3. With the ignition “ON” and the diagnostic terminal grounded, the' control valve solenoid should **be** energized. This closes “OFF” the manifold to the wastegate actuator.
4. Check the electrical control portion of the system. With key “ON” **and** engine not running, the solenoid should not be energized.

CODE 31
(Page 1 of 2)
TURBO WASTEGATE OVERBOOST 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- DISCONNECT HOSE BETWEEN INTAKE MANIFOLD AND WASTEGATE CONTROL VALVE SOLENOID.
- CONNECT RADIATOR PRESSURE TESTER TO CONTROL VALVE.
- APPLY PRESSURE AND OBSERVE WASTEGATE ACTUATOR.
- THE ACTUATOR SHOULD START TO MOVE AT 27 kPa (5 psi) AND REACH FULL TRAVEL AT 103 kPa (15 psi).

DOES IT?

YES

②
- OBSERVE ACTUATOR AFTER PRESSURE IS APPLIED. DOES PRESSURE BLEED OFF THROUGH VENT IN WASTEGATE CONTROL VALVE SOLENOID?

YES

③
- TURN IGNITION KEY "ON" AND GROUND ALDL DIAGNOSTIC TERMINAL.
- APPLY PRESSURE TO CONTROL VALVE SOLENOID.

DOES ACTUATOR MOVE?

YES

④
- DISCONNECT SOLENOID ELECTRICAL CONNECTOR.
- CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMINALS.

LIGHT "OFF"

- GROUND ALDL DIAGNOSTIC TERMINAL AND OBSERVE TEST LIGHT.

LIGHT "OFF"

- CONNECT TEST LIGHT BETWEEN EACH HARNESS TERMINAL AND GROUND.

LIGHT "ON"-ONE TERMINAL.

CHECK CKT 471 FOR OPEN. IF NOT OPEN, REPLACE.

LIGHT "ON"-BOTH TERMINALS.

CHECK CKT 471 FOR SHORT TO VOLTAGE.

NO LIGHT

CONTINUED ON PAGE 6E3-A-43.

LIGHT "ON"

REPLACE CONTROL VALVE SOLENOID.

LIGHT "ON"

CHECK CKT 471 FOR SHORT TO GROUND. IF IT IS NOT SHORTED, REPLACE ECM.

NO

NO TROUBLE FOUND.

NO

REPLACE CONTROL VALVE.

NO

- REMOVE HOSE FROM WASTEGATE ACTUATOR SIDE OF CONTROL VALVE. APPLY PRESSURE TO HOSE AND OBSERVE ACTUATOR.

DOESN'T MOVE

- CHECK ACTUATOR HOSE.

OK

- DISCONNECT ACTUATOR LINKAGE AT WASTEGATE.
- APPLY PRESSURE.

DOES ACTUATOR MOVE?

YES

WASTEGATE IS STICKING.

NO

REPLACE ACTUATOR.

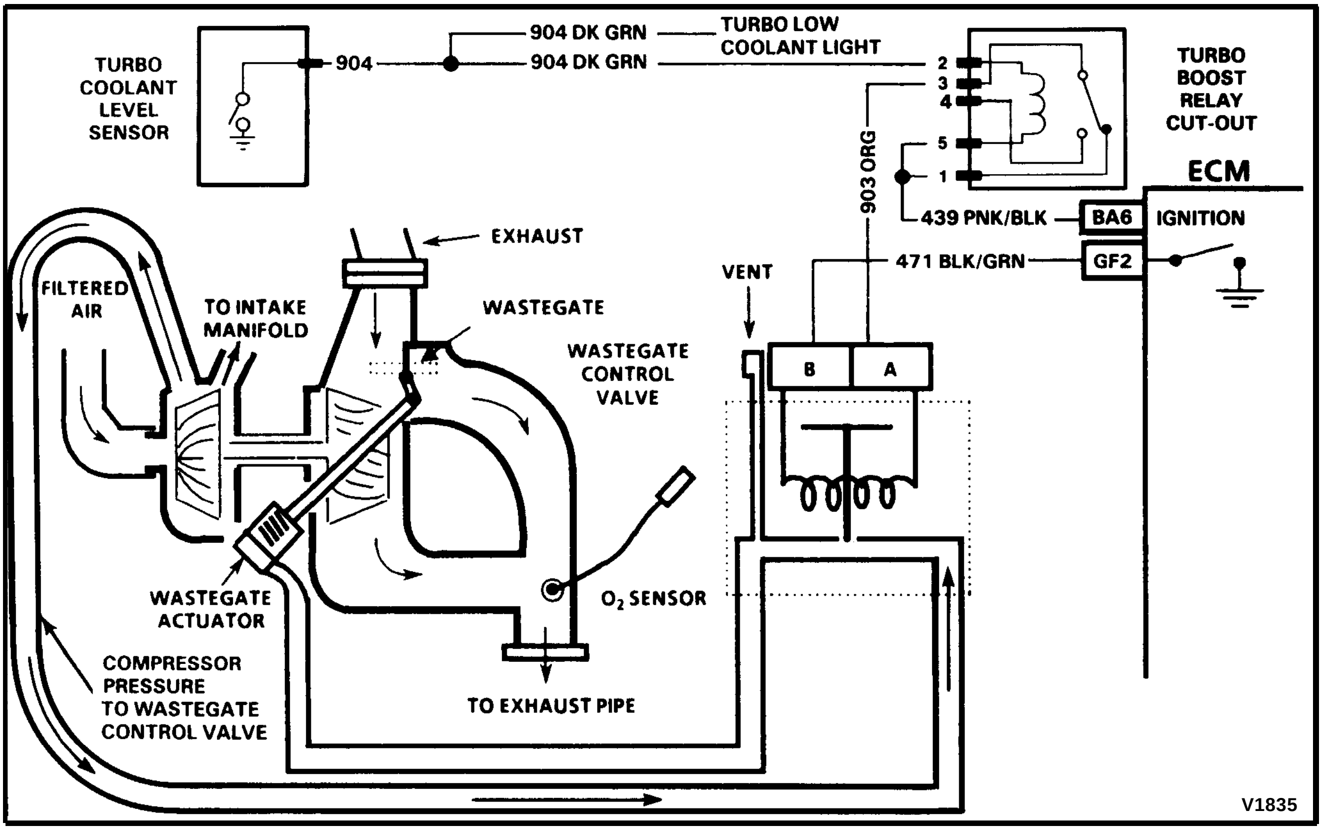
NOT OK

REPLACE HOSE.

MOVES

REPLACE WASTEGATE CONTROL VALVE SOLENOID.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.



CODE 31

(Page 2 of 2)

TURBO WASTEGATE OVERBOOST

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

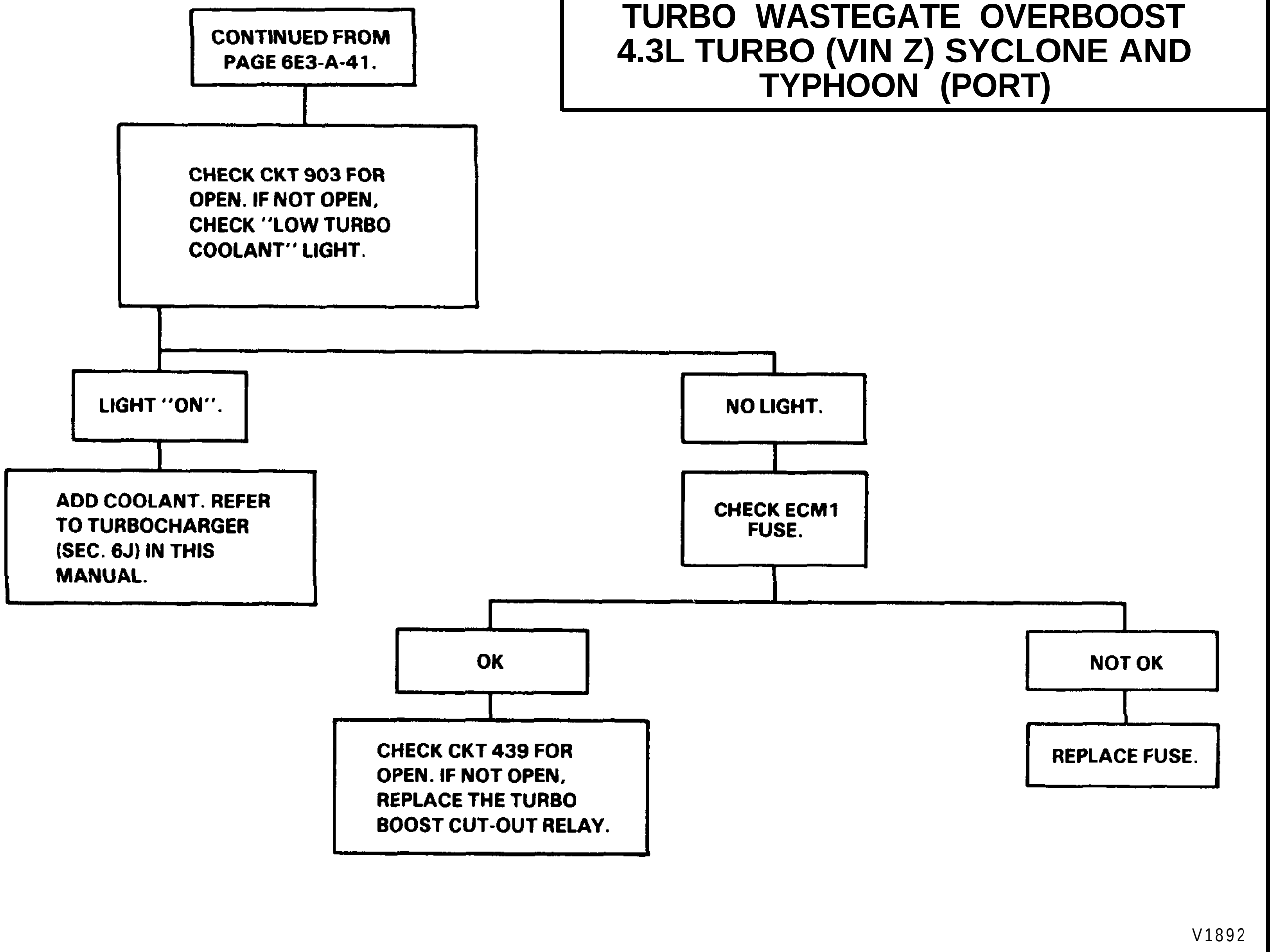
Circuit Description:

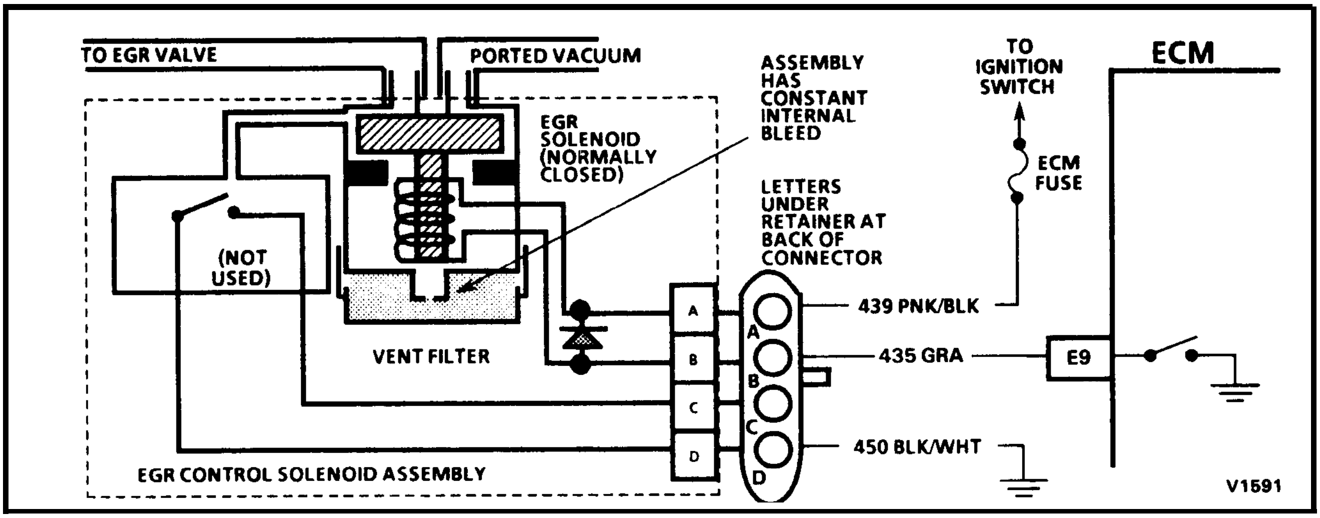
If the level of coolant in the charge air cooler (CAC) is low, the turbo boost cut-out relay will shut off all power to the wastegate solenoid. This will open the wastegate to bypass exhaust gas and lower the boost. The “LOW TURBO COOLANT” lamp will remain “ON” until coolant is added. To add turbo coolant, refer to “TURBOCHARGER” (SEC. 6J) in this manual.

CODE 31

(Page 2 of 2)

TURBO WASTEGATE OVERBOOST 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)





CODE 32

EXHAUST GAS RECIRCULATION (EGR) CIRCUIT
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM operates a vacuum solenoid to control the Exhaust Gas Recirculation (EGR) valve. This solenoid is normally closed. By providing a ground path, the ECM energizes the solenoid, allowing vacuum to reach the EGR valve.

Under certain conditions, when the EGR valve is normally open, the ECM tests the EGR function by de-energizing the EGR control solenoid, blocking vacuum to the EGR valve diaphragm. Without EGR, the system will sense a lean condition and will increase the fuel integrator rate in response. The ECM monitors the amount of fuel delivery increase. If the increase is below a specified value, the ECM will interpret that the test was failed. The failure indicates that closing the EGR valve when it would normally be open does not make a significant change, indicating a problem in the EGR system.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

The diagnostic chart covers checks for the entire EGR system. If no trouble is found but Code 32 was set, an intermittent electrical condition or a sticky EGR valve is at fault.

Diagnostic Aids:

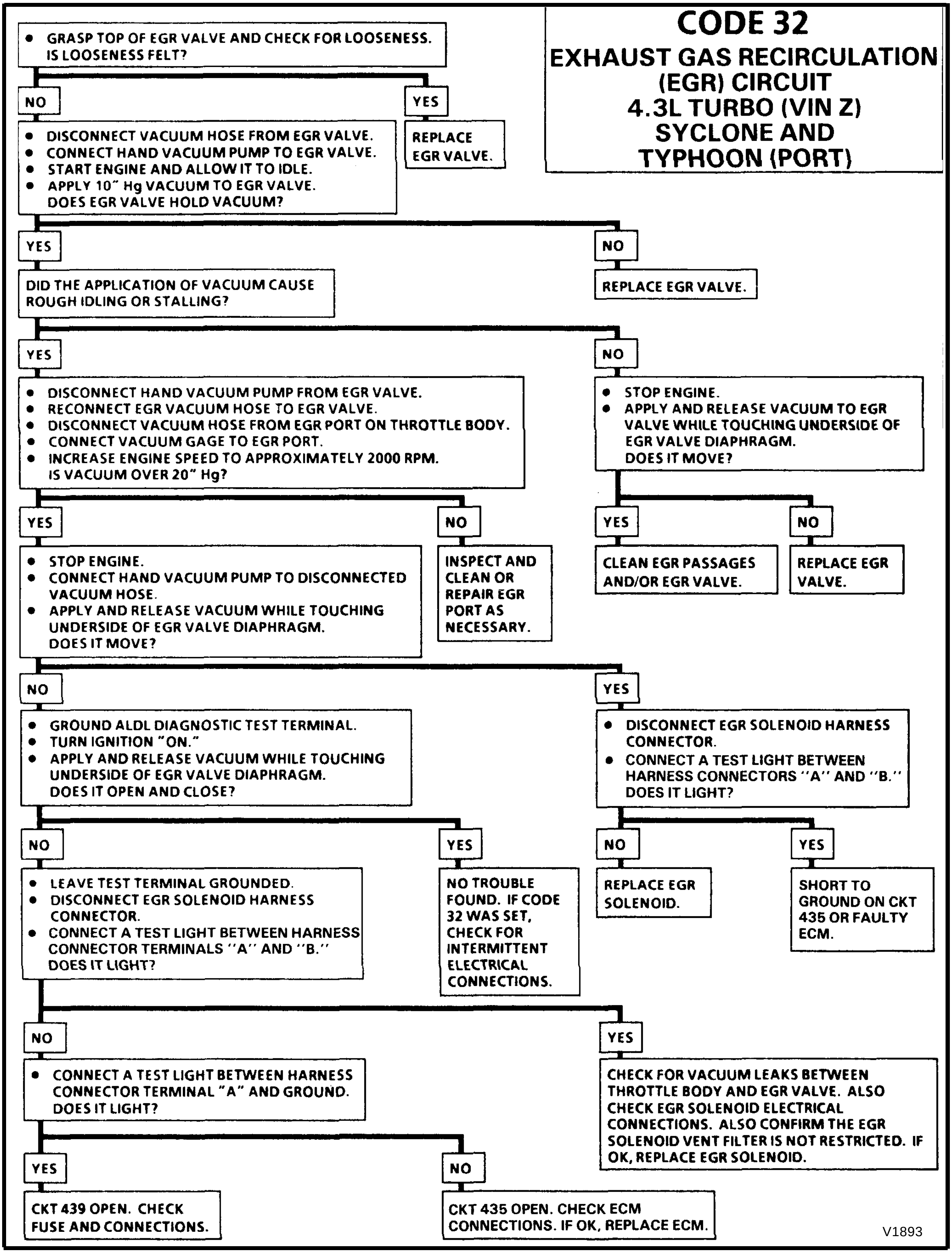
The vacuum switch in the EGR solenoid assembly is not used.

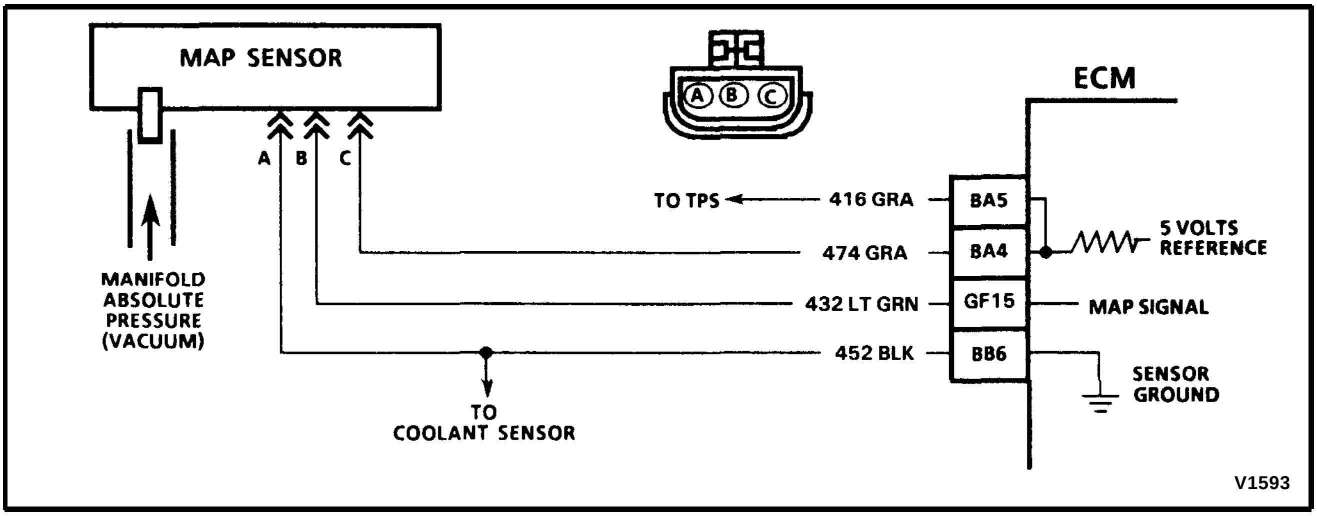
An EGR valve stuck open will cause a rough idle.

A plugged EGR solenoid vent filter could cause the EGR valve to remain open or to close slowly.

An inoperative check valve in the ported vacuum line will result in faulty EGR system operation.

CODE 32
EXHAUST GAS RECIRCULATION (EGR) CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)





CODE 33

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT

(SIGNAL VOLTAGE HIGH - LOW VACUUM)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from less than 1.0 volt at closed throttle idle, to 4-4.5 volts at wide open throttle (low vacuum or boost).

If the MAP sensor fails, the ECM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This step will determine if Code 33 is the result of a hard failure or an intermittent condition.

   A Code 33 will set if:

   - MAP signal voltage is too high (low vacuum)
   - TPS less than 2%
   - These conditions for a time longer than 5 seconds

2. This step simulates conditions for a Code 34. If the ECM recognizes the change, the ECM and CKTs 474 and 432 are OK. If CKT 452 is open, there may also be a stored Code 23.

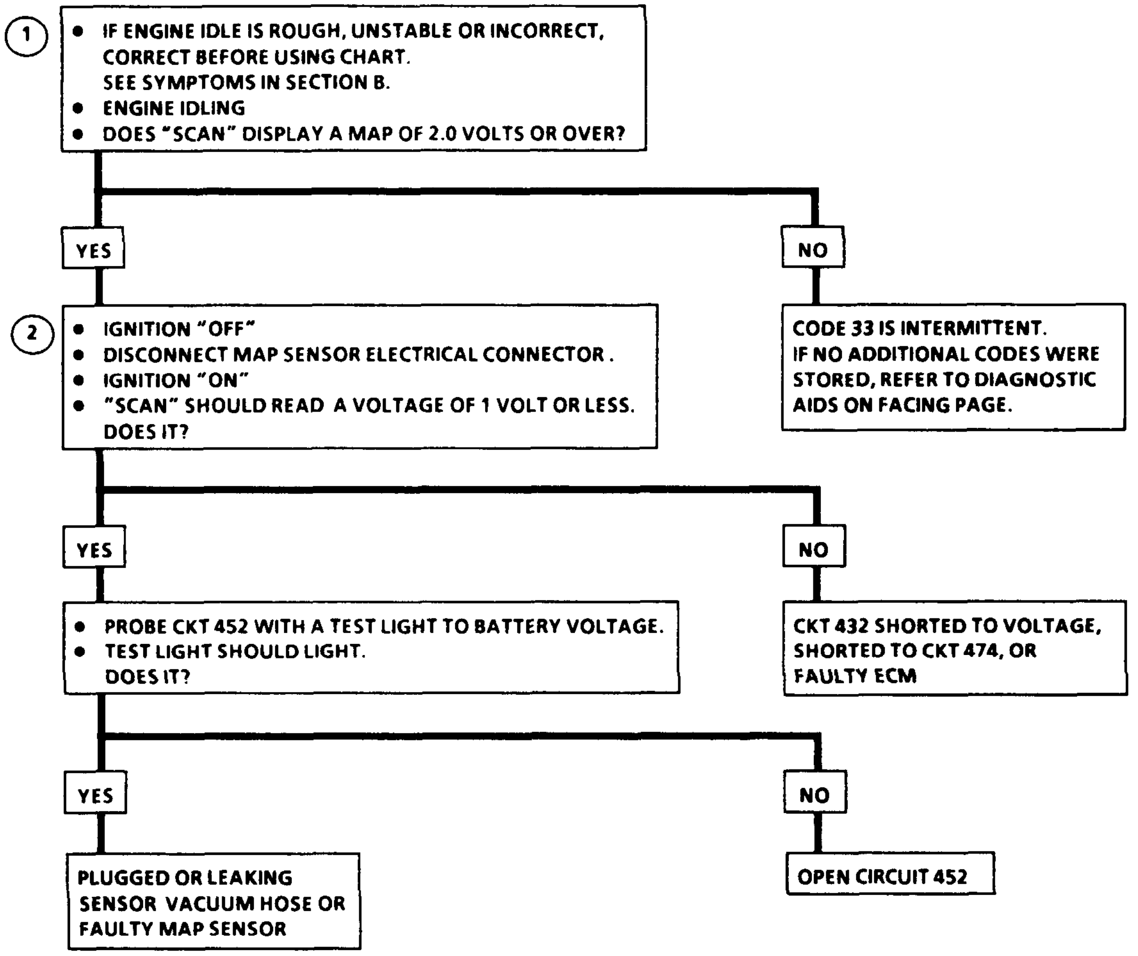
Diagnostic Aids:

With the ignition “ON” and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be approximately 2.5 volts. This information is used by the ECM as an indication of vehicle altitude and is referred to as BARO. Comparison of this BARO reading with a known good vehicle with the same sensor is a good way to check accuracy of a “suspect” sensor. Reading should be the same ± .4 volt.

A Code 33 will result if CKT 452 is open, or if CKT 432 is shorted to voltage or to CKT 474.

If Code 33 is intermittent, refer to Section “B”.

CODE 33
MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT
(SIGNAL VOLTAGE HIGH - LOW VACUUM)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- IF ENGINE IDLE IS ROUGH, UNSTABLE OR INCORRECT, CORRECT BEFORE USING CHART. SEE SYMPTOMS IN SECTION B.
- ENGINE IDLING
- DOES "SCAN" DISPLAY A MAP OF 2.0 VOLTS OR OVER?

YES

②
- IGNITION "OFF"
- DISCONNECT MAP SENSOR ELECTRICAL CONNECTOR .
- IGNITION "ON"
- "SCAN" SHOULD READ A VOLTAGE OF 1 VOLT OR LESS. DOES IT?

YES

- PROBE CKT 452 WITH A TEST LIGHT TO BATTERY VOLTAGE.
- TEST LIGHT SHOULD LIGHT. DOES IT?

YES

PLUGGED OR LEAKING SENSOR VACUUM HOSE OR FAULTY MAP SENSOR

NO

OPEN CIRCUIT 452

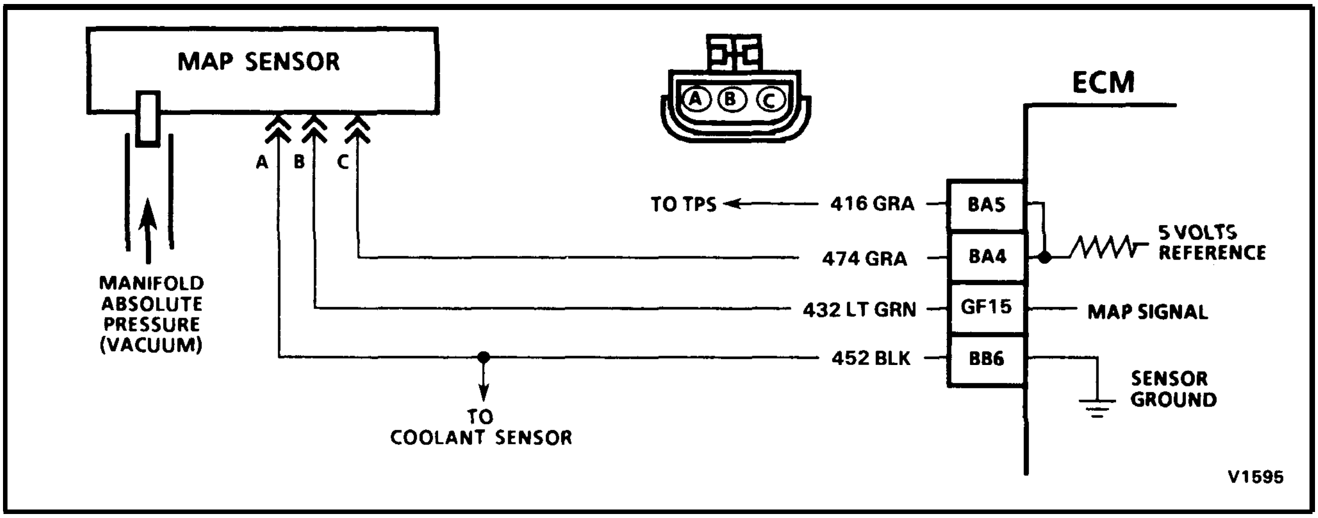
NO

CKT 432 SHORTED TO VOLTAGE, SHORTED TO CKT 474, OR FAULTY ECM

NO

CODE 33 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO DIAGNOSTIC AIDS ON FACING PAGE.

V1894



CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT

(SIGNAL VOLTAGE LOW - HIGH VACUUM)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Manifold Absolute Pressure (MAP) sensor responds to changes in manifold pressure (vacuum). The ECM receives this information as a signal voltage that will vary from less than 1.0 volt at closed throttle idle, to 4-4.5 volts at wide open throttle.

If the MAP sensor fails, the ECM will substitute a fixed MAP value and use the Throttle Position Sensor (TPS) to control fuel delivery.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This step determines if Code 34 is the result of a hard failure or an intermittent condition.
   A Code 34 will set when:
   - MAP signal voltage is too low
   - Engine speed below 1200 rpm and/or TPS greater than 20%
2. Jumpering harness terminals “B” to “C”, 5 volts to signal, will determine if the sensor is at fault or if there is a problem with the ECM or wiring.
3. The “Scan” tool may not display battery voltage. The important thing is that the ECM recognizes the voltage as more than 4 volts, indicating that the ECM and CKT 432 are OK.

Diagnostic Aids:

With the ignition “ON” and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be approximately 2.5 volts. This information is used by the ECM as an indication of vehicle altitude and is referred to as BARO. Comparison of this BARO reading with a known good vehicle with the same sensor is a good way to check accuracy of a “suspect” sensor. Reading should be the same ± .4 volt.

A Code 34 will result if CKTs 474 or 432 are open or shorted to ground.

If CKT 416 is shorted to ground, there may also be a stored Code 22.

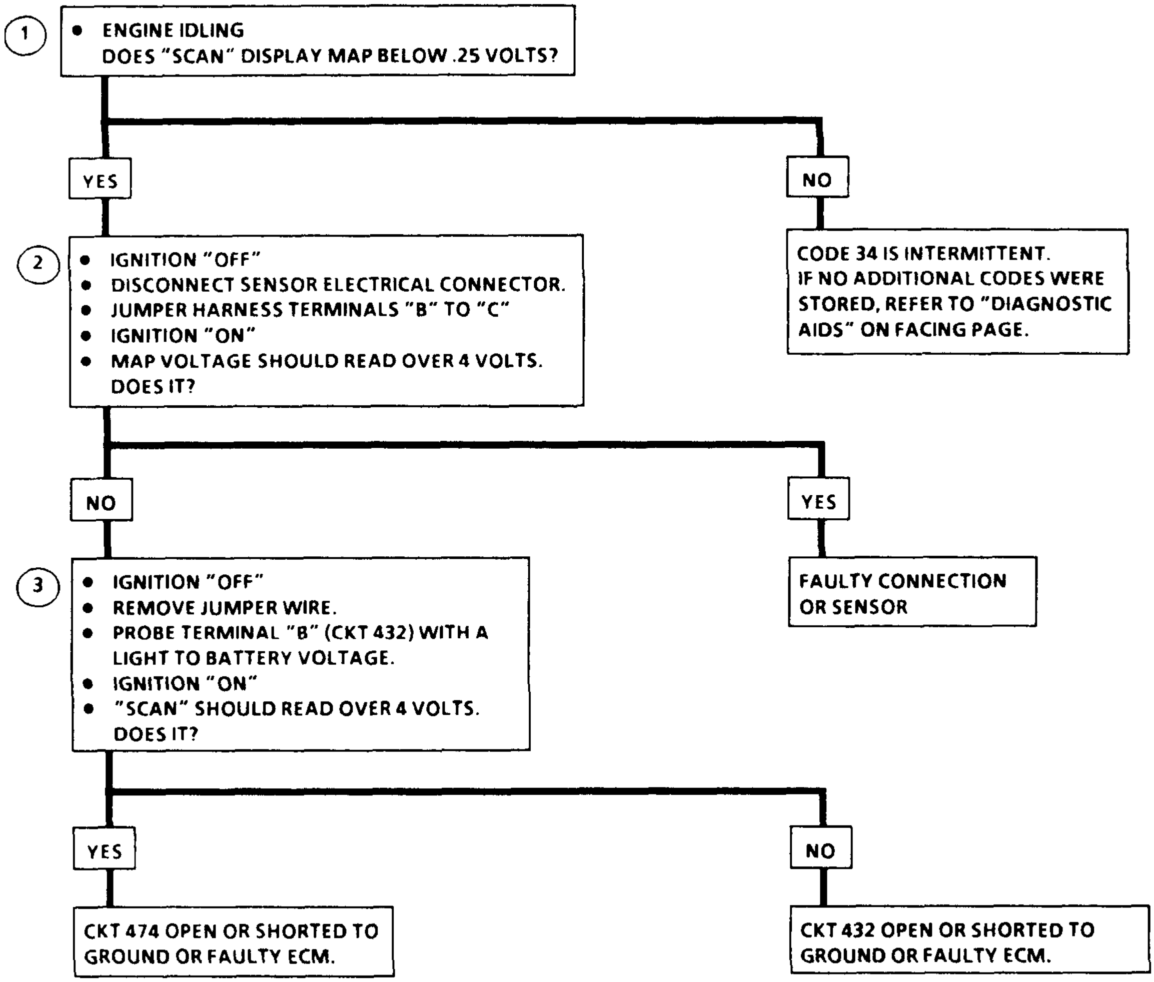
If Code 34 is intermittent, refer to Section “B”.

CODE 34

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT

(SIGNAL VOLTAGE LOW - HIGH VACUUM)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- ENGINE IDLING

DOES "SCAN" DISPLAY MAP BELOW .25 VOLTS?

YES

②
- IGNITION "OFF"
- DISCONNECT SENSOR ELECTRICAL CONNECTOR.
- JUMPER HARNESS TERMINALS "B" TO "C"
- IGNITION "ON"
- MAP VOLTAGE SHOULD READ OVER 4 VOLTS.

DOES IT?

NO

CODE 34 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NO

③
- IGNITION "OFF"
- REMOVE JUMPER WIRE.
- PROBE TERMINAL "B" (CKT 432) WITH A LIGHT TO BATTERY VOLTAGE.
- IGNITION "ON"
- "SCAN" SHOULD READ OVER 4 VOLTS.

DOES IT?

YES

FAULTY CONNECTION OR SENSOR

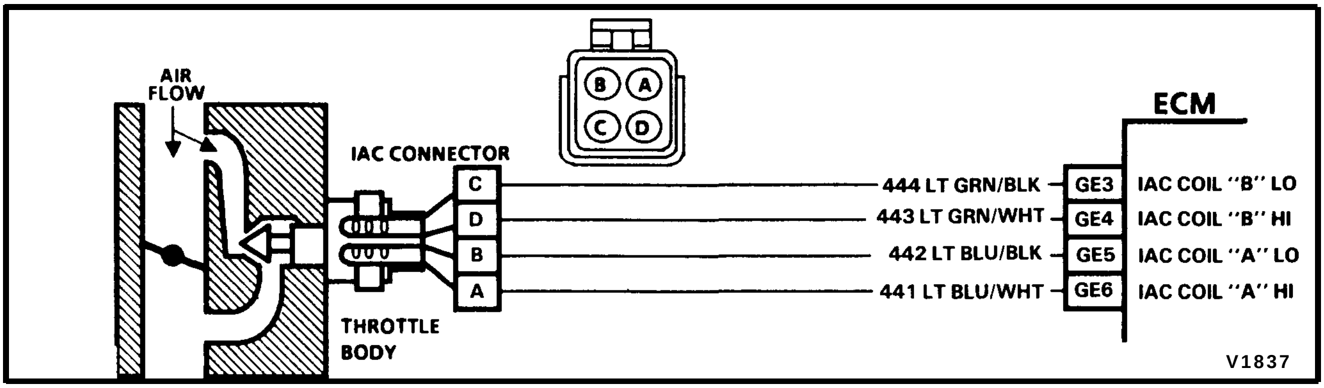
YES

CKT 474 OPEN OR SHORTED TO GROUND OR FAULTY ECM.

NO

CKT 432 OPEN OR SHORTED TO GROUND OR FAULTY ECM.

V1895



CODE 35

IDLE SPEED ERROR

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM controls engine idle speed with the IAC valve. To increase idle speed, the ECM retracts the IAC valve pintle away from its seat, allowing more air to bypass the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing bypass air flow. A "Scan" tool will read the ECM commands to the IAC valve in counts. Higher counts indicate more air bypass (higher idle). The lower the counts indicate less air is allowed to bypass (lower idle). Code 35 will set when the closed throttle engine speed is 225 rpm above or below the desired (commanded) idle speed for 20 seconds. Review the general description of the IAC operation in section "C2."

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. The Tech 1 rpm control mode is used to extend and retract the IAC valve. The valve should move smoothly within the specified range. If the idle speed is commanded (IAC extended) too low (below 700 rpm), the engine may stall. This may be normal and would not indicate a problem. Retracting the IAC beyond its controlled range (above 1500 rpm) will cause a delay before the rpm's start dropping. This too is normal.
2. This test uses the Tech 1 to command the IAC controlled idle speed. The ECM issues commands to obtain commended idle speed. The node lights each should flash red and green to indicate a good circuit as the ECM issues commands. While the sequence of color is not important if either light is "OFF" or does not flash red and green, check the circuits for faults, beginning with poor terminal contacts.

Diagnostic Aids:

A slow, unstable, or fast idle may be caused by a non--IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC "Scan" tool counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non-IAC system problem:

- Vacuum Leak (High Idle)
  If idle is too high, stop the engine. Fully extend (low) IAC with tester. Start engine. If idle speed is above 800 rpm, locate and correct vacuum leak including PCV system. Also check for binding of throttle blade or linkage.
- System too lean (High Air/Fuel Ratio)
  The idle speed may be too high or too low. Engine speed may vary up and down and disconnecting the IAC valve does not help. Code 44 may be set. "Scan 0_2 voltage will be less than 300 mV (.3 volts). Check for low regulated fuel pressure, water in the fuel or a restricted injector.
- System too rich (Low Air/Fuel Ratio)
  The idle speed will be too low. "Scan" tool IAC Counts will usually be above 80. System is obviously rich and may exhibit black smoke in exhaust.

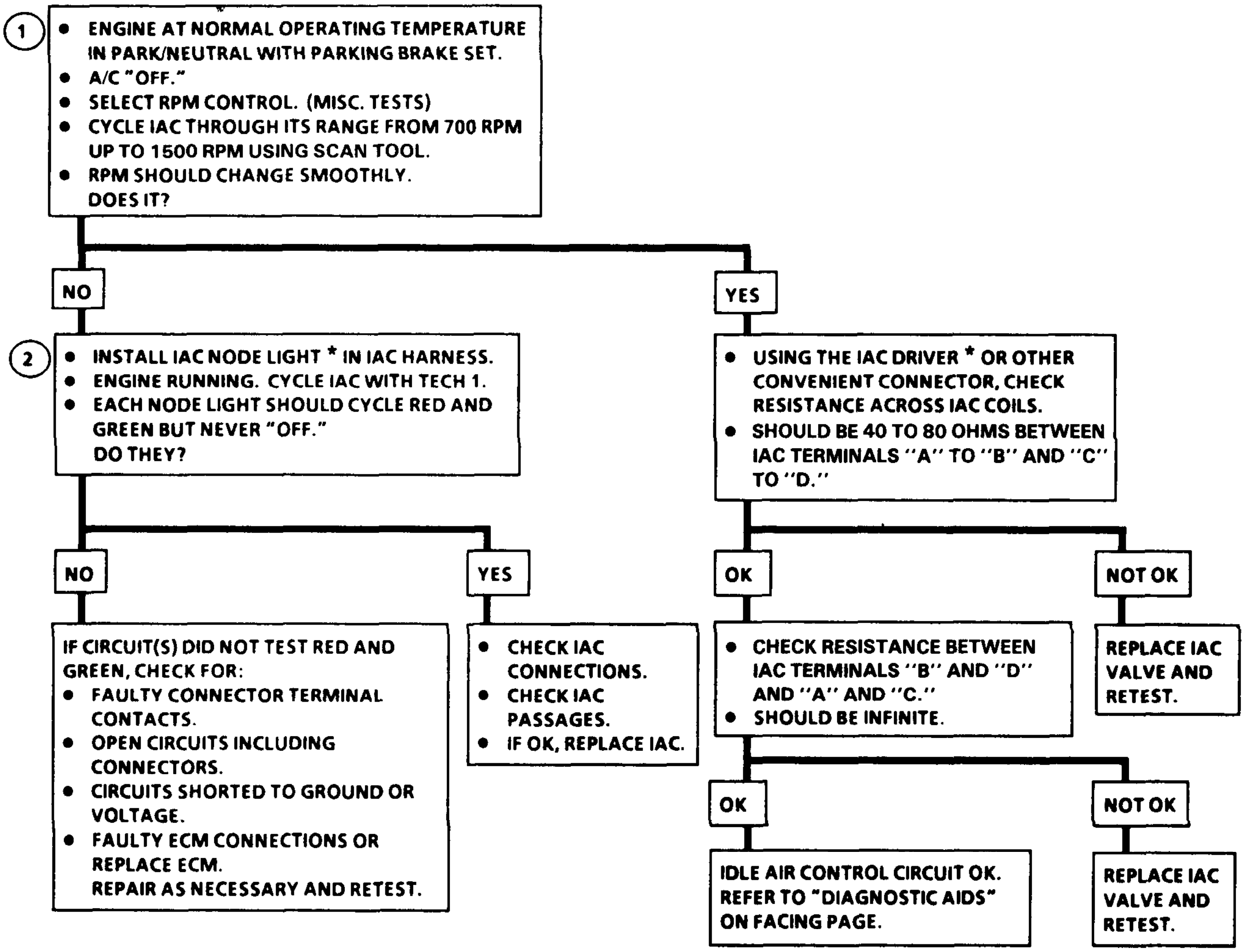
"Scan" tool O_2 voltage will be fixed above 800 mV (.8 volt).

Check for high fuel pressure, leaking or sticking injector. Silicone contaminated 0_2 "Scan" voltage will be slow to respond.

- Throttle Body
  Remove IAC valve and inspect bore for foreign material.
- IAC Valve Electrical Connections
  IAC valve connections should be carefully checked for proper contact.
- PCV Valve
  An incorrect or faulty PCV valve may result in an incorrect idle speed.
- Refer to "Rough, Unstable, Incorrect Idle or Stalling" in "Symptoms," in Section "B."
  - If intermittent poor driveability or idle symptoms are resolved by disconnecting the IAC, carefully recheck connections, valve terminal resistance, or replace IAC.

CODE 35

IDLE SPEED ERROR
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- ENGINE AT NORMAL OPERATING TEMPERATURE IN PARK/NEUTRAL WITH PARKING BRAKE SET.
- A/C "OFF."
- SELECT RPM CONTROL. (MISC. TESTS)
- CYCLE IAC THROUGH ITS RANGE FROM 700 RPM UP TO 1500 RPM USING SCAN TOOL.
- RPM SHOULD CHANGE SMOOTHLY.

DOES IT?

NO

②
- INSTALL IAC NODE LIGHT * IN IAC HARNESS.
- ENGINE RUNNING. CYCLE IAC WITH TECH 1.
- EACH NODE LIGHT SHOULD CYCLE RED AND GREEN BUT NEVER "OFF."

DO THEY?

NO

IF CIRCUIT(S) DID NOT TEST RED AND GREEN, CHECK FOR:
- FAULTY CONNECTOR TERMINAL CONTACTS.
- OPEN CIRCUITS INCLUDING CONNECTORS.
- CIRCUITS SHORTED TO GROUND OR VOLTAGE.
- FAULTY ECM CONNECTIONS OR REPLACE ECM.

REPAIR AS NECESSARY AND RETEST.

YES

- CHECK IAC CONNECTIONS.
- CHECK IAC PASSAGES.
- IF OK, REPLACE IAC.

YES

- USING THE IAC DRIVER * OR OTHER CONVENIENT CONNECTOR, CHECK RESISTANCE ACROSS IAC COILS.
- SHOULD BE 40 TO 80 OHMS BETWEEN IAC TERMINALS "A" TO "B" AND "C" TO "D."

OK

- CHECK RESISTANCE BETWEEN IAC TERMINALS "B" AND "D" AND "A" AND "C."
- SHOULD BE INFINITE.

OK

IDLE AIR CONTROL CIRCUIT OK. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

NOT OK

REPLACE IAC VALVE AND RETEST.

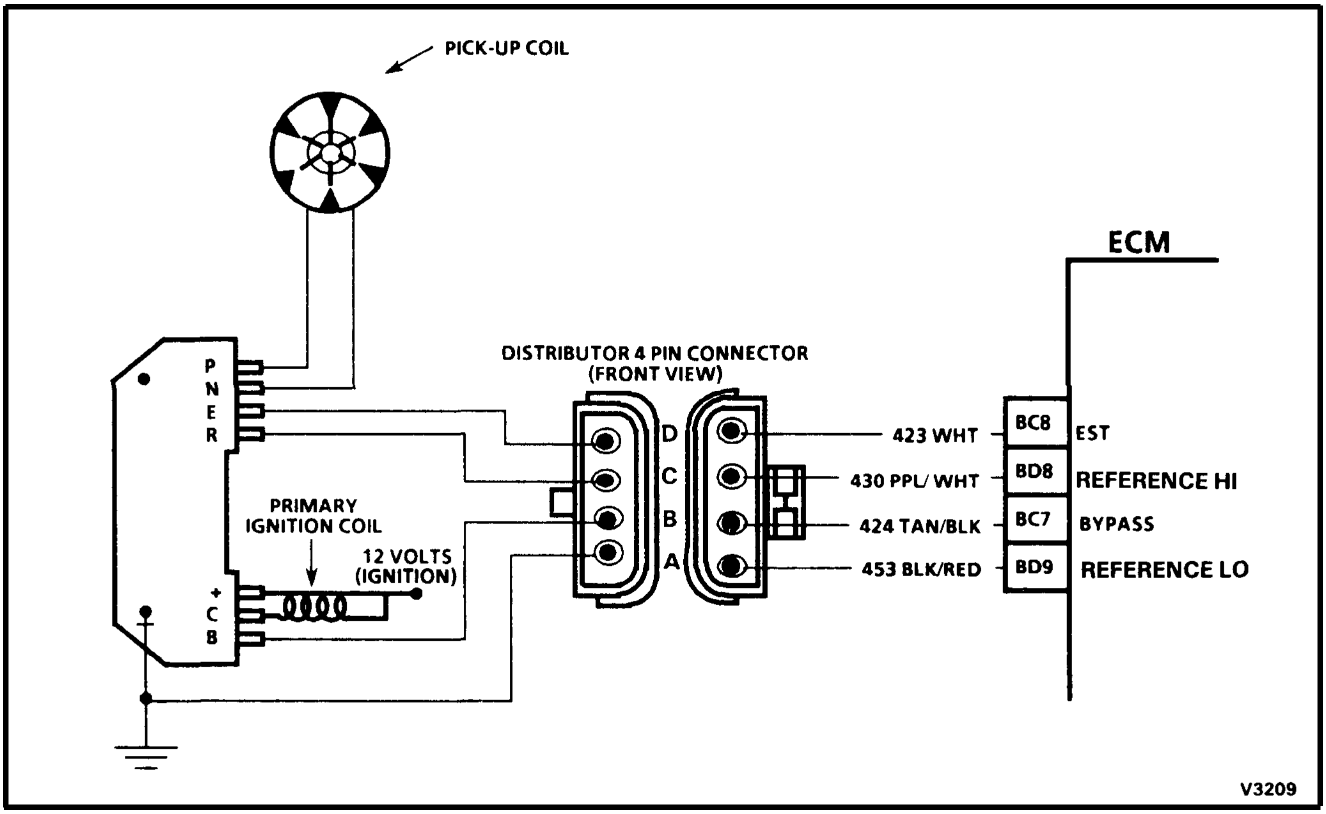
NOT OK

REPLACE IAC VALVE AND RETEST.

* IAC DRIVER AND NODE LIGHT REQUIRED KIT
222-L FROM: CONCEPT TECHNOLOGY, INC.
J37027 FROM: KENT-MOORE, INC.

CLEAR CODES, CONFIRM "CLOSED LOOP" OPERATION, NO "CHECK ENGINE" LIGHT, PERFORM IAC RESET PROCEDURE PER APPLICABLE SERVICE MANUAL AND VERIFY CONTROLLED IDLE SPEED IS CORRECT.

V1896



CODE 42

ELECTRONIC SPARK TIMING (EST) CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ignition module sends a reference signal (CKT 430) to the ECM when the engine is cranking. While the engine speed is under 400 rpm, the ignition module will control ignition timing. When the engine speed exceeds 400 rpm, the ECM applies 5 volts to the bypass line (CKT 424) to switch the timing to ECM control (EST CKT 423).

When the system is running "ON" the ignition module, that is, no voltage on the bypass line, the ignition module grounds the EST signal. The ECM expects to see no voltage on the EST line during this condition. If it sees a voltage, it sets Code 42 and will not go into the EST mode.

When the rpm for EST is reached (about 400 rpm), voltage will be applied to the bypass line, the EST should no longer be grounded in the ignition module, so the EST voltage should be varying.

If the bypass line is open or grounded, the ignition module will not switch to EST mode, so the EST voltage will be low and Code 42 will be set.

If the EST line is grounded, the ignition module will switch to EST but, because the line is grounded, there will be no EST signal. A Code 42 will be set.

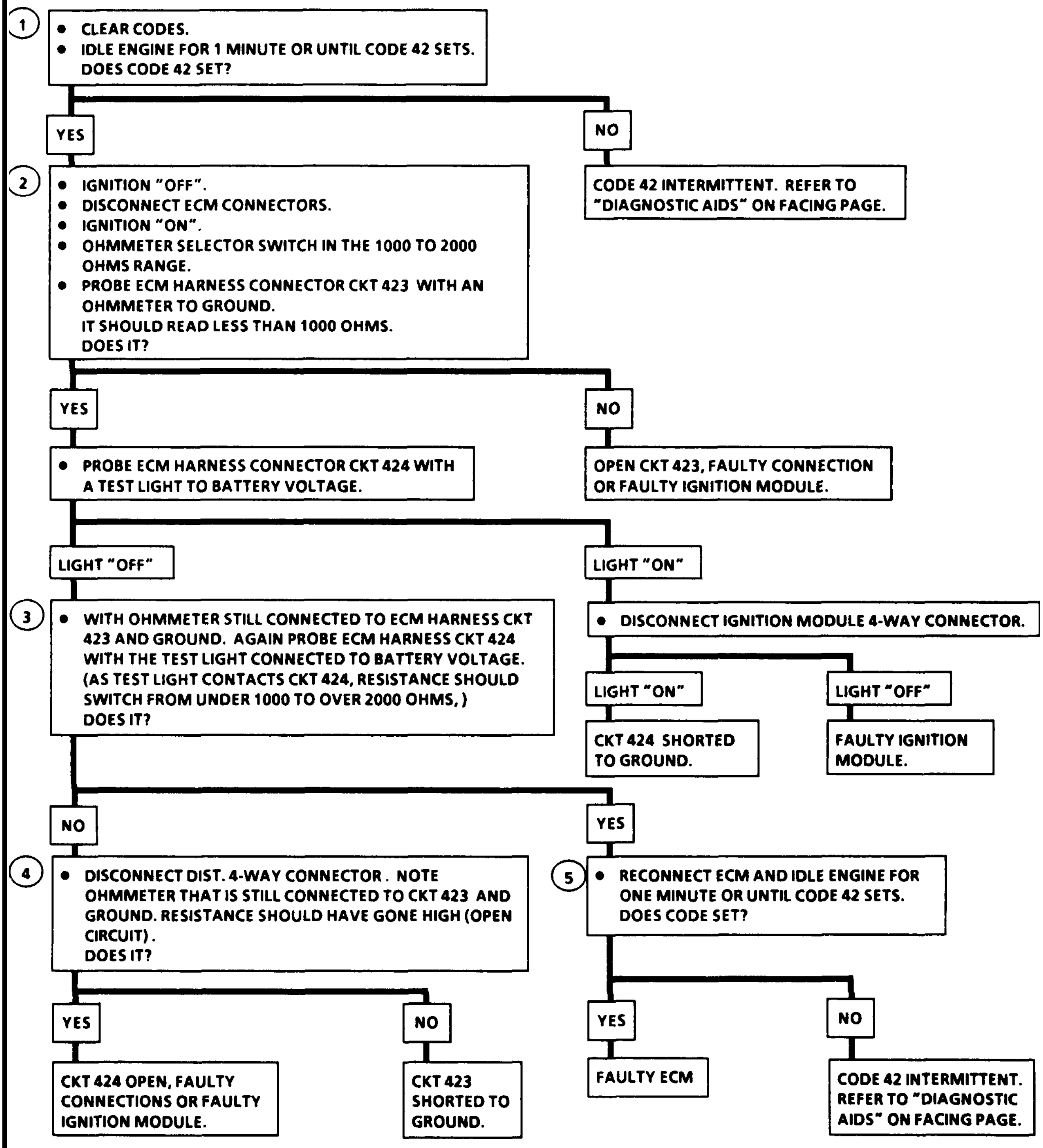
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Confirms Code 42 and that the fault causing the code is present.
2. Checks for a normal EST ground path through the ignition module. An EST CKT 423 shorted to ground will also read less than 500 ohms, however, this will be checked later.
3. As the test light voltage touches terminal "C7," the module should switch, causing the ohmmeter to "overrange" if the meter is in the 1000-2000 ohms position.

   Selecting the 10-20,000 ohms position will indicate above 5000 ohms. The important thing is that the module "switched."
4. The module did not switch and this step checks for:
   - EST CKT 423 shorted to ground
   - Bypass CKT 424 open
   - Faulty ignition module connection or module
5. Confirms that Code 42 is a faulty ECM and not an intermittent in CKTs 423 or 424.

CODE 42

ELECTRONIC SPARK TIMING (EST) CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- CLEAR CODES.
- IDLE ENGINE FOR 1 MINUTE OR UNTIL CODE 42 SETS.

DOES CODE 42 SET?

NO: CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES:

②
- IGNITION "OFF".
- DISCONNECT ECM CONNECTORS.
- IGNITION "ON".
- OHMMETER SELECTOR SWITCH IN THE 1000 TO 2000 OHMS RANGE.
- PROBE ECM HARNESS CONNECTOR CKT 423 WITH AN OHMMETER TO GROUND.

IT SHOULD READ LESS THAN 1000 OHMS.
DOES IT?

NO: OPEN CKT 423, FAULTY CONNECTION OR FAULTY IGNITION MODULE.

YES:
- PROBE ECM HARNESS CONNECTOR CKT 424 WITH A TEST LIGHT TO BATTERY VOLTAGE.

LIGHT "ON":
- DISCONNECT IGNITION MODULE 4-WAY CONNECTOR.

LIGHT "ON": CKT 424 SHORTED TO GROUND.

LIGHT "OFF": FAULTY IGNITION MODULE.

LIGHT "OFF":

③
- WITH OHMMETER STILL CONNECTED TO ECM HARNESS CKT 423 AND GROUND. AGAIN PROBE ECM HARNESS CKT 424 WITH THE TEST LIGHT CONNECTED TO BATTERY VOLTAGE. (AS TEST LIGHT CONTACTS CKT 424, RESISTANCE SHOULD SWITCH FROM UNDER 1000 TO OVER 2000 OHMS,)

DOES IT?

NO:

④
- DISCONNECT DIST. 4-WAY CONNECTOR . NOTE OHMMETER THAT IS STILL CONNECTED TO CKT 423 AND GROUND. RESISTANCE SHOULD HAVE GONE HIGH (OPEN CIRCUIT) .

DOES IT?

YES: CKT 424 OPEN, FAULTY CONNECTIONS OR FAULTY IGNITION MODULE.

NO: CKT 423 SHORTED TO GROUND.

YES:

⑤
- RECONNECT ECM AND IDLE ENGINE FOR ONE MINUTE OR UNTIL CODE 42 SETS.

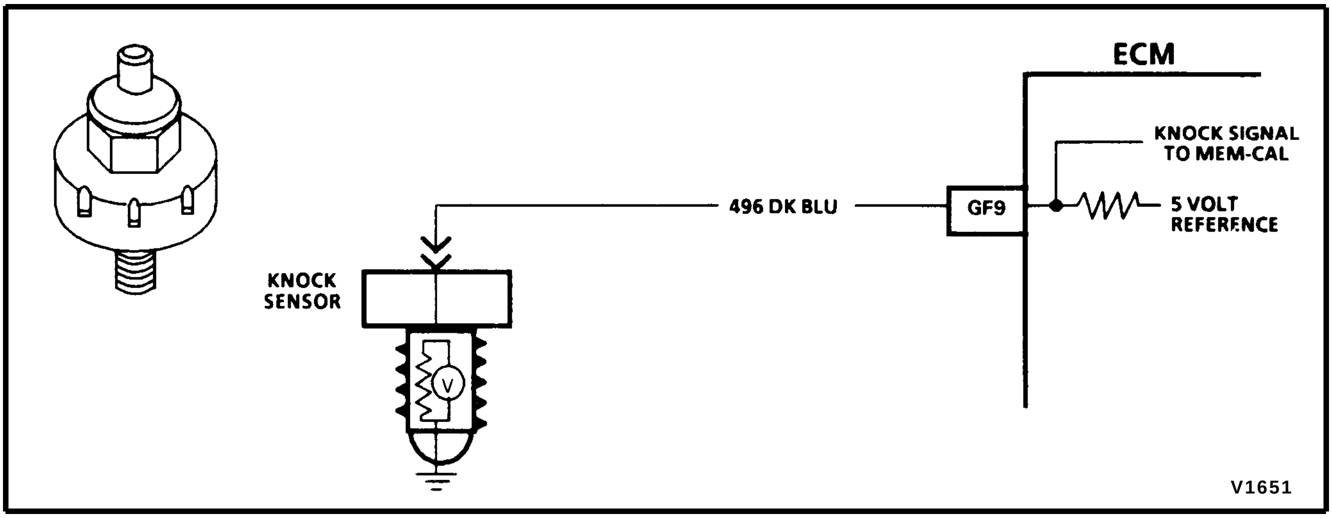
DOES CODE SET?

YES: FAULTY ECM

NO: CODE 42 INTERMITTENT. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1897



CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The knock sensor is used to detect engine detonation and the ECM will retard the electronic spark timing based on the signal being received. The circuitry within the knock sensor causes the ECM 5 volts to be pulled down so that under a no knock condition, CKT 496 would measure about 2.5 volts. The knock sensor produces an A/C signal which rides on the 2.5 volts, DC voltage. The amplitude and signal frequency is dependent upon the knock level.

If CKT 496 becomes open or shorted to ground the voltage will either go above 3.5 volts or below 1.5 volts. If either of these conditions are met for about 5 seconds, a Code 43 will be stored.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 43 will set when:
   - Coolant temperature is over 90°C
   - MAT temperature is over 0°C
   - High engine load based on MAP and rpm
   - Voltage on CKT 496 goes above 3.5 volts or below 1.5 volts
   - All conditions present for 5 seconds

   If an audible knock is heard from the engine, repair the internal engine problem, as normally no knock should be detected at idle.
2. If tapping on the engine lift hook does not produce a knock signal, try tapping engine closer to sensor before proceeding.
3. The ECM has a 5 volts pull-up resistor, which should be present at the knock sensor terminal.
4. This test determines if the knock sensor is faulty or if the ESC portion of the Mem-Cal is faulty.

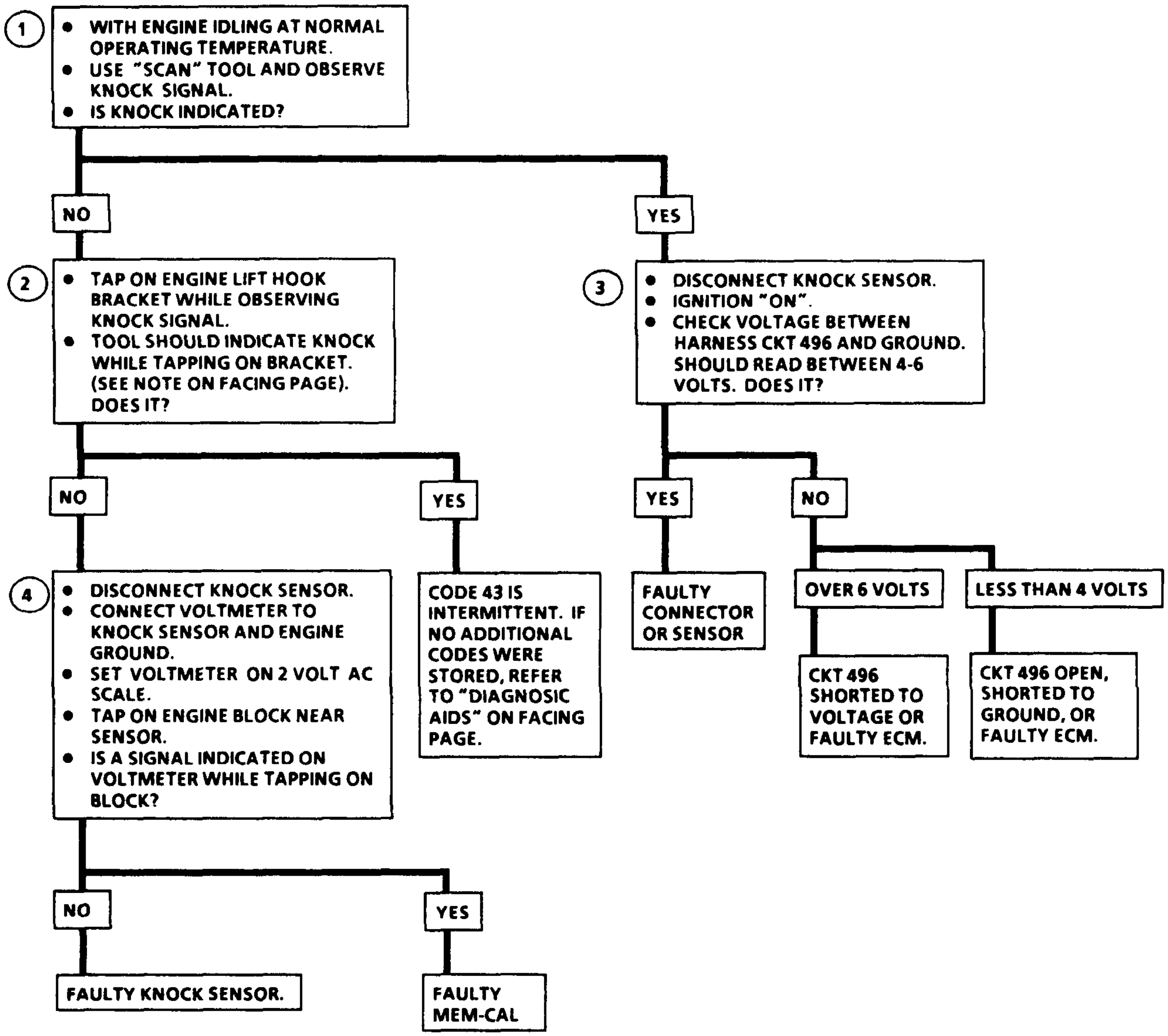
Diagnostic Aids:

Check CKT 496 for a potential open or short to ground. Also check for proper installation of Mem-Cal.

Refer to “Intermittents” in Section “B”.

CODE 43

ELECTRONIC SPARK CONTROL (ESC) CIRCUIT 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- WITH ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
- USE "SCAN" TOOL AND OBSERVE KNOCK SIGNAL.
- IS KNOCK INDICATED?

②
- TAP ON ENGINE LIFT HOOK BRACKET WHILE OBSERVING KNOCK SIGNAL.
- TOOL SHOULD INDICATE KNOCK WHILE TAPPING ON BRACKET. (SEE NOTE ON FACING PAGE). DOES IT?

③
- DISCONNECT KNOCK SENSOR.
- IGNITION "ON".
- CHECK VOLTAGE BETWEEN HARNESS CKT 496 AND GROUND. SHOULD READ BETWEEN 4-6 VOLTS. DOES IT?

④
- DISCONNECT KNOCK SENSOR.
- CONNECT VOLTMETER TO KNOCK SENSOR AND ENGINE GROUND.
- SET VOLTMETER ON 2 VOLT AC SCALE.
- TAP ON ENGINE BLOCK NEAR SENSOR.
- IS A SIGNAL INDICATED ON VOLTMETER WHILE TAPPING ON BLOCK?

CODE 43 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSIC AIDS" ON FACING PAGE.

FAULTY CONNECTOR OR SENSOR

OVER 6 VOLTS

CKT 496 SHORTED TO VOLTAGE OR FAULTY ECM.

LESS THAN 4 VOLTS

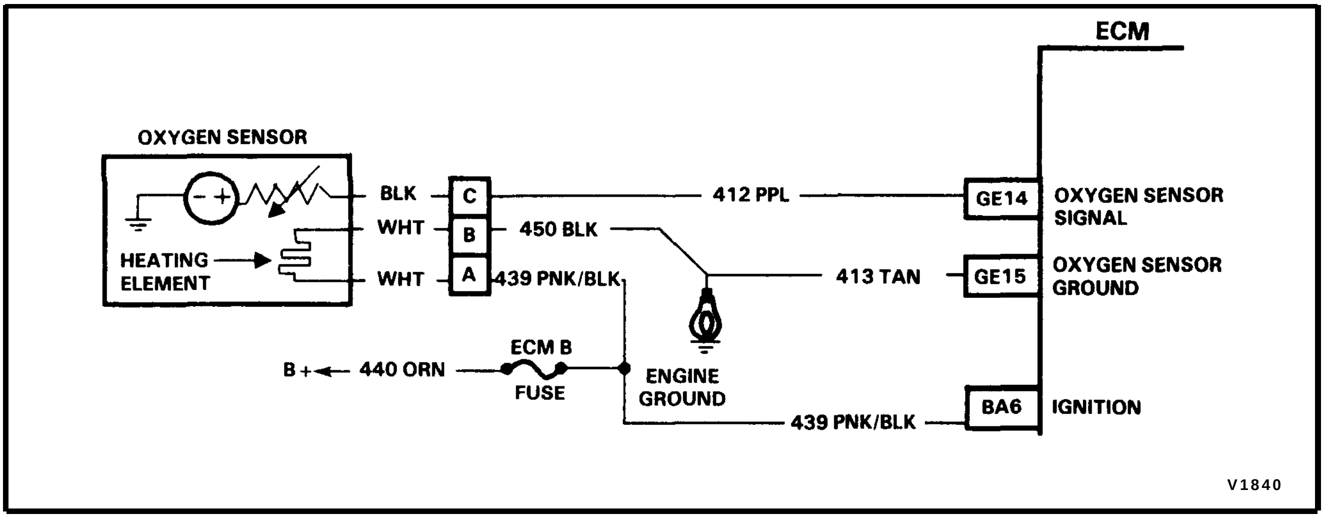
CKT 496 OPEN, SHORTED TO GROUND, OR FAULTY ECM.

FAULTY KNOCK SENSOR.

FAULTY MEM-CAL

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1898



CODE 44

OXYGEN (0,) SENSOR CIRCUIT

(LEAN EXHAUST INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM applies a bias voltage of approximately 450 millivolts (350-550 mV is normal bias voltage) between terminals “GE14” and “GE15” (if measured with a 10 megohm digital voltmeter, this may read as low as .32 volt). The oxygen (0,) sensor varies the voltage within a range of about 1 volt, if the exhaust is rich, down through about .10 volt, if exhaust is lean.

A lean exhaust condition will cause the oxygen sensor to output a low voltage, which will pull the bias voltage from CKT 412 low. The ECM is programmed to interpret any voltage less than 500 mV as a “lean exhaust condition.”

The sensor is like an open circuit and produces no voltage when it is below about 316°C (600°F). An open sensor circuit causes “Open Loop” operation. The heating element in the 0_2 sensor causes the sensor to heat up quickly, allowing for quicker closed loop operation.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. This test checks the oxygen sensor’s heating element. The heating element resistance should be 3.5 ohms at 20°C (68°F) or 14 ohms at 350°C (562°F).
2. Code 44 is set when the oxygen (0,) sensor signal voltage on CKT 412;
   - Remains below .2 volt for 2 minutes and the fuel system is operating in “Closed Loop.”

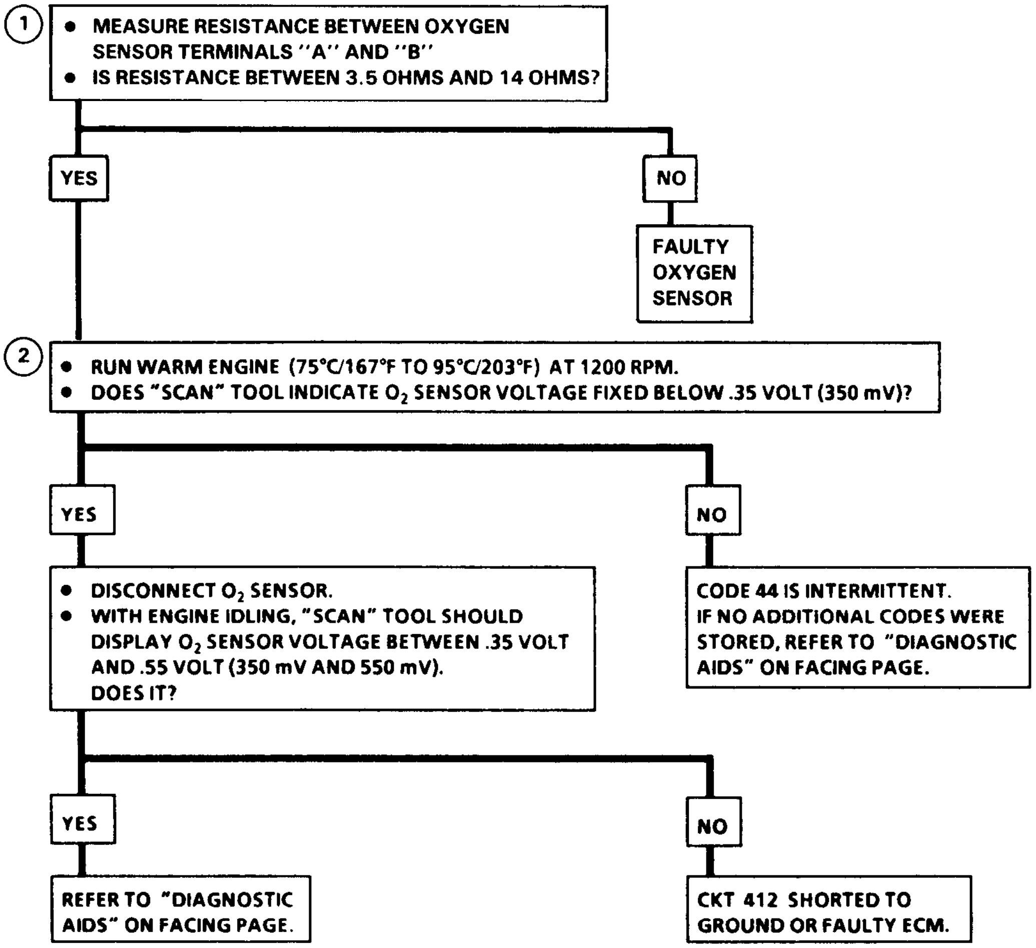
Diagnostic Aids:

Using the Tech I diagnostic computer “Scan” tool, observe the block learn values at different rpm and air flow conditions. The “Scan” tool also displays the block cells, so the block learn values can be checked in each of the cells to determine when the Code 44 may have been set. If the conditions for Code 44 or Code 64 exist, the block learn values will be around 150.

- 0_2 Sensor Wire: Sensor pigtail may be mispositioned and contacting the exhaust manifold.
- Check for intermittent ground in wire between connector and sensor.
- Poor connection at oxygen (0_2) sensor ground wire.
- Lean Injector(s): Perform injector balance test CHART C-2A.
- Fuel Contamination: Water, even in small amounts, near the in-tank fuel pump inlet can be delivered to the injectors. The water causes a lean exhaust and can set a Code 44 or Code 64.
- Fuel Pressure: System will be lean if pressure is too low. It may be necessary to monitor fuel pressure while driving the car at various road speeds and/or loads to confirm. Refer to Fuel System Diagnosis CHART A-7.
- Exhaust Leaks: If there is an exhaust leak, the engine can cause outside air to be pulled into the exhaust and past the sensor. Vacuum or crankcase leaks can cause a lean condition.
- If the above are OK, it is a faulty oxygen sensor.

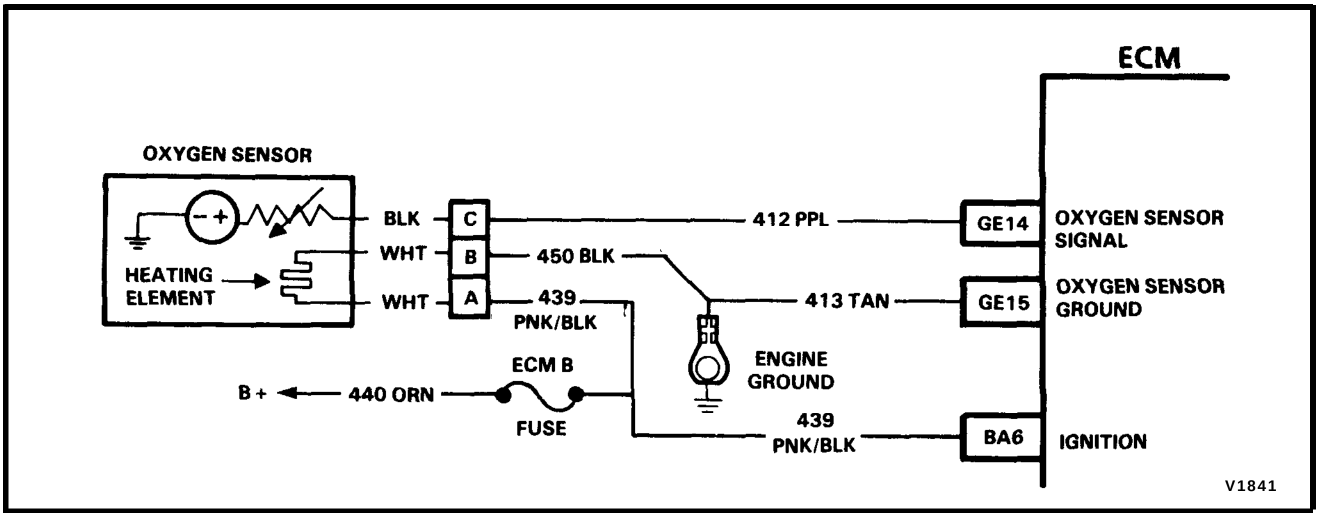
CODE 44

OXYGEN (O_2) SENSOR CIRCUIT
(LEAN EXHAUST INDICATED)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1899



CODE 45

OXYGEN (0,) SENSOR CIRCUIT

(RICH EXHAUST INDICATED)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ECM applies a bias voltage of approximately 450 millivolts (350-550 mV is normal bias voltage) between terminals "GE14" and "GE15" (if measured with a 10 megohm digital voltmeter, this may read as low as .32 volt). The 0_2 sensor varies the voltage within a range of about 1 volt if the exhaust is rich, down through about .10 volt if exhaust is lean.

The sensor is like an open circuit and produces no voltage when it is below about 316°C (600°F). An open sensor circuit causes "Open Loop" operation. The heating element in the 0_2 sensor causes the sensor to heat up quickly, allowing for quicker closed-loop operation.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Code 45 is set when the 0_2 sensor voltage:
   - Remains above .75 volt for 50 seconds; and the system is in "Closed Loop."

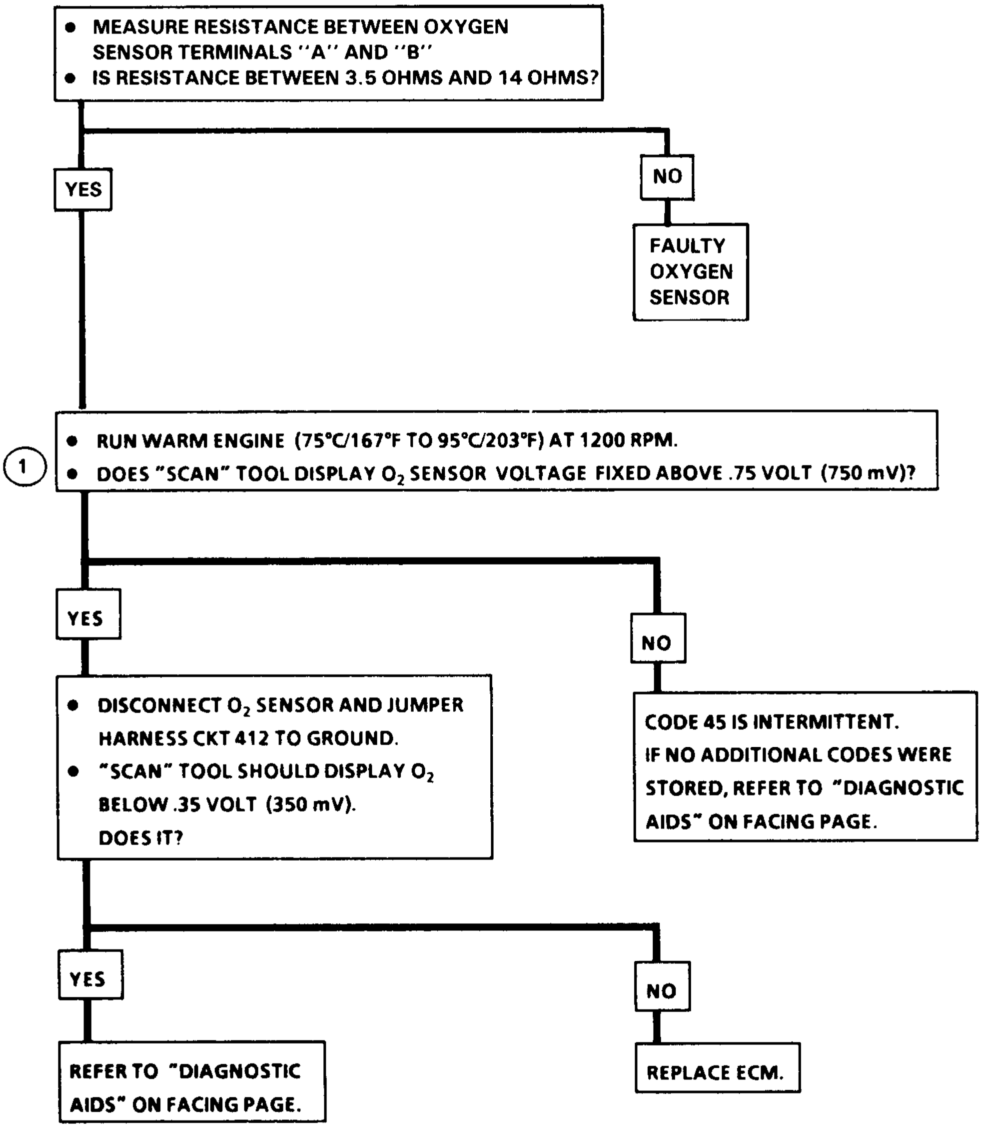
Diagnostic Aids:

Using the "Scan," observe the block learn values at different rpm and air flow conditions. The "Scan" also displays the block cells, so the block learn values can be checked in each of the cells to determine when the Code 45 may have been set. If the conditions for Code 45 exists, the block learn values will be around 115.

- Fuel Pressure. System will go rich if pressure is too high. The ECM can compensate for some increase. However, if it gets too high, a Code 45 may be set. See Fuel System diagnosis CHART A-7.
- Rich Injector. Perform injector balance test CHART C-2A.
- Leaking Injector. See CHART A-7.
- Check for fuel contaminated oil.
- HEI Shielding. An open ignition ground CKT 453 may result in EMI, or induced electrical "noise." The ECM looks at this "noise" as reference pulses. The additional pulses result in a higher than actual engine speed signal. The ECM then delivers too much fuel, causing system to go rich. Engine tachometer will also show higher than actual engine speed, which can help in diagnosing this problem.
- Canister purge. Check canister for fuel saturation. If full of fuel, check canister control and hoses. See "Purge Valve Operation" Section "C3."
- MAP Sensor. An output that causes the ECM to sense a higher than normal manifold pressure can cause the system to go rich. Disconnecting the MAP sensor will allow the ECM to set a fixed value for the sensor. Substitute a different MAP sensor if the rich condition is gone while the sensor is disconnected.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for fuel.
- TPS. An intermittent TPS output will cause the system to go rich, due to a false indication of the engine accelerating.
- EGR. An EGR staying open (especially at idle) will cause the 0_2 sensor to indicate a rich exhaust, and this could result in a Code 45.

CODE 45

OXYGEN (0_2) SENSOR CIRCUIT
(RICH EXHAUST INDICATED)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



- MEASURE RESISTANCE BETWEEN OXYGEN SENSOR TERMINALS "A" AND "B"
- IS RESISTANCE BETWEEN 3.5 OHMS AND 14 OHMS?

YES

NO

FAULTY OXYGEN SENSOR

①
- RUN WARM ENGINE (75°C/167°F TO 95°C/203°F) AT 1200 RPM.
- DOES "SCAN" TOOL DISPLAY O_2 SENSOR VOLTAGE FIXED ABOVE .75 VOLT (750 mV)?

YES

NO

- DISCONNECT O_2 SENSOR AND JUMPER HARNESS CKT 412 TO GROUND.
- "SCAN" TOOL SHOULD DISPLAY O_2 BELOW .35 VOLT (350 mV). DOES IT?

CODE 45 IS INTERMITTENT. IF NO ADDITIONAL CODES WERE STORED, REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

YES

NO

REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

REPLACE ECM.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "SERVICE ENGINE SOON" LIGHT.

V1900

CODE 51
PROM ERROR
(FAULTY OR INCORRECT PROM)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

CHECK THAT ALL PINS ARE FULLY INSERTED IN THE SOCKET AND THAT PROM IS PROPERLY SEATED. IF OK, REPLACE PROM, CLEAR MEMORY, AND RECHECK. IF CODE 51 REAPPEARS, REPLACE ECM.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1730

SECTION B

SYMPTOMS

CONTENTS

PERFORMING SYMPTOM DIAGNOSIS

The DIAGNOSTIC CIRCUIT CHECK should be performed before using this section. The purpose of this section is to locate the source of a driveability or emissions problem when other diagnostic procedures cannot be used. This may be because of difficulties in locating a suspected sub-system or component.

Many driveability related problems can be eliminated by following the procedures found in Service Bulletins. These bulletins supersede this manual. Be sure to check all bulletins related to the complaint or suspected system.

If the engine cranks but will not run, use CHART A-3.

The sequence of the checks listed in this section is not intended to be followed as on a step-by-step procedure. The checks are listed such that the less difficult and time consuming operations are performed before more difficult ones.

Most of the symptom procedures call for a careful visual and physical check. *The importance of this step cannot be stressed too strongly.* It can lead to correcting a problem without further checks, and can save valuable time. This procedure includes checking the following.

- Vacuum hoses for splits, kinks, and proper connections, as shown on the underhood Emission Control Information label
- Throttle body and intake manifold for leaks
- Ignition wires for cracking, hardness, proper routing, and carbon tracking
- Wiring for proper connections, pinches, and cuts

INTERMITTENTS

Definition: Problem may or may not activate the “Check Engine” light or store a trouble code.

DO NOT use the trouble code charts in Section “A” for intermittent problems. The fault must be present to locate the problem. If a fault is intermittent, the use of trouble code charts may result in the replacement of good parts.

- Most intermittent problems are caused by faulty electrical connections or wiring. Perform careful checks of suspected circuits for
  - Poor mating of the connector halves and terminals not fully seated in the connector body (backed out).
  - Improperly formed or damaged terminals. All connector terminals in problem circuit should be carefully reformed to increase contact tension.
  - Poor terminal to wire connection. This requires removing the terminal from the connector body to check as outlined in the introduction to Section “6E3.”
- If a visual and physical check does not locate the cause of the problem, the vehicle can be driven with a voltmeter connected to a suspected circuit or a “Scan” tool may be used. An abnormal voltage reading while the problem occurs indicates that the problem may be in that circuit.
- Check for loss of trouble code memory. To check, disconnect the TPS and allow the engine to idle until the “Check Engine” light turns “ON.” Code 22 should be stored and kept in memory when the ignition is turned “OFF” for at least 10 seconds. If not, the ECM is faulty.
- An intermittent “Check Engine” light and no trouble codes may be caused by
  - Electrical system interference caused by **a** defective relay, ECM driven solenoid, or switch. They can cause a sharp electrical surge. Normally, the problem will occur when the faulty component is operated.
  - Improper installation of electrical options, such as lights, 2-way radios, etc.
  - EST wires which should be routed away from spark plug wires, ignition system components, and generator. Ground wire from ECM to ignition system which may he faulty.
  - Ignition secondary wire shorted to ground.
  - “Check Engine” light and diagnostic “test” terminal circuits intermittently shorted to ground.
  - Faulty ECM grounds.

HARD START

Definition: Engine cranks well but does not start for a long time. Engine does eventually start, but may or may not continue to run.

Perform careful visual and physical check as described at the beginning of Section “B”.

Perform “Diagnostic Circuit Check.”

- **CHECK**
  - Fuel for poor quality, “stale” fuel, and water contamination
  - Ignition wires for shorts or faulty insulation
  - Ignition coil connections
  - Fuel pump relay. Connect test light between pump “test” terminal and BATT + . Light should be “OFF” for 2 seconds following ignition “ON.” If not, use CHART A-5.
  - Secondary ignition voltage output with J 26792 (ST-125) tester or equivalent.
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits. Visually inspect ignition system for moisture, dust, cracks, burns, etc.
  - For faulty ECM and ignition grounds
  - PROM for correct application. (Consult Service Bulletins.) Spray plug wires with fine water mist to check for shorts.
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle.
  - For improper crank sensor resistance or faulty connections
  - EGR operation. Use Code 32 chart.
  - Idle Air Control system. Use Code 35 chart.
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - Injectors for leakage. Pressurize system by energizing fuel pump through the underhood fuel pump test connector.
  - Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
  - Worn dist. shaft
  - Moisture in dist. cap

- TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a ‘Scan” tool.
- In-tank fuel pump check valve. A faulty valve would allow the fuel in the lines to drain back to the tank after the engine is stopped. To check for this condition, conduct the following test.
  1. Ignition “OFF.”
  2. Disconnect fuel line at the filter.
  3. Remove the tank filler cap.
  4. Connect a radiator test pump to the line and apply 103 kPa (15 psi) pressure. If the pressure will hold for 60 seconds, the check valve is OK.
- For the possibility of an exhaust restriction or improper valve timing by performing the following test.
  1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
  2. Run engine at 1000 rpm and record vacuum reading.
  3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
  4. If vacuum at 2500 rpm decreases more than 3” Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
  5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3” Hg with exhaust disconnected, check valve timing. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.
- Engine valve timing and compression.

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING

Definition: The engine runs unevenly at idle. If severe, the vehicle may shake. Also, the idle speed may vary (called “hunting”). Either condition may be severe enough to cause stalling. Engine idles at incorrect speed.

Perform careful visual and physical check as described at the beginning of Section “B”.

Perform “Diagnostic Circuit Check.”

- **CHECK**
  - MAP sensor. Use CHART Cl-D.
  - Throttle for sticking shaft or binding linkage. This will cause a high TPS voltage (open throttle indication) and the ECM will not control idle. TPS voltage should be less than 1.25 volts with throttle closed.
  - Battery cables and ground straps for poor contact. Erratic voltage will cause the IAC valve to change its position, resulting in poor idle quality.
  - Ignition wires for shorts or faulty insulation.
  - Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the “Ignition System Check” Chart in Section “C4.”
  - Secondary ignition voltage output with J 26792 (ST-125) spark tester or equivalent.
  - For worn distributor shaft.
  - For moisture in distributor cap.
  - Ignition pick-up coil resistance and connection.
  - Ignition coil connections.
  - ECM and ignition system for faulty grounds.
  - Proper operation of EST. See Section “C4”.
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - Injectors for leakage. Pressurize system by energizing fuel pump through the underhood fuel pump test connector.
    connector.
  - EGR operation. Use Code 32 chart.
  - For vacuum leaks at intake manifold gasket.
  - Idle Air Control system. Use Code 35 chart.
  - Electrical system voltage. IAC valve will not move if voltage is below 9 volts or greater than 17.8 volts.

- PCV valves for proper operation by placing finger over inlet hole in each valve end several times. Valve should snap back. If not, replace valve. Ensure that valve is correct part. Also check PCV hoses.
- Canister purge system for proper operation. Use CHART C-3.
- PROM for correct application (Consult Service Bulletins.)
- Throttle shaft or TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a “Scan” tool with the throttle closed.
- MAP sensor output. Use CHART Cl-D and/or check sensor by comparing it to the output on a similar vehicle if possible.
- Oxygen sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
- A/C refrigerant pressure for high pressure. Check for overcharging or faulty pressure switch.
- P/N switch circuit on vehicle with automatic transmission. Use CHART C-1A.
- Generator output voltage. Repair if less than 9 volts or more than 16 volts.
- Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.
- For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.
- Check ignition timing. Refer to underhood emission label for proper procedure.
- For the possibility of an exhaust restriction or improper valve timing, perform the following test.
    1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
    2. Run engine at 1000 rpm and record vacuum reading.
    3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
    4. If vacuum at 2500 rpm decreases more than 3” Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
    5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3” Hg with exhaust disconnected, check valve timing.

For overheating and possible causes. Look for the following.

- Low or incorrect coolant solution. It should be a 50/50 mix of GM #1052753 anti-freeze coolant (or equivalent) and water.
- Loose accessory drive belt.
- Restricted air flow to radiator, or restricted water flow through radiator.
- Faulty or incorrect thermostat.
- Faulty fan clutch.

● If the system is running RICH, (block learn less than 118), refer to “Diagnostic Aids” on facing page of Code 45.

● If the system is running LEAN, (block learn greater than 138), refer to “Diagnostic Aids” on facing page of Code 44.

● **CHECK**

- For possibility of misfiring, crossfiring, or cutting under load or at idle. Locate misfiring cylinder(s) by performing the following test.
    1. Start engine. Disconnect idle air control valve. Remove one spark plug wire from a spark plug and ground it against the engine.
    2. Note drop in engine speed.
    3. Repeat for all six cylinders.
    4. Stop engine and reconnect idle air control valve.

  If the engine speed dropped equally (within 50 rpm) on all cylinders, proceed through the causes listed. If there was no drop or excessive variation in engine speed on one or more cylinders, check for spark on the respective cylinder(s) with J 26792 (ST-125) spark tester or equivalent. If there is no spark, refer to IGNITION SYSTEM (SEC. 6D4) in the 1992 Service Manual Sonoma and Jimmy Models. If spark is present, refer to spark plug check in this section.

POOR GAS MILEAGE

Definition: Gas mileage, as measured by an actual road test, is noticeably lower than expected. Gas mileage is noticeably lower than it was during a previous actual road test.

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
  - Proper operation of EST. See Section "C4".
  - For possibility of misfiring, crossfirng, or cutting out under load or at idle. If present, refer to the "Ignition System Check" Chart in Section "C4."
  - Spark plugs. Look for wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Spark plugs for correct heat range.
  - Fuel for poor quality, "stale" fuel, and water contamination.
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - Injectors for leakage. Pressurize system by energizing fuel pump through the underhood fuel pump test connecter.
  - EGR operation. Use Code 32 chart.
  - Distributor for worn shaft.
  - For vacuum leaks at intake manifold gasket.
  - Air cleaner element (filter) for dirt or plugging.
  - Idle Air Control system. Use Code 35 chart.
  - Canister purge system for proper operation. Refer to EVAPORATIVE EMISSION CONTROL SYSTEM (SEC. C3) in this manual.
  - PROM for correct application (Consult Service Bulletins.)
  - Throttle shaft or TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a "Scan" tool with the throttle closed.
  - MAP sensor output. Use CHART Cl-D and/or check sensor by comparing it to the output on a similar vehicle if possible.
  - Oxygen sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
  - Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
  - Vehicle Speed Sensor (VSS) input with a "Scan" tool to make sure reading of VSS matches that of vehicle speedometer. Refer to "Diagnostic Information" in Section "6E."
  - A/C relay operation. A/C should cut out at wide open throttle. Use CHART C-10.
  - A/C refrigerant pressure for high pressure. Check for overcharging or faulty pressure switch.
  - Generator output voltage. Repair if less than 9 volts or more than 16 volts.
  - Cooling fan operation. Use CHART C-12.
  - Transmission torque converter operation. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission for proper shift points. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission torque converter clutch operation. Use CHART C-8.
  - Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.
  - For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.
  - For the possibility of an exhaust restriction or improper valve timing by performing the following test.
    1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
    2. Run engine at 1000 rpm and record vacuum reading.
    3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
    4. If vacuum at 2500 rpm decreases more than 3" Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.

5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3” Hg with exhaust disconnected, check valve timing.

  - Thermostat for incorrect heat range or being inoperative

- Check driver’s driving habits and vehicle conditions which affect gas mileage.
  - Suggest driver read “Important Facts on Fuel Economy” in Owner’s Manual.
  - Is A/C “ON” full time (Defroster mode “ON”)?
  - Are tires at correct pressure?
  - Are excessively heavy loads being carried?
  - Is acceleration often heavy?
  - Are the wheels aligned correctly?
  - Is the speedometer calibrated correctly?
  - Are the vehicle brakes dragging?
  - Is the brake switch applying excessive force on the brake pedal?
- If the system is running RICH, (block learn less than 118, refer to “Diagnostic Aids” on facing page of Code 45.

DETONATION/SPARK KNOCK

Definition: A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

Perform careful visual and physical check as described at the beginning of Section “B”.

Perform “Diagnostic Circuit Check.”

- **CHECK**
  - Ignition wires for shorts or faulty insulation
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the “Ignition System Check” Chart in Section “C4.”
  - Spark plugs for correct heat range.
  - Ignition timing. Refer to underhood emissions label for correct procedure.
  - Fuel for poor quality, “stale” fuel, and water contamination
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - For excessive oil entering combustion chamber. Oil will reduce the effective octane of fuel.
  - EGR operation. Use Code 32 chart.
  - For vacuum leaks at intake manifold gasket
  - PCV valves for proper operation by placing finger over inlet hole in each valve end several times. Valve should snap back. If not, replace valve. Ensure that valves are correct part. Also check PCV hoses.
  - MAP sensor output. Use CHART Cl-D and/or check sensor by comparing it to the output on a Similar vehicle, if possible.
  - Coolant sensor for a shift in calibration
  - Oxygen sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication).

    The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem
  - Vehicle Speed Sensor (VSS) input with a “Scan” tool to make sure reading of VSS matches that of vehicle speedometer. See “Diagnostic Information” in Section “6E.”
  - Transmission torque converter operation. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission for proper shift points. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission torque converter clutch operation. Use CHART C-8.
  - Vehicle brakes for dragging.
  - PROM for correct application. (Consult Service Bulletins.)
  - For overheating and possible causes. Look for the following.
    - Low or incorrect coolant solution. It should be a 50/50 mix of GM #1052753 anti-freeze coolant (or equivalent) and water.
    - Loose accessory drive belt.
    - Restricted air flow to radiator or restricted water flow through radiator.
    - Faulty or incorrect thermostat.
    - Faulty fan clutch.
  - Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.
  - For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.

- For the possibility of an exhaust restriction or improper valve timing by performing the following test.
    1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
    2. Run engine at 1000 rpm and record vacuum reading.
    3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
    4. If vacuum at 2500 rpm decreases more than 3" Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
    5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3" Hg with exhaust disconnected, check valve timing.

- Remove internal engine carbon with top engine cleaner.
- If the system is running LEAN, (block learn greater than 138), refer to *'Diagnostic Aids" on facing page of Code 44.

LACK OF POWER, SLUGGISH, OR SPONGY

Definition: Engine delivers less than expected power. There is little or no increase in speed when the accelerator pedal is depressed partially.

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
    - Turbocharger function.
    - Charge air cooler operation.
    - Air induction for blockage.
    - Fuel octane (has it been downgraded'?)
    - Ignition wires for shorts or faulty insulation
    - Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.
    - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the "Ignition System Check" Chart in Section "C4."
    - Secondary ignition voltage output with J 26792 (ST-125) spark tester or equivalent.
    - Ignition coil connections.
    - ECM and ignition system for faulty grounds.
    - Proper operation of EST. See Section "C4."
    - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
    - Spark plugs for correct heat range
    - Fuel for poor quality, "stale" fuel, and water contamination
    - Fuel system for restricted filter or improper pressure. Use CHART A-7.
    - EGR operation. Use Code 32 chart.
    - For vacuum leaks at intake manifold gasket
    - Air cleaner element (filter) for dirt or plugging
    - PROM for correct application. (Consult Service Bulletins.)
    - Throttle shaft or TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a "Scan" tool with the throttle closed.
    - MAP sensor output. Use CHART Cl-D and/or check sensor by comparing it to the output on a similar vehicle if possible.
    - Oxygen (0_2) sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
    - Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
    - Vehicle Speed Sensor (VSS) input with a "Scan" tool to make sure reading of VSS matches that of vehicle speedometer. See "Diagnostic Information" in Section "6E."
    - Engine for improper or worn camshaft. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.
    - A/C relay operation. A/C should cut out at wide open throttle. Use CHART C-10.
    - A/C refrigerant pressure for high pressure. Check for overcharging or faulty pressure switch.
    - Generator output voltage. Repair if less than 9 volts or more than 16 volts.
    - Cooling fan operation. Use CHART C-12.
    - Transmission torque converter operation. See AUTOMATIC TRANSMISSION (Section 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.

Transmission for proper shift points. See AUTOMATIC TRANSMISSION (Section 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.

Transmission torque converter clutch operation. Use CHART C-8.

Vehicle brakes for dragging.

Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.

For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to 4.3 LITER V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.

For the possibility of an exhaust restriction or improper valve timing by performing the following test.

1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
2. Run engine at 1000 rpm and record vacuum reading.
3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 2500 rpm.
4. If vacuum at 2500 rpm decreases more than 3” Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3” Hg with exhaust disconnected, check valve timing.

- For overheating and possible causes. Look for the following:
- Low or incorrect coolant solution. It should be a 50/50 mix of GM #1052753 anti-freeze coolant (or equivalent) and water.
  - Loose accessory drive belt.
  - Restricted air flow to radiator, or restricted water flow through radiator.
  - Faulty or incorrect thermostat.
  - Inoperative electric cooling fan circuit. See CHART C-12.

- If the system is running RICH (block learn less than 118), refer to “Diagnostic Aids” on facing page of Code 45.
- If the system is running LEAN (block learn greater than 138), refer to “Diagnostic Aids” on facing page of Code 44.

SURGES AND/OR CHUGGLE

Definition: Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.

Perform careful visual and physical check as described at the beginning of Section “B”.

Perform “Diagnostic Circuit Check.”

- **CHECK**
  - Ignition wires for shorts or faulty insulation.
  - Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present,, refer to the “Ignition System Check” Chart in Section “C4.”
  - Secondary ignition voltage output with J 26972 (ST-125) spark tester or equivalent.
  - Ignition coil connections.
  - ECM and ignition system for faulty grounds.
  - Proper operation of EST. See Section “C4”.
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Spark plugs for correct heat range.
  - Fuel for poor quality, “stale” fuel, and water contamination.
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - Injectors for leakage. Pressurize system by energizing fuel pump through the underhood fuel pump test connector.
  - EGR operation. Use Code 32 chart.
  - For vacuum leaks at intake manifold gasket.
  - Idle Air Control system. Use Code 35 chart.
  - Electrical system voltage. IAC valve will not move if voltage is below 9 volts or greater than 17.8 volts. Also check battery cables and ground straps for poor contact. Erratic voltage will cause the IAC valve to change its position, resulting in poor idle quality.

- PCV valves for proper operation by placing finger over inlet, hole in each valve end several times. Valve should snap back. If not, replace valve. Ensure that valve is correct part. Also check PCV hoses.
- Canister purge system for proper operation. Use CHART C-3.
- PROM for correct application. (Consult Service Bulletins).
- Throttle shaft or TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a "Scan" tool with the throttle closed.
- MAP sensor output. Use CHART Cl-D and/or check sensor by comparing it to the output on a similar vehicle, ifpossible.
- Oxygen sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
- Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
- Vehicle speed sensor (VSS) input with a "Scan" tool to make sure reading of VSS matches that of vehicle speedometer. See "Special Information" in Section "6E".
- A/C relay operation. A/C should cut out at wide open throttle. Use CHART C-10.
- P/N switch circuit on vehicle with automatic transmission. Use CHART C-1A.
- Transmission torque converter clutch operation. Use CHART C-8.

CUTS OUT, MISSES

Definition: Steady pulsation or jerking that follows engine speed, usually more pronounced as engine load increases. The exhaust has a steady spitting sound at idle or low speed.

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
  - Ignition wires for shorts or faulty insulation
  - Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the "Ignition System Check" Chart in Section "C4."
  - Secondary ignition voltage output with J 26792 (ST-125) spark tester or equivalent.
  - Ignition coil connections
  - ECM and ignition system for faulty grounds
  - Proper operation of EST. See Section "C4".
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Spark plugs for correct heat range
  - For improper crank sensor resistance or faulty connections
  - Fuel for poor quality, "stale" fuel, and water contamination
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - Fuel shut-off due to overboost. Use Code 31 chart.
  - Throttle shaft or TPS for sticking or binding. TPS voltage should read less than 1.25 volts on a "Scan" tool with the throttle closed.

For possibility of misfiring, crossfiring, or cutting under load or at idle. Locate misfiring cylinder(s) by performing the following test.

1. Start engine. Disconnect idle air control valve. Remove one spark plug wire from a spark plug and ground it against the engine.
2. Note drop in engine speed.
3. Repeat for all six cylinders.
4. Stop engine and reconnect idle air control valve.

If the engine speed dropped equally (within 50 rpm) on all cylinders, refer to "Rough, Unstable, or Incorrect Idle, Stalling" symptom. If there was no drop or excessive variation in engine speed on one or more cylinders, check for spark on the respective cylinder(s) with J 26792 (ST-spark, refer to IGNITION SYSTEM (SEC. 6D4) in the 1992 Service Manual Sonoma and Jimmy Models. If spark is present, remove the spark plugs from the cylinder(s) and check for the following.

Cracks
Wear
Improper gap
Burned electrode
Heavy deposits
Wetness

HESITATION, SAG, STUMBLE

Definition: Momentary lack of response as the accelerator is pushed down. Can occur at all vehicle speeds. Usually most severe when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
  - Ignition wires for shorts or faulty insulation
  - Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the "Ignition System Check" Chart in Section "C4."
  - Secondary ignition voltage output with J 26792 (ST-125) spark tester or equivalent.
  - Ignition coil connections
  - ECM and ignition system for faulty grounds
  - Proper operation of EST. See Section "C4".
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Spark plugs for correct heat range
  - Fuel for poor quality, "stale" fuel, and water contamination
  - Fuel system for restricted filter or improper pressure. Use CHART A-7.
  - EGR operation. Use Code 32 chart.
  - For vacuum leaks at intake manifold gasket
  - Air cleaner element (filter) for dirt or plugging
  - Idle Air Control system. Use Code 35 chart.
  - Check electrical system voltage. IAC valve will not move if voltage is below 9 volts or greater than 17.8 volts. Also check battery cables and ground straps for poor contact. Erratic voltage will cause the IAC valve to change its position, resulting in poor idle quality.
  - PCV valves for proper operation by placing finger over inlet hole in each valve end several times. Valve should snap back. If not, replace valve. Ensure that valve is correct part. Also check PCV hoses.
  - Canister purge system for proper operation. Use CHART C-3.
  - PROM for correct application (Consult Service Bulletins.)
  - Throttle shaft or TPS for sticking or binding TPS voltage should read less than 1.25 volts on a "Scan" tool with the throttle closed.
  - MAP sensor output. Use CHART Cl- D and/or check sensor by comparing it to the output on a similar vehicle, if possible.
  - Oxygen sensor for silicone contamination from contaminated fuel or use of improper RTV sealant. The sensor will have a white, powdery coating and will cause a high but false signal voltage (rich exhaust indication). The ECM will reduce the amount of fuel delivered to the engine, causing a severe driveability problem.
  - Coolant sensor for a shift in calibration. Use Code 14 or Code 15 chart.
  - A/C relay operation. A/C should cut out at wide open throttle. Use CHART C-10.
  - A/C refrigerant pressure for high pressure. Check for overcharging or faulty pressure switch.
  - P/N switch circuit on vehicle with automatic transmission. Use CHART C-1A.
  - Generator output voltage. Repair if less than 9 volts or more than 16 volts.
  - Transmission torque converter operation. See AUTOMATIC TRANSMISSION (Section 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission for proper shift points. See AUTOMATIC TRANSMISSION (Section 7A1) in the 1992 Service Manual Sonoma and Jimmy Models.
  - Transmission torque converter clutch operation. Use CHART C-8.
  - Vehicle brakes for dragging.
  - Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.
  - For the possibility of an exhaust restriction or improper valve timing by performing the following test.
    1. With engine at normal operating temperature, connect a vacuum gauge to any convenient vacuum port on intake manifold.
    2. Run engine at 1000 rpm and record vacuum reading.
    3. Increase engine speed slowly to 2500 rpm. Note vacuum reading at steady 200 rpm.
    4. If vacuum at 2500 rpm decreases more than 3" Hg from reading at 1000 rpm, the exhaust system should be inspected for restrictions.
    5. Disconnect exhaust pipe from engine and repeat Steps 3 & 4. If vacuum still drops more than 3" Hg with exhaust disconnected, check valve timing.

- For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to 4.3L V6 (SEC. 6A3) in the 1992 Service Manual Sonoma and Jimmy Models.
- For overheating and possible causes. Look for the following.
    - Low or incorrect coolant solution. It should be a 50/50 mix of GM #1052753 anti-freeze coolant (or equivalent) and water.
    - Loose accessory drive belt.
    - Restricted air flow to radiator, or restricted water flow through radiator.
    - Faulty or incorrect thermostat.
    - Faulty fan clutch. See CHART C-12.
- If the system is running RICH (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.
- If the system is running LEAN (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44.

EXCESSIVE EXHAUST EMISSIONS OR ODORS

Definition: Vehicle fails an emission test or vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions).

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
    - EGR valve not opening. Use CHART C-7.
    - Vacuum leaks
    - Faulty coolant system and/or coolant fan operation. Use CHART C-12.
    - Remove carbon with top engine cleaner. Follow instructions on can.
- If the system is running RICH (block learn less than 118), refer to "Diagnostic Aids" on facing page of Code 45.
- If the system is running LEAN (block learn greater than 138), refer to "Diagnostic Aids" on facing page of Code 44.
- If emission test indicates excessive NO,, check for items which cause vehicle to run lean or too hot.
- If emission test indicates excessive HC and CO or exhaust has excessive odors, check for items which cause car to run RICH.
    - Incorrect fuel pressure. Use CHART A-7.
    - Fuel loading of evaporative vapor canister. Use CHART C-3.
    - PCV valve plugging, sticking, or blocked PCV hose. Check for fuel in crankcase.
    - Catalytic converter lead contamination (Look for removal of fuel filler neck restrictor.)
    - Improper fuel cap installation
    - Faulty spark plugs, plug wires, or ignition components. See IGNITION SYSTEM (Section "6D4.")

DIESELING, RUN-ON

Definition: Engine continues to run after key is turned "OFF", but runs very roughly. (If engine runs smoothly, check ignition switch).

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**

  Injectors for leakage. Pressurize system by energizing fuel pump through the fuel pump test connecter.

BACKFIRE

Definition: Fuel ignites in intake manifold or in exhaust system, making a loud popping sound.

Perform careful visual and physical check as described at the beginning of Section "B".

Perform "Diagnostic Circuit Check."

- **CHECK**
  - EGR operation for valve being open all the time. Use CHART C-7.
  - Intake manifold gasket for leaks
  - For possibility of misfiring, crossfiring, or cutting out under load or at idle. If present, refer to the "Ignition System Check" Chart in Section "C4."
  - Spark plugs. Look for wear, wetness, cracks, improper gap, burned electrodes, and heavy deposits.
  - Ignition coil connections

  Ignition system for moisture, dust, cracks, burns, etc. Spray plug wires with fine water mist to check for shorts.

  ECM and ignition system for faulty grounds

  Secondary ignition voltage output with J 26792 (ST-125) spark tester or equivalent.
  - For vacuum leaks at intake manifold gasket.

  Engine valve timing and compression. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.

  For worn or incorrect basic engine parts such as cam, heads, pistons, etc. Also check for bent pushrods, worn rocker arms, and broken or weak valve springs. Refer to ENGINE, DRIVEABILITY, AND DIAGNOSIS (SEC. 6A) in the 1992 Service Manual Sonoma and Jimmy Models.

SECTION C

COMPONENT SYSTEMS

Section "C" provides information on the following:

- General description of components and sub-systems.
- On-vehicle service.
- Part names and group numbers.
- Diagnostic charts. These include a functional check of the system as well as diagnosis of any problem found in the functional check.

For locations of components, wiring diagrams, and ECM terminal end view, refer to the front of Section "A."

Refer to the following sections for the appropriate sub-system information:

DIAGNOSTIC CHARTS

The following diagnostic charts can be found at the end of some of the sections.

SECTION C1

ELECTRONIC CONTROL MODULE (ECM) AND SENSORS

CONTENTS

GENERAL DESCRIPTION

ELECTRONIC CONTROL MODULE (ECM)

The Electronic Control Module (ECM) (Figure Cl-l), located under the instrument panel behind the glove box, is the control center of the turbocharger and fuel injection systems. It constantly looks at the information from various sensors, and controls the systems that affect vehicle performance. The ECM also performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the “Check Engine” light, and store a code or codes which identify the problem areas to aid the technician in making repairs. See “Introduction” Section “6E” for more information on using the diagnostic function of the ECM.

The ECM used in the vehicle covered by this manual is a type called GMP4. For service, this ECM only consists of two parts: a controller (the ECM without a Mem-Cal) and an assembly called a Mem-Cal. (This stands for “Memory and Calibration” unit.)

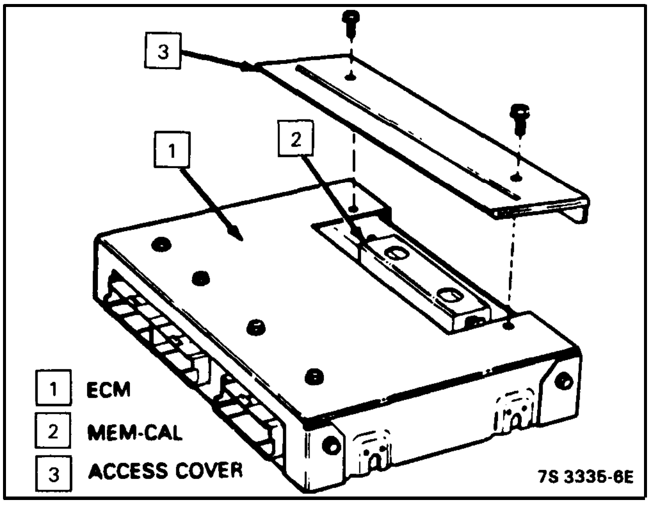


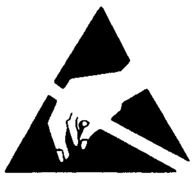
Figure C1-1 – Electronic Control Module (ECM)

HANDLING ELECTROSTATIC DISCHARGE SENSITIVE PARTS

When handling an electronic part that has an ESD sensitive sticker (Figure C1-2) the service technician should follow these guidelines to reduce any possible electrostatic charge build-up on the service technician's body and the electronic part in the dealership:

1. Do not open the package until it is time to install the part.
2. Avoid touching electrical terminals of the part.
3. Before removing the part from its package, ground the package to a known good ground on the vehicle.
4. Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across the seat, sitting down from a standing position or walking a distance.

NOTICE



CONTENTS SENSITIVE
TO
STATIC ELECTRICITY

HANDLE IN ACCORDANCE WITH STATIC CONTROL
PROCEDURES GM9107P AND GM9108P,
OR GM DIVISIONAL SERVICE MANUALS.

F-5403

Figure C1-2 – Electrostatic Discharge Warning

MEM-CAL

This assembly contains the functions of the PROM, CalPak, and the ESC module used on other GM applications. Like the PROM, it contains the calibrations needed for a specific vehicle as well as the back-up fuel control circuitry required if the rest of the ECM becomes damaged or faulty.

ECM FUNCTION

The ECM supplies either 5 or 12 volts to power various sensors or switches. This is done through resistances in the ECM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a 10 megohm input impedance digital voltmeter is required to assure accurate voltage readings.

The ECM controls output circuits such as the injector(s), IAC, charge air cooler (CAC) pump relay, etc. by controlling the ground circuit through transistors or a device called a "quad-driver."

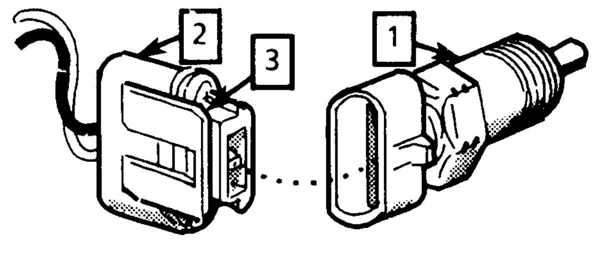
INFORMATION SENSORS

Coolant Temperature Sensor (CTS) (Figure C1-3)

The Coolant Temperature Sensor (CTS) is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance (100,000 ohms at -40°C/-40°F) while high temperature causes low resistance (70 ohms at 130°C/266°F).

The ECM supplies a 5-volt signal to the coolant sensor through a resistor in the ECM and measures the voltage. The voltage will be high when the engine is cold, and low when the engine is hot. By measuring the voltage, the ECM knows the engine coolant temperature. Engine coolant temperature affects most systems the ECM controls.

A failure in the coolant sensor circuit should set either a Code 14 or Code 15. Remember, these codes indicate a failure in the coolant temperature circuit, so proper use of the chart will lead to either repairing a wiring problem or replacing the sensor, to properly repair a problem.



1 ENGINE COOLANT TEMPERATURE SENSOR (CTS)
2 HARNESS CONNECTOR TO ECM
3 LOCKING TAB

4-2-85

*5S 1640-6EA

Figure C1-3 – Coolant Temperature Sensor (CTS)

Manifold Air Temperature (MAT) Sensor

The Manifold Air Temperature (MAT) sensor is a thermistor, a resistor which changes value based on the temperature of air entering the engine. Low temperature produces a high resistance (100,000 ohms at -40°C/-40°F), while high temperature causes low resistance (70 ohms at 130°C/266°F). The ECM supplies a 5-volt signal to the sensor through a resistor in the ECM and measures the voltage. The voltage will be high when the intake air is cold, and low when the air is hot.

By measuring the voltage, the ECM knows the manifold air temperature.

The MAT sensor is also used to control spark timing and delays EGR when intake air is cold.

A failure in the MAT sensor circuit should set either a Code 23 or Code 25.

Oxygen (0_2) Sensor (Figure C1-4)

The exhaust Oxygen (0,) sensor is mounted in the exhaust system where it can monitor the oxygen content of the exhaust gas stream. The oxygen content in the exhaust reacts with the sensor to produce a voltage output. This voltage ranges from approximately .1 volt (high O_2-lean mixture) to .9 volt (low O_2-rich mixture). This voltage can be measured with a digital voltmeter having at least 10 megohms input impedance. Use of standard shop type voltmeters will result in very inaccurate readings.

By monitoring the voltage output of the 0_2 sensor, the ECM will know what fuel mixture command to give to the injector (lean mixture-low 0_2 voltage=rich command, rich mixture-high 0_2 voltage=lean command).

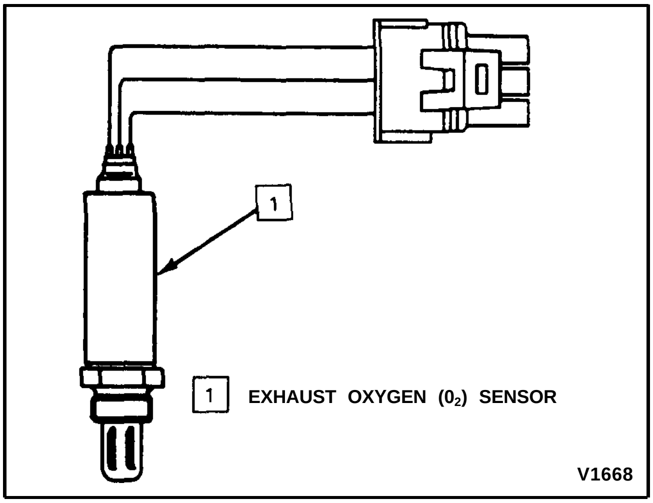


Figure C1-4 – Heated Exhaust Oxygen (0_2) Sensor

The 0_2 sensor circuit, if open, should set a Code 13. A constant low voltage in the sensor circuit should set a Code 44. While a constant high voltage in the circuit should set a Code 45. Codes 44 and 45 could also be set as a result of fuel system problems. See code charts for conditions that can cause a lean or rich system.

Throttle Position Sensor (TPS) (Figure C1-5)

The Throttle Position Sensor (TPS) is a potentiometer connected to the throttle shaft on the throttle body. The TPS electrical circuit consists of a 5-volt supply line and a ground line, both provided by the ECM. By monitoring the voltage on this signal line the ECM calculates throttle position. As the throttle valve angle is changed valve angle is changed (accelerator pedal moved), the output of the TPS also changes. At a closed throttle position, the output of the TPS is low (approximately 1 volt). As the throttle valve opens, the output increases so that, at wide-open throttle, the output voltage should be approximately 5 volts.

The ECM can determine fuel delivery based on throttle valve angle (driver demand). A broken or loose TPS can cause intermittent bursts of fuel from the injectors, and an unstable idle, because the ECM thinks the throttle is moving. A problem in any of the TPS circuits should set either a Code 21 or 22. Once a trouble code is set, the ECM will use an artificial default value for TPS, and some vehicle performance will return. A high idle will result when either Code 21 or 22 is set.

See “On-Vehicle Service” for replacement or adjustment of TPS.

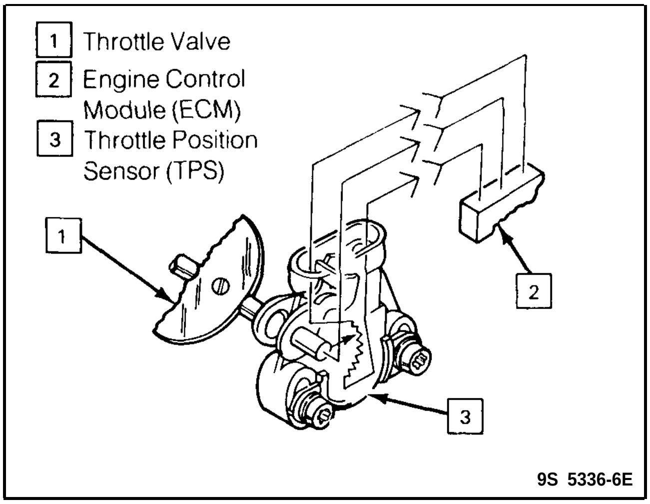


Figure C1-5 – Throttle Position Sensor (Typical)

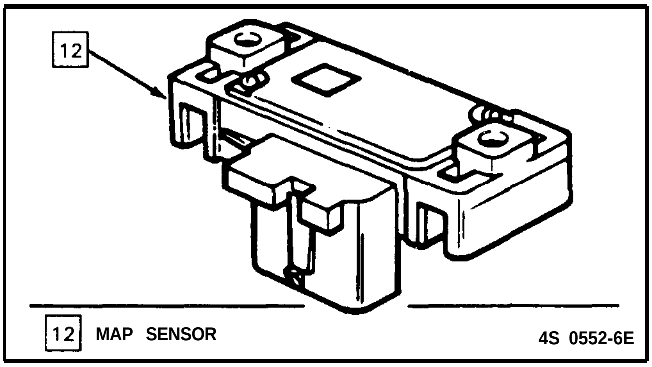


Figure C1-6 – Manifold Absolute Pressure (MAP)

Manifold Absolute Pressure (MAP) Sensor

The Manifold Absolute Pressure (MAP) sensor (see Figure C1-6) measures the changes in the intake manifold pressure which result from engine load and speed changes, and converts this to a voltage output.

A closed throttle on engine coast down would produce a relatively low MAP output, while a wide-open throttle would produce a high output. Manifold Absolute Pressure (MAP) is the OPPOSITE of what you would measure on a vacuum gage. When manifold pressure is high, vacuum is low. The MAP sensor is also used to measure barometric pressure under certain conditions, which allows the ECM to automatically adjust for different altitudes. The ECM sends a 5-volt reference signal to the MAP sensor. As the manifold pressure changes, the electrical resistance of the sensor also changes. By monitoring the sensor output voltage, the ECM knows the manifold pressure. A higher pressure, low vacuum or boost (high voltage) requires more fuel, while a lower pressure, higher vacuum (low voltage) requires less fuel.

A failure in the MAP sensor circuit should set a Code 33 or Code 34.

Vehicle Speed Sensor (VSS)

The Vehicle Speed Sensor (VSS) is made up of a coil mounted on the transmission and a tooth rotor mounted to the output shaft in the transmission. As each rotor tooth nears the coil, the coil produces an AC voltage pulse. As the vehicle speed increases the number of AC voltage pulses per second increases. The Digital Ratio Adapter Controller (DRAC) processes inputs from the VSS and output signal to the speedometer, ECM, and cruise control module. The DRAC takes the voltage pulses from the VSS and uses them to open and close four solid state output switches to ground at a rate proportional to vehicle speed. The DRAC is matched to the vehicle based on transmission final drive ratio and tire size. It is important to ensure that the correct DRAC is installed in the vehicle if replacement is necessary.

Knock Sensor

Refer to Electronic Spark Control (Section "C5").

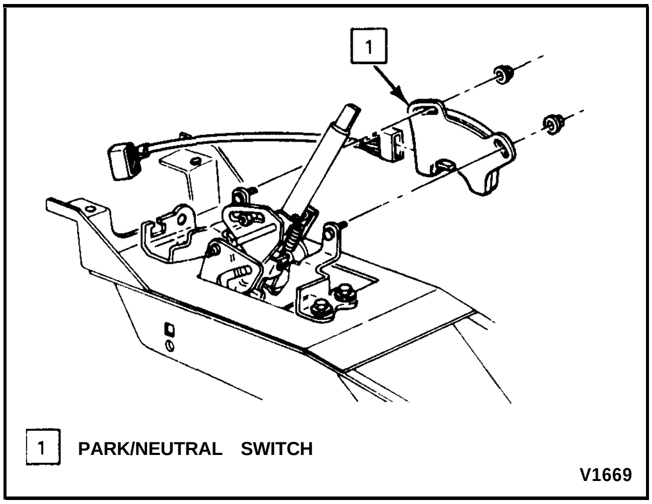


Figure C1-7 – Park/Neutral (P/N) Switch

A/C Request Signal

This signal tells the ECM that the A/C selector switch is turned "ON." The ECM uses this to adjust the idle speed, before turning "ON" the A/C clutch.

If this signal is not available to the ECM, the A/C compressor will be inoperative.

See Section "C-10" for A/C wiring diagrams and diagnosis of A/C electrical system.

Park/Neutral Switch

The Park/Neutral (P/N) switch (Figure C1-7) indicates to the ECM when the transmission is in park or neutral or drive. This information is used for the TCC, EGR, and the IAC valve operation.

Important

- Vehicle should not be driven with park/neutral switch disconnected, as idle quality will be affected and a possible false Code 24 (VSS) could be set.

See AUTOMATIC TRANSMISSION (Section "7A1") for more information on the P/N switch, which is part of the shifter assembly on the console. See CHART C-1A for P/N switch check.

DIAGNOSIS

To read the codes, use a "Scan" tool, or ground the diagnostic terminal, with the engine not running and the ignition "ON." The "Check Engine" light will flash Code 12 three times and then flash each code stored in memory three times. All codes stored in memory will have been read when Code 12 is flashed again. No new codes can be stored when in the diagnostics mode (diagnostics lead grounded). This eliminates confusion while the system is being worked on.

To clear the codes from memory:

- Ignition "OFF."
- Disconnect battery for 30 seconds.

Since the ECM can have a failure, which may affect only one circuit,, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the ECM connections or ECM is the cause of a problem, and the ECM is replaced, but does not correct the problem, one of the following may be the reason:

- There is a problem with the ECM terminal connections. - The diagnostic chart will say ECM connections or ECM. The terminals may have to be removed from the connector in order to check them properly.
- The ECM, or Mem-Cal is not correct for the application. - The incorrect components may cause a malfunction and may or may not set a code.

- The problem is intermittent. - This means that the problem is not present at the time the system is being checked. In this case, refer to the "Symptoms" portion of the manual and make a careful physical inspection of all portions of the system involved.
- Shorted solenoid, relay coil, or harness. - Solenoids and relays are turned "ON" and "OFF" by the ECM, using internal electronic switches called "drivers". Each driver is part of a group of four, called "quad-drivers." Failure of one driver can damage any other driver in the set.

A shorted solenoid, relay coil, or harness in a GMP4 computer will not damage the ECM, but will cause the circuit and controlled component to be inoperative. When the circuit fault is not present or has been repaired, the "quad-driver" will again operate in a normal manner due to its fault protected design. If a fault has been repaired in a circuit controlled by a "quad-driver," the original ECM should be reinstalled and the circuit checked for proper operation. ECM replacement will not be necessary if the repaired circuit or component now operates correctly.

J 34636 or BT 8405 testers or equivalent, provide a fast, accurate means of checking for a shorted coil or a short to battery voltage.

- The Mem-Cal may be faulty. - Although these rarely fail, it operates as part of the ECM. Therefore, it could be the cause of the problem. Substitute a known good Mem-Cal.
- The replacement ECM may be faulty. - After the ECM is replaced, the system should be re-checked for proper operation. If the diagnostic chart again indicates the ECM is the problem, substitute a known good ECM. Although this is a rare condition, it could happen,

ECM

A faulty ECM will be determined in the diagnostic charts.

MEM-CAL

An incorrect or faulty Mem-Cal, which is part of the ECM, may set a Code 51.

ECM INPUTS

All of the sensors and input switches can be diagnosed by the use of a "Scan" tool. Following is a short description of how the sensors and switches can be diagnosed by the use of "Scan." The "Scan" can also be used to compare the values for a normal running engine with the engine you're diagnosing.

Coolant Temperature Sensor (CTS)

A "Scan" tool displays engine temperature in degrees centigrade. After engine is started, the temperature should rise steadily to about 90°C then stabilize when thermostat opens. If the engine has not been run for several hours (overnight) the coolant temperature and MAT temperatures should read close to each other. A fault in the coolant sensor circuit should set a Code 14 or 15. The code charts also contain a chart to check for sensor resistance values relative to temperature.

Manifold Air Temperature (MAT) Sensor

A "Scan" tool displays temperature of the air entering the engine and should read close to ambient air temperature when engine is cold, and rise as underhood temperature increases. If the engine has not been run for several hours (overnight) the MAT sensor temperature and coolant temperature should read close to each other. A failure in the MAT sensor circuit should set a Code 23 or 25. The code charts also contain a chart to check for sensor resistance values relative to temperature.

Oxygen (0_2) Sensor

The "Scan" has several positions that will indicate the state of the exhaust gases, 0_2 voltage, integrator, and block learn. See "Scan" position information in EMISSIONS (Section "6E").

A problem in the 0_2 sensor circuit, or fuel system, should set a Code 13 (open circuit), Code 44 (lean indication), or Code 45 (rich indication). Refer to applicable chart, if any of these codes were stored in memory.

The heated oxygen (0_2) sensor (Figure C1-8) is constructed from a zirconia/platinum electrolytic element. It is equipped with an internal heating element that allows the sensor to reach normal operating temperature, 316°C (600°F), quickly. This allows for closed-loop operation. The heated 0_2 sensor is at the ideal operating temperature at all times, which provides for low exhaust emissions. A platinum coating on the outer surface of the element stimulates further combustion of the exhaust gases right at the surface and this helps keep the element up to the desired temperature.

Throttle Position Sensor (TPS)

A "Scan" tool displays throttle position in volts. The 4.3L (turbo) should read below 1.25 volts, with throttle closed and ignition "ON," or at idle. Voltage should increase at a steady rate as throttle is moved toward WOT.

The ECM has the ability to auto-zero the TPS voltage

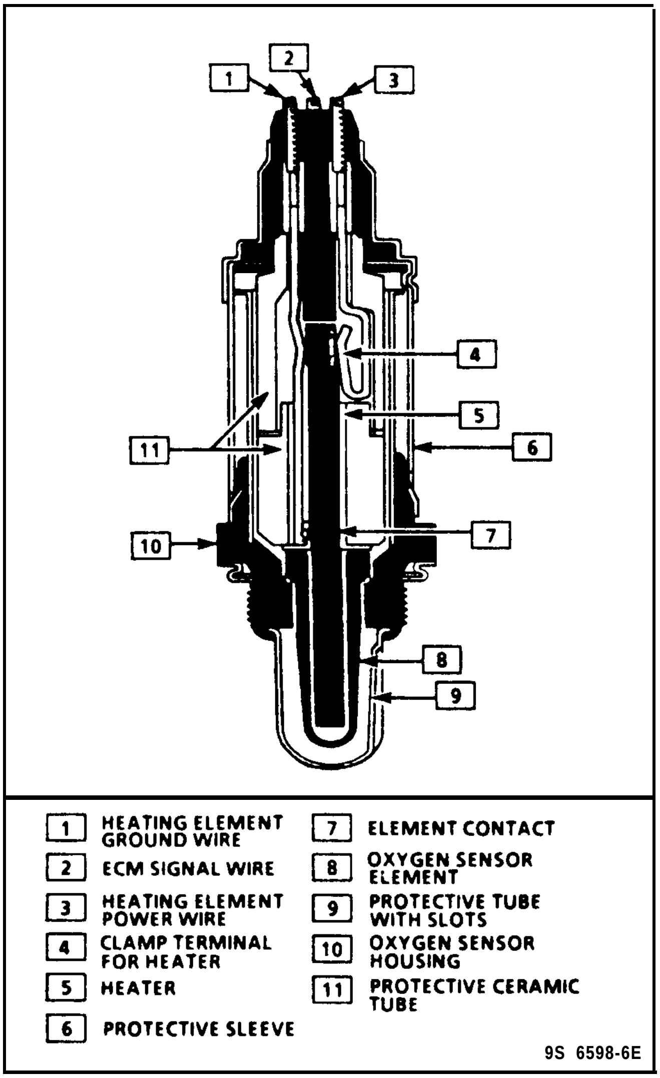


Figure C1-8 – Heated Oxygen (0_2) Sensor
Cutaway View

if it is below about 1.25 volts. This means that any voltage less than 1.25 volts will be determined by the ECM to be 0% throttle. Some “Scan” tools have the ability to read the throttle angle and should read 0%, when the throttle is closed. A failure in the TPS or circuit should set a Code 21 or 22.

Manifold Absolute Pressure (MAP) Sensor

“Scan” displays manifold pressure in volts. Low pressure (high vacuum) reads a low voltage, while a high pressure (low vacuum) reads a high voltage. A failure in the MAP sensor circuit should set a Code 33 or 34 and using the chart will find the cause of the problem. A Code 33 may be set if a rough or unstable idle exists. CHART C-1D can also be used to check MAP sensor.

Vehicle Speed Sensor (VSS)

A “Scan” tool reading should closely match with speedometer reading with drive wheels turning. A failure in the VSS circuit should set a Code 24.

Park/Neutral (P/N) Switch

A “Scan” tool should read P/N when in park, or neutral, and R-D, L, when in drive or overdrive. This reading may vary with different makes of tools. Refer to CHART C-1A for P/N switch diagnosis.

A/C Request Signal

When A/C is “ON.” the “Scan” tool should indicate A/C “ON.”

Refer to Section “C10” for electrical system diagnosis.

Distributor Reference Signal

The ignition module sends a signal to the ECM, which is used to calculate proper spark advance and fuel delivery. A “Scan” tool will read this signal and is displayed in rpm. Refer to Section “C4” for more information on the ignition system (EST).

ON-VEHICLE SERVICE

ELECTRONIC CONTROL MODULE (ECM)

Important

- The ECM is equipped with a PAS Tamper Resistant Label. This label crosses the ECM access cover and hooks onto the large, black connector. It prevents tampering with the ECM or Mem-Cal without the knowledge of the technician. If the seal has been broken and not properly replaced as described in “ECM or Mem-Cal Replacement” in this section, the new vehicle warranty will be void. In this case, notify the service manager before proceeding with the repair.

  Before servicing the ECM, it is important to record the registration number from the label on the customer repair order. After repairs have been made to the unit, a new label must be applied and its registration number must be recorded on the repair order.

Service of the ECM should, normally, consist of either replacement of the ECM or a Mem-Cal change.

If the diagnostic procedures call for the ECM to be replaced, the engine calibrator (Mem-Cal) and ECM should be checked first to see if they are the correct parts. If they are, remove the Mem-Cal from the faulty ECM and install it in the new service ECM. THE SERVICE ECM WILL NOT CONTAIN A MEM-CAL.

Trouble Code 51 indicates the Mem-Cal is installed improperly or has malfunctioned. When Code 51 is obtained, check the ECM installation for bent pins or pins not fully seated in the socket. If it is installed correctly and Code 51 still shows, replace the Mem-Cal.

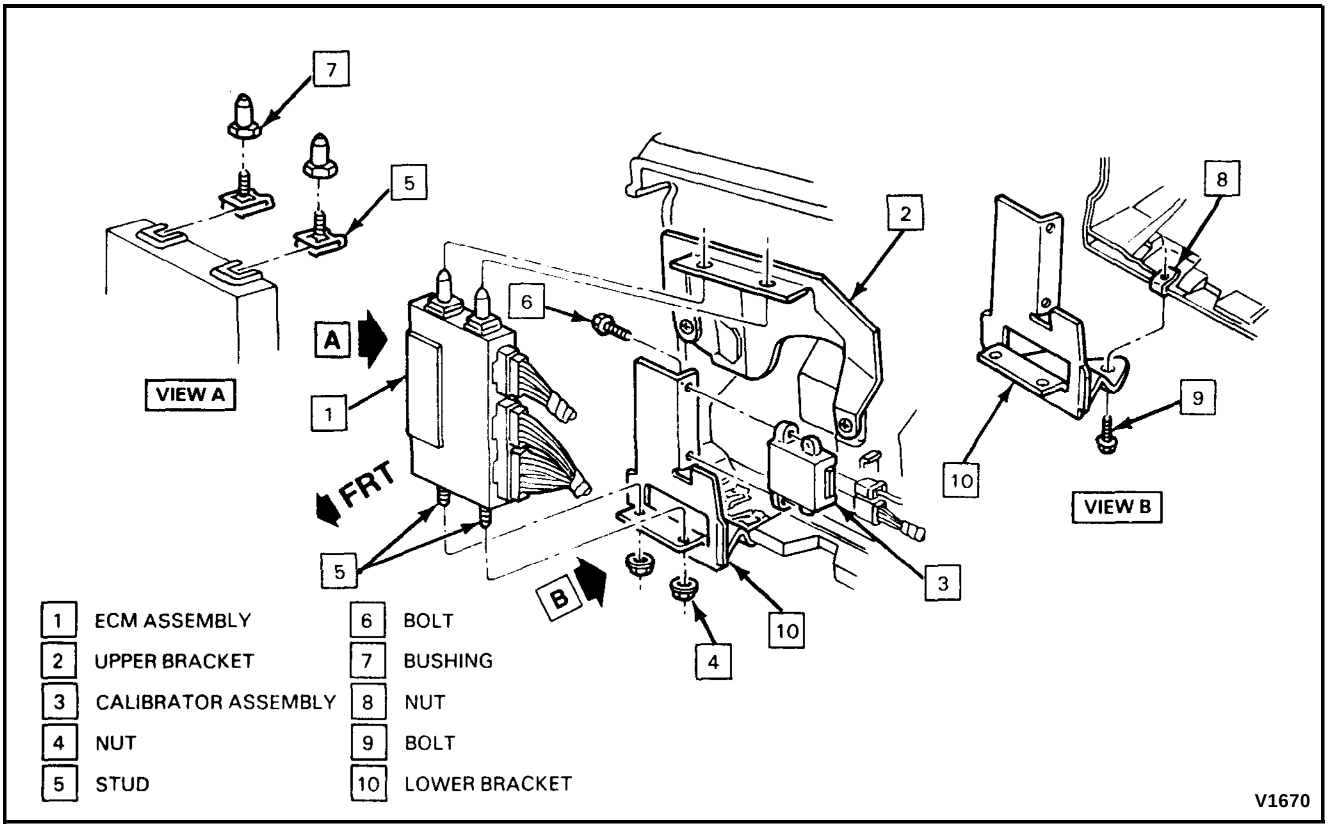


Figure C1-9 – ECM Location

Important

- When replacing the production ECM with a service ECM (controller), it is important to transfer the broadcast code and production ECM number to the service ECM label. Please do not record on ECM cover. This will allow positive identification of ECM parts throughout the service life of the vehicle.

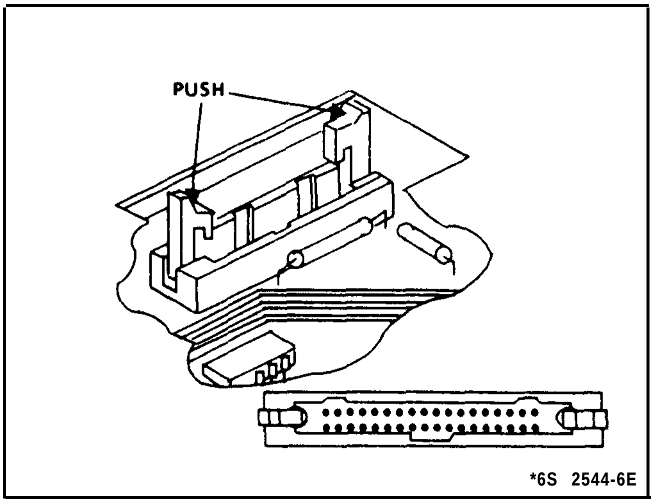


Figure C1-10 – Mem/Cal Unit Socket

Important

- To prevent internal ECM damage, the ignition must be "OFF" when disconnecting or reconnecting power to ECM (for example; battery cable, ECM pigtail, ECM fuse, jumper cables, etc.).

ECM OR MEM-CAL REPLACEMENT

Remove or Disconnect (Figures 9 through 11)

1. Negative (-) battery cable.
2. Right-hand hush panel.
3. ECM mounting hardware.

- Log serial number from Tamper-Resistant. Label.

NOTICE: To prevent possible Electrostatic Discharge damage to the ECM, Do Not touch the connector pins or soldered components on the circuit board.

4. Connectors from ECM, breaking seal to Tamper-Resistant Label.
5. ECM from passenger compartment.
6. ECM access cover, breaking seal to Tamper-Resistant Label.
7. Mem-Cal (Figure C1-11).

NOTICE: To prevent possible Electrostatic Discharge damage to the Mem-Cal, Do Not touch the component leads, and Do Not remove integrated circuit from carrier.

Important

- Replacement ECM is supplied without a Mem-Cal, so care should be used, when removing it from the defective ECM, because it will be reused in the new ECM.

Using two fingers, push both retaining clips back away from the Mem-Cal. At the same time, grasp it at both ends and lift it up out of the socket. Do not remove the cover of the Mem-Cal. Use of unapproved Mem-Cal removal methods may cause damage to the Mem-Cal or socket.

Inspect (Figure C1-10)

- For alignment notches of the Mem-Cal and carefully set it aside.

8. New ECM from its packaging and check the service number to make sure it is the same as the defective ECM.
9. Access Cover.

Install or Connect (Figures 9 through 11)

1. Mem-Cal.

Important

- Press only on the ends of the Mem-Cal. Indexes on the Mem-Cal must be aligned with the small index notches in the Mem-Cal socket. Press on the ends of the Mem-Cal until the retaining clips snap into the ends of the Mem-Cal. Do not press on the middle of the Mem-Cal, only on the ends.

2. ECM access cover.
3. ECM to passenger compartment.
4. Connectors to ECM.

- Log serial number from new Tamper-Resistant Label and apply to access cover and at large, black connector.

5. ECM mounting hardware.
6. Right-hand hush panel.
7. Negative (-) battery cable.

Functional Check

1. Turn ignition “ON.”
2. Enter diagnostics.
   A. Allow Code 12 to flash four times to verify no other codes are present. This indicates the Mem-Cal is installed properly and the ECM is functioning.
   B. If Trouble Codes 42, 43 or 51 occur, or if the “Check Engine” light is “ON” constantly with no codes, the Mem-Cal is not fully seated or is defective.
      a. If not fully seated, press firmly on the ends of the Mem-Cal.
      b. If it is necessary to remove the Mem-Cal, follow the previous removal instructions.

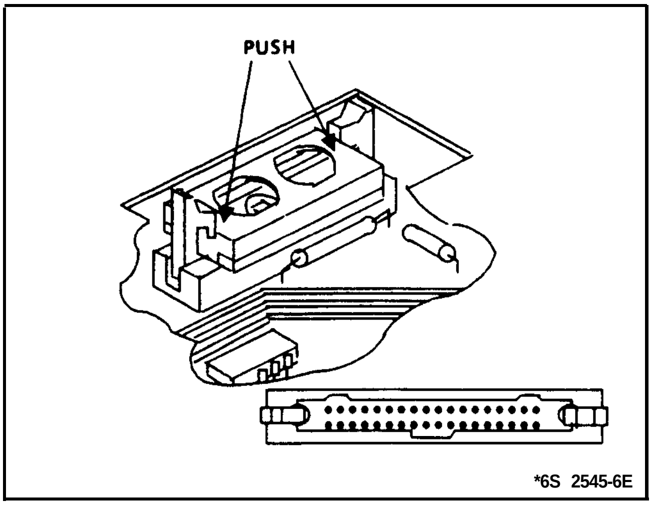


Figure C1-11 – Mem/Cal Unit Installation

COOLANT TEMPERATURE SENSOR (CTS)

NOTICE: Care must be taken when handling coolant temperature sensor. Damage to coolant sensor will affect proper operation of the fuel injection system.

Remove or Disconnect

1. Relieve coolant system pressure.
2. Negative battery cable.
3. Electrical connector.
4. Carefully back out coolant sensor.

Install or Connect

1. Coat threads (only) with sealer P/N 1052080 or equivalent.
2. Sensor in engine. Torque to 30 N•m (22 lb. ft.).
3. Electrical connector.
4. Negative battery cable.
5. Refill lost coolant.

MANIFOLD AIR TEMPERATURE (MAT) SENSOR

The MAT sensor is mounted in the air intake manifold.

Remove or Disconnect

1. Negative battery cable.
2. Electrical connector.
3. Carefully back out MAT sensor.

→← Install or Connect

1. Coat threads (only) with sealer P/N 1052080 or equivalent.
2. Sensor in engine.
3. Electrical connector.
4. Negative battery cable.

OXYGEN (0_2) SENSOR

NOTICE: The oxygen sensor uses a permanently attached pigtail and connector (Figure Cl- 12). This pigtail should not be removed from the oxygen sensor. Damage or removal of the pigtail or connector could affect proper operation of the oxygen sensor.

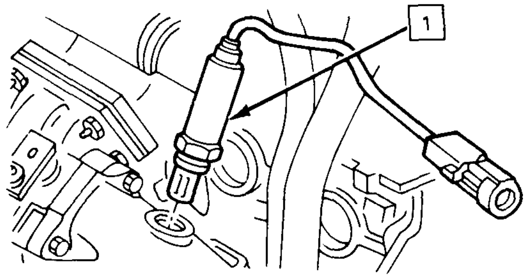
Important

- Take care when handling the oxygen sensor. The in-line electrical connector and louvered end must be kept free of grease, dirt, or other contaminants. Also, avoid using cleaning solvents of any type. Do not drop or roughly handle the oxygen sensor.

←→ Remove or Disconnect

- The oxygen sensor may be difficult to remove when engine temperature is below 48°C (120^{o}F).
- Excessive force may damage threads in exhaust, manifold or exhaust pipe.

1. Negative battery cable.
2. Electrical connector.
3. Carefully back out oxygen sensor.



1 OXYGEN (02) SENSOR 41 N•m (30 FT. LBS.)

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Figure C1-12 – Oxygen (0_2) Sensor

→← Install or Connect

Important

- A special anti-seize compound is used on the oxygen sensor threads. The compound consists of a liquid graphite and glass beads. The graphite will burn away, but the glass beads will remain, making the sensor easier to remove.
- New or service sensors will already have the compound applied to the threads. If a sensor is removed from an engine, and, if for any reason, it is to be reinstalled, the threads must have anti-seize compound applied before reinstallation.

1. Coat threads of oxygen sensor with anti-seize compound P/N 5613695, or equivalent, if necessary.
2. Sensor, and torque to 41 N•m (30 lb. ft.).
3. Electrical connector.
4. Negative battery cable.

THROTTLE POSITION SENSOR (TPS)

←→ Remove or Disconnect

1. TPS Electrical connector.
2. Remove TPS attaching screws and retainers.
3. Sensor.

→← Install or Connect

1. With throttle valve in the normal closed idle position, install throttle position sensor on throttle body assembly.
2. Retainers and two TPS screws.

Important

- Use a “Scan” tool to check TPS output voltage with throttle closed, should be under 1.25 volts. If over, check for binding throttle shaft, or TPS lever. If all OK, replace TPS.

3. TPS electrical connector.
4. Throttle cables.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

←→ Remove or Disconnect

1. Vacuum hose.
2. Electrical connector.
3. Attaching screws.
4. Sensor.

→← Install or Connect

1. Sensor using attaching screws.
2. Electrical connector.
3. Vacuum hose.

VEHICLE SPEED SENSOR (VSS)

Refer to INSTRUMENT PANEL AND GAGES (SEC. 8C) of the 1992 Service Manual Sonoma and Jimmy Models for trans. mounted VSS.

PARK/NEUTRAL P/N SWITCH

Refer to AUTOMATIC TRANSMISSION (SEC. 7A1) for park/neutral switch.

PARTS INFORMATION

PART NAME	GROUP
Controller, ECM	3.670
Memory Calibration Unit, Mem/Cal	3.670
Sensor, Coolant Temp	3.682
Sensor, Exhaust Oxygen	3.682
Sensor, Throttle Position: Part of Sensor Kit, Throttle Position	3.440
Sensor, Manifold Pressure	3.682
Sensor, Vehicle Speed	3.682

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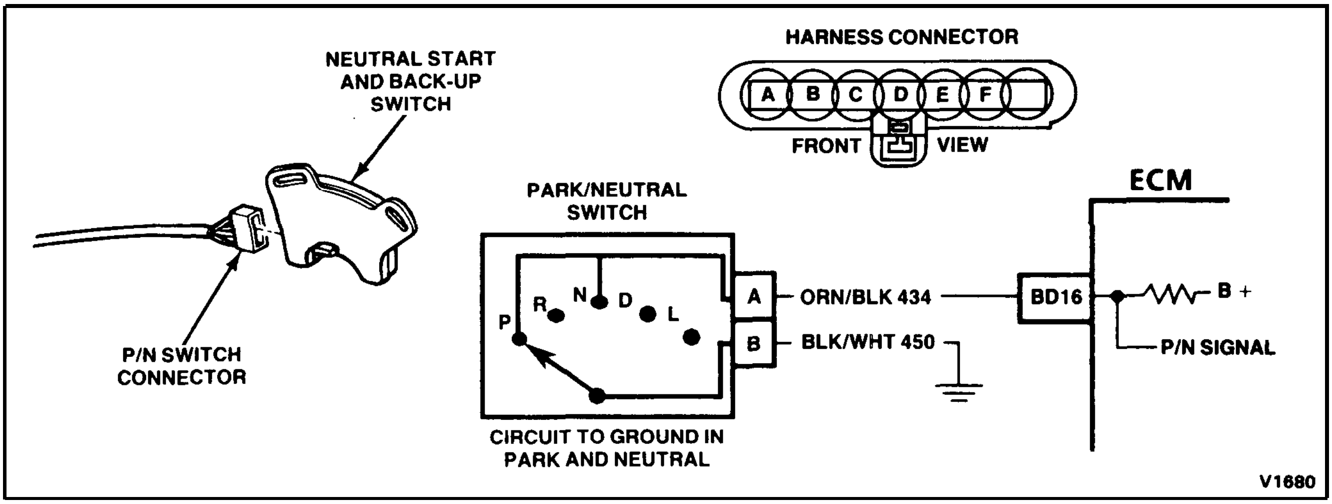


CHART C-1A

PARK/NEUTRAL SWITCH DIAGNOSIS
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The Park/Neutral switch contacts are a part of the neutral start switch. They are closed to ground in park or neutral and open in drive ranges.

The ECM supplies voltage through a current limiting resistor to CKT 434 and senses a closed switch when the voltage on CKT 434 drops to less than one volt.

The ECM uses the P/N signal as one of the inputs to control idle air and EGR.

If CKT 434 indicates P/N (grounded), while in drive range, the EGR would be inoperative, resulting in possible detonation.

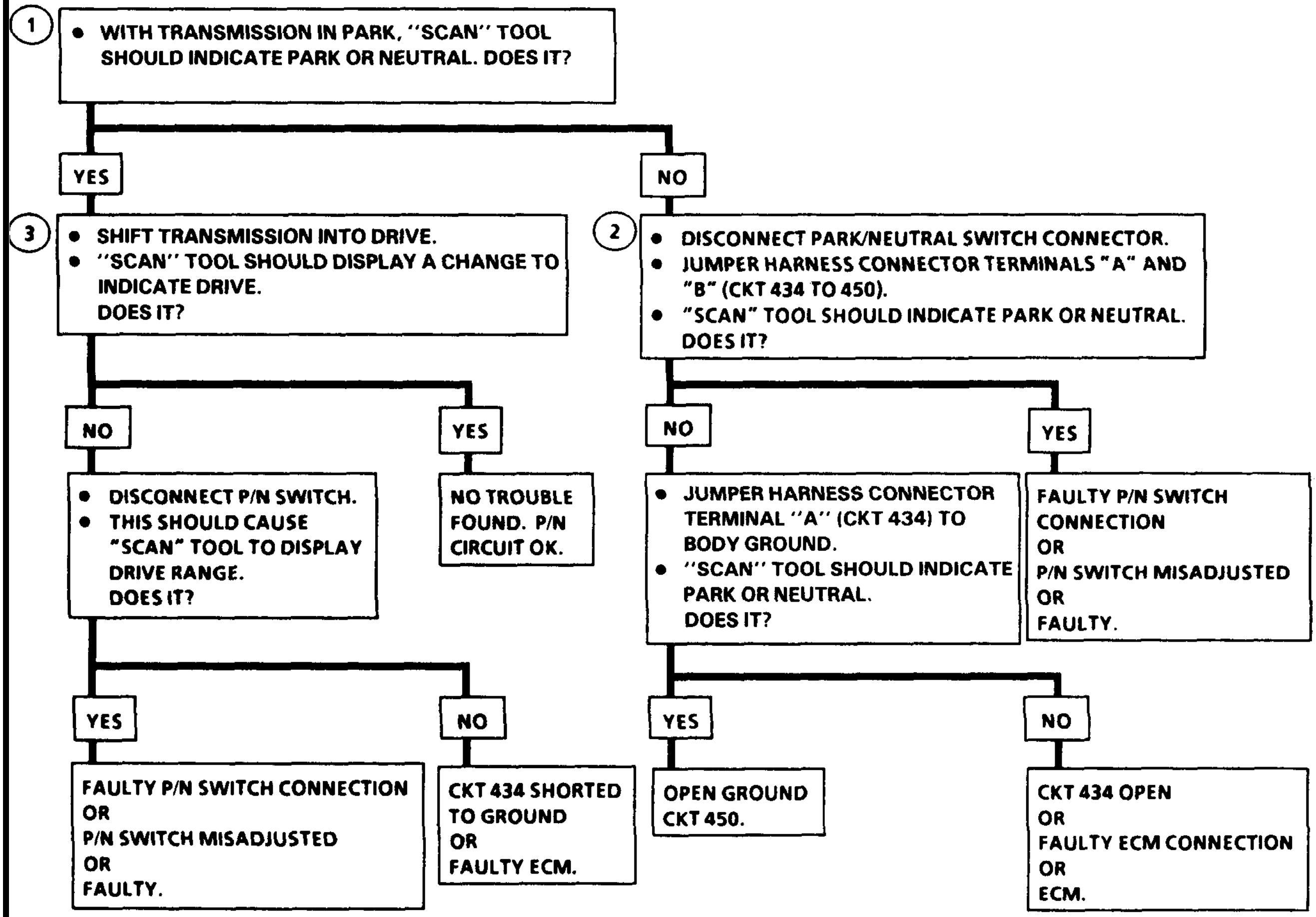
If CKT 434 indicates drive (open), a dip in the idle may exist when the gear selector is moved into drive range.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Checks for a closed switch to ground in park position. Different makes of “Scan” tools will read P/N differently. Refer to tool operator’s manual for type of display used for a specific tool.
2. Checks for an open switch in drive range.
3. Be sure “Scan” indicates drive, even while wiggling shifter, to test for an intermittent or misadjusted switch in drive or overdrive range.

CHART C-1A

PARK/NEUTRAL SWITCH DIAGNOSIS 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- WITH TRANSMISSION IN PARK, "SCAN" TOOL SHOULD INDICATE PARK OR NEUTRAL. DOES IT?

YES

③
- SHIFT TRANSMISSION INTO DRIVE.
- "SCAN" TOOL SHOULD DISPLAY A CHANGE TO INDICATE DRIVE.

DOES IT?

NO

- DISCONNECT P/N SWITCH.
- THIS SHOULD CAUSE "SCAN" TOOL TO DISPLAY DRIVE RANGE.

DOES IT?

YES

FAULTY P/N SWITCH CONNECTION
OR
P/N SWITCH MISADJUSTED
OR
FAULTY.

NO

CKT 434 SHORTED TO GROUND
OR
FAULTY ECM.

YES

NO TROUBLE FOUND. P/N CIRCUIT OK.

NO

②
- DISCONNECT PARK/NEUTRAL SWITCH CONNECTOR.
- JUMPER HARNESS CONNECTOR TERMINALS "A" AND "B" (CKT 434 TO 450).
- "SCAN" TOOL SHOULD INDICATE PARK OR NEUTRAL.

DOES IT?

NO

- JUMPER HARNESS CONNECTOR TERMINAL "A" (CKT 434) TO BODY GROUND.
- "SCAN" TOOL SHOULD INDICATE PARK OR NEUTRAL.

DOES IT?

YES

OPEN GROUND CKT 450.

NO

CKT 434 OPEN
OR
FAULTY ECM CONNECTION
OR
ECM.

YES

FAULTY P/N SWITCH CONNECTION
OR
P/N SWITCH MISADJUSTED
OR
FAULTY.

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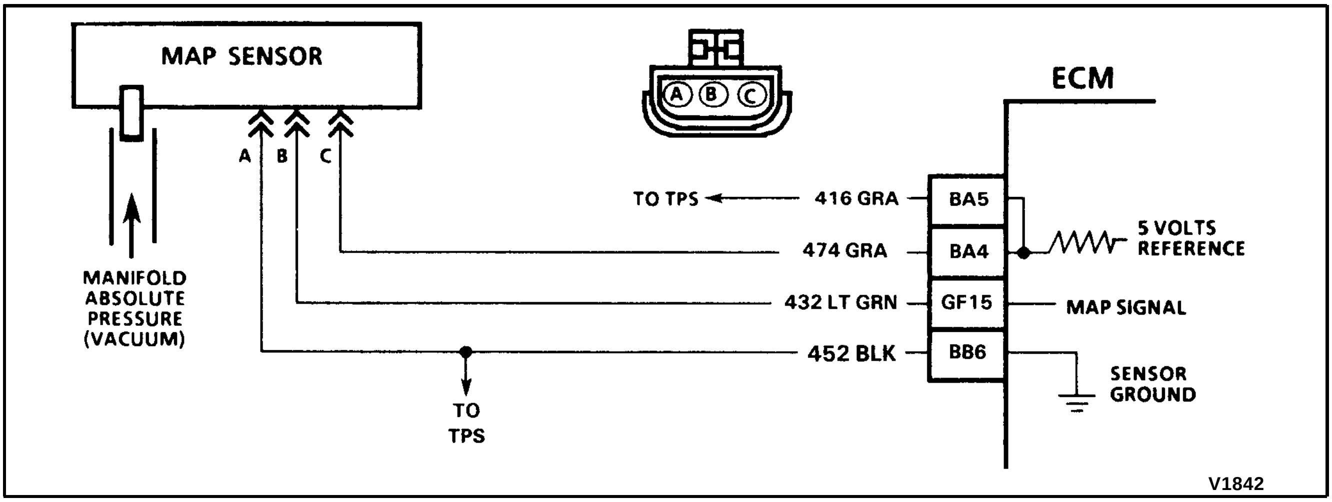


CHART C-1D

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

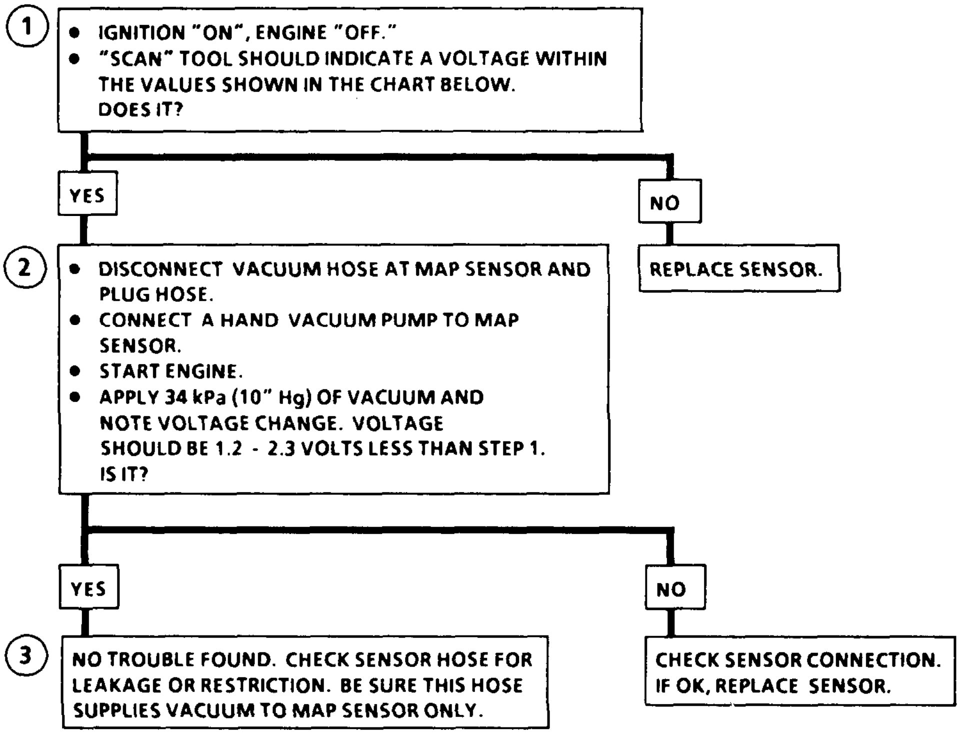
The Manifold Absolute Pressure (MAP) sensor measures manifold pressure (vacuum) and sends that signal to the ECM. The MAP sensor is mainly used to calculate engine load, which is a fundamental input for spark and fuel calculations. The MAP sensor is also used to determine barometric pressure.

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Checks MAP sensor output voltage to the ECM. With the ignition "ON" and the engine stopped, the manifold pressure is equal to atmospheric pressure and the signal voltage will be high. This voltage, without engine running, represents a barometer reading to the ECM.
   Comparison of this BARO reading with a known good vehicle with the same sensor is a good way to check accuracy of a "suspect" sensor. Readings should be the same ± .4 volt.
2. Applying 34 kPa (10 inches Hg) vacuum to the MAP sensor should cause the voltage to be 1.2-2.3 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check vacuum hose to sensor for leaking or restriction. Be sure no other vacuum devices are connected to the MAP hose.

CHART C-1D

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- IGNITION "ON", ENGINE "OFF."
- "SCAN" TOOL SHOULD INDICATE A VOLTAGE WITHIN THE VALUES SHOWN IN THE CHART BELOW. DOES IT?

YES

NO

REPLACE SENSOR.

②
- DISCONNECT VACUUM HOSE AT MAP SENSOR AND PLUG HOSE.
- CONNECT A HAND VACUUM PUMP TO MAP SENSOR.
- START ENGINE.
- APPLY 34 kPa (10" Hg) OF VACUUM AND NOTE VOLTAGE CHANGE. VOLTAGE SHOULD BE 1.2 - 2.3 VOLTS LESS THAN STEP 1. IS IT?

YES

NO

③ NO TROUBLE FOUND. CHECK SENSOR HOSE FOR LEAKAGE OR RESTRICTION. BE SURE THIS HOSE SUPPLIES VACUUM TO MAP SENSOR ONLY.

CHECK SENSOR CONNECTION. IF OK, REPLACE SENSOR.

ALTITUDE		VOLTAGE RANGE
Meters	Feet	
Below 305	Below 1,000	3.8---5.5V
305--- 610	1,000--2,000	3.6---5.3V
610--- 914	2,000--3,000	3.5---5.1V
914--1219	3,000--4,000	3.3---5.0V
1219--1524	4,000--5,000	3.2---4.8V
1524--1829	5,000--6,000	3.0---4.6V
1829--2133	6,000--7,000	2.9---4.5V
2133--2438	7,000--8,000	2.8---4.3V
2438--2743	8,000--9,000	2.6---4.2V
2743--3048	9,000--10,000	2.5---4.0V

LOW ALTITUDE = HIGH PRESSURE = HIGH VOLTAGE

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

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SECTION C2

FUEL METERING SYSTEM

CONTENTS

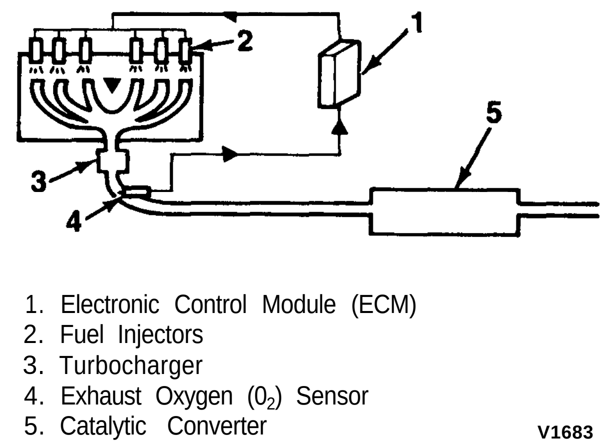
GENERAL DESCRIPTION

PURPOSE

The basic function of the fuel metering system is to control fuel delivery to the engine.

Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each cylinder.

The main control sensor is the oxygen (O_2) sensor, which is located in the turbo outlet pipe. The O_2 sensor tells the ECM how much oxygen is in the exhaust gas, and the ECM changes the air/fuel ratio to the engine by controlling the fuel injectors. The best mixture to minimize exhaust emissions is 14.7 to 1, which allows the catalytic converter to operate the most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a “Closed Loop” system (shown in Figure C2-1).



1. Electronic Control Module (ECM)
2. Fuel Injectors
3. Turbocharger
4. Exhaust Oxygen (0_2) Sensor
5. Catalytic Converter

Figure C2-1 - “Closed Loop” System

MODES OF OPERATION

The ECM looks at voltages from several sensors to determine how much fuel to give the engine. The fuel is delivered under one of several conditions, called “modes.” All the modes are controlled by the ECM, and are described below.

Starting Mode

When the ignition is first turned “ON,” the ECM will turn “ON” the fuel pump relay for two seconds, and the fuel pump will build up pressure. The ECM then checks the coolant temperature and throttle position sensor and determines the proper air/fuel ratio for starting. This ranges from 1.5:1 at -36°C (-33°F) to 14.7:1 at 94°C (201°F). The ECM controls the amount of fuel delivered in the starting mode by changing how long the injectors are turned “ON” and “OFF.” This is done by “pulsing” the injectors for very short times.

Clear Flood Mode

If the engine floods, clear it by pushing the accelerator pedal down all the way. The ECM then pulses the injectors to deliver an air/fuel ratio of 20:l. The ECM holds this injector rate as long as the throttle stays wide open, and the engine rpm is below 600. If the throttle position becomes less than 80%, the ECM returns to the starting mode.

Run Mode

The run mode has two conditions called "Open Loop" and "Closed Loop."

When the engine is first started, and rpm is above 400 rpm, the system goes into "Open Loop" operation. In "Open Loop," the ECM will ignore the signal from the oxygen (O_2) sensor, and calculate the air/fuel ratio based on inputs from the coolant and MAP sensors.

The system will stay in "Open Loop" until the following conditions are met

1. The 0_2 sensor has varying voltage output, showing that it is hot enough to operate properly. (This depends on temperature).
2. The coolant temperature sensor is above a specified temperature.
3. A specific amount of time has elapsed after starting the engine.

The values for the above conditions vary with different engines, and are stored in the Mem-Cal. When these conditions are met, the system goes into "Closed Loop" operation. In "Closed Loop," the ECM will calculate the air/fuel ratio (injector on-time) based on the signal from the 0_2 sensor. This allows the air/fuel ratio to stay very close to 14.7: 1.

Acceleration Mode

The ECM looks at rapid changes in throttle position and manifold pressure and provides extra fuel.

Deceleration Mode

The ECM looks at changes in throttle position and manifold pressure, and reduces the amount of fuel. When deceleration is very fast, the ECM can cut off fuel completely for short periods.

Battery Voltage Correction Mode

When battery voltage is low, the ECM can compensate for the weak spark delivered by the distributor by

- Increasing the amount of fuel delivered
- Increasing the idle rpm
- Increasing ignition dwell time

Fuel Cut-off Mode

No fuel is delivered by the injector when the ignition is "OFF." This prevents dieseling. Also, fuel is not delivered if no reference pulses are seen from the distributor, which means the engine is not running. This prevents flooding. The fuel cut-off mode is also activated when the engine is in overspeed (4800 rpm, 120 mph/193 km/h) or turbo overboost (205 kPa/ 30 psi for 2 seconds) conditions.

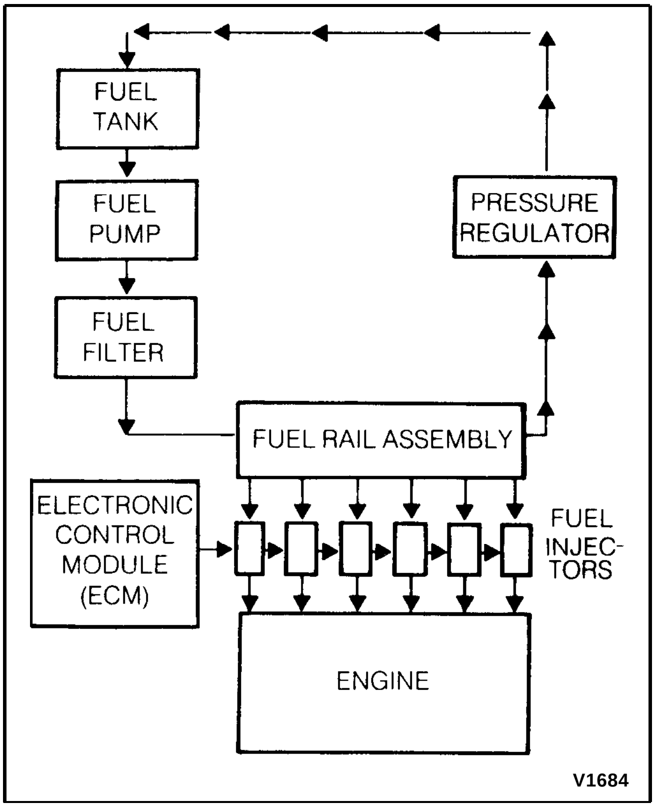


Figure C2-2 - Fuel Supply System (Typical)

FUEL METERING SYSTEM COMPONENTS

The fuel metering system is made up of the following parts:

- Fuel injectors
- Throttle body
- Fuel rail
- Fuel pressure regulator
- Idle air control (IAC) valve
- Fuel pump
- Fuel pump relay

BASIC SYSTEM OPERATION

The fuel supply system (Figure C2-2) starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank with the gage sending unit, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A pressure regulator in the fuel rail keeps fuel available to the injectors at a constant pressure that is above manifold pressure. Unused fuel is returned to the fuel tank by a separate line. For further information on the fuel tank, in-line filter, and fuel lines, see Fuel System (Section "6C").

The injectors are controlled by the ECM. They deliver fuel in one of several modes, as described above.

In order to properly control the fuel supply, the fuel pump is operated by the ECM through the fuel pump relay and oil pressure switch (see "Fuel Pump Electrical Circuit").

THROTTLE BODY UNIT

The throttle body has a throttle valve to control the amount of air delivered to the engine. The TPS and IAC valve are also mounted on the throttle body.

The throttle body contains vacuum ports located at, above, or below the throttle valve. These ports generate the vacuum signals needed by various components.

FUEL RAIL

The fuel rail is mounted to the top of the engine. It distributes fuel to the individual injectors. Fuel is delivered to the input end of the rail by the fuel lines, goes through the rail, then to the pressure regulator. The regulator keeps the pressure to the injectors at a constant pressure. Remaining fuel is then returned to the fuel tank.

FUEL INJECTOR

The fuel injector is a solenoid operated device controlled by the ECM (see Figure C2-3). The ECM turns "ON" the solenoid, which opens a valve to allow fuel delivery. The fuel, under pressure, is injected in a conical spray pattern at the opening of the intake valve. The fuel which is not used by the injectors passes through the pressure regulator before being returned to the fuel tank.

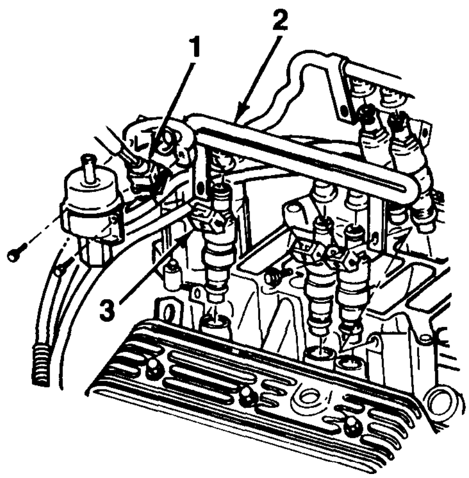
An injector which is stuck partly open could cause loss of pressure after setting, so long crank times would be noticed on some engines. Also, dieseling could occur because some fuel could be delivered to the engine after the ignition is turned "OFF."

PRESSURE REGULATOR

The pressure regulator (see Figure C2-4) is a diaphragm-operated. relief valve with injector pressure on one side and manifold pressure on the other. The function of the regulator is to maintain a constant pressure at the injector at all times. The pressure regulator also compensates for engine load by increasing fuel pressure, when it sees low engine vacuum or boost.

The pressure regulator is mounted on the fuel rail, and is serviced separately.

If the pressure is too low, poor performance could result. If the pressure is too high, excessive odor and a Code 45 may result. CHART A-7 in Section "A" has information on diagnosing fuel pressure conditions.



1. Injector Harness Connector
2. Fuel Rail
3. Fuel Injector

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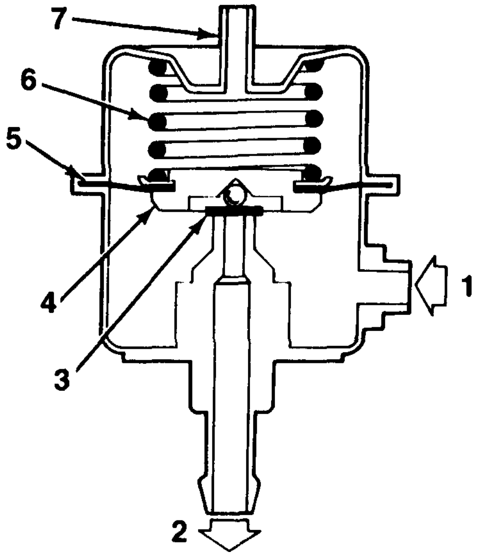
Figure C2-3 - Fuel Injector



1. Fuel Inlet
2. Fuel Return Outlet
3. Valve
4. Valve Holder
5. Diaphragm
6. Compression Spring
7. Vacuum Connection

V1686

Figure C2-4 - Fuel Pressure Regulator

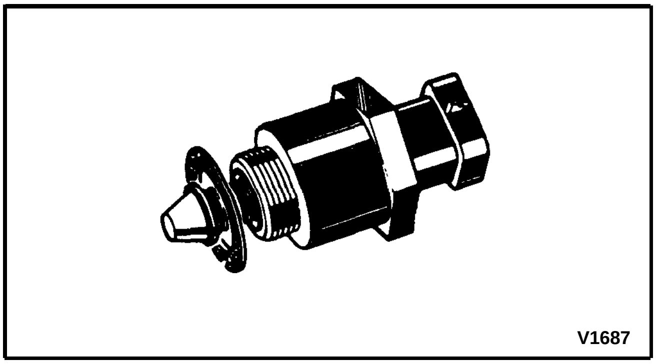


Figure C2-5 - IAC Valve

IDLE AIR CONTROL (IAC) VALVE

The purpose of the Idle Air Control (IAC) valve (shown in Figure C2-5), is to control engine idle speed, while preventing stalls due to changes in engine load.

The IAC valve, mounted in the throttle body, controls bypass air around the throttle valve. By moving a conical valve IN (to decrease air flow) or OUT (to increase air flow), a controlled amount of air can move around the throttle plate. If rpm is too low, more air is bypassed around the throttle valve to increase rpm. If rpm is too high, less air is bypassed around the throttle valve to decrease rpm.

The IAC valve moves in small steps called “counts,” which can be monitored by a “Scan” tool.

During idle, the proper position of the IAC valve is “learned” by the ECM based on battery voltage, coolant temperature, and engine rpm.

If the “learned” IAC valve position is incorrect, the ECM will command a reset. The reset will occur when the vehicle speed is about 30 mph.

If the rpm drops below a specified value, and the throttle plate is closed, the ECM senses a near stall condition. The ECM will then calculate a new value position to prevent stalls.

Different pintle designs are used for the IAC valve. Be sure to use the correct design, when replacement is required.

FUEL PUMP ELECTRICAL CIRCUIT

When the key is first turned “ON” without the engine running, the ECM will turn the fuel pump relay “ON” for two seconds. This builds up the fuel pressure quickly. If the engine is not started within two seconds, the ECM will shut the fuel pump “OFF” and wait until the engine starts. As soon as the engine is cranked, the ECM will turn the relay “ON” and run the fuel pump.

As a backup system to the fuel pump relay, the fuel pump can also be turned “ON” by the oil pressure switch. The oil pressure switch is a normally open switch which closes when oil pressure reaches about 28 kPa (4 psi). If the fuel pump relay fails, the oil pressure switch will close and run the fuel pump.

An inoperative fuel pump relay can result in long cranking times, particularly if the engine is cold.

An inoperative fuel pump would cause a no start condition. A fuel pump which does not provide enough pressure can result in poor performance.

DIAGNOSIS

The diagnosis of the fuel metering system is covered in CHARTS A-3 through A-7 in Section “A.”

ON-VEHICLE SERVICE

FUEL SYSTEM PRESSURE TEST

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, use the procedure on the page opposite CHART A-7 in Section “A.”

PORT FUEL INJECTION COMPONENTS

CAUTION: **Before servicing an injector, fuel rail, or pressure regulator, it is necessary to relieve the pressure in the fuel system, to minimize the risk of fire and personal injury. (See “Fuel Pressure Relief Procedure’* below). To reduce the chance of personal injury, cover the fuel line with a shop cloth to collect the fuel, and then place the cloth in an approved container.**

FUEL PRESSURE RELIEF PROCEDURE

CAUTION:

- **To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing fuel system components.**
- **After relieving system pressure, a small amount of fuel may be released when servicing fuel lines or connections. In order to reduce the chance of personal injury, cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when disconnect is completed.**

Tool Required:

J 34730-1 Fuel Pressure Gage

1. Disconnect negative battery terminal to avoid possible fuel discharge if an accidental attempt is made to start the engine.
2. Loosen fuel filler cap to relieve tank vapor pressure.
3. Connect gage J 34730-1 to fuel pressure connection. Wrap a shop towel around fitting while connecting gage to avoid spillage.
4. Install bleed hose into an approved container and open valve to bleed system pressure. Fuel connections are now safe for servicing.
5. Drain any fuel remaining in gage into an approved container.

FUEL INJECTORS

Important

- Use care in removing injectors to prevent damage to the electrical connector pins on the injector and the nozzle. The fuel injector is serviced as a complete assembly only. The fuel injector is an electrical component and should not be immersed in any type of cleaner.

Remove or Disconnect

1. Ignition "OFF," remove electrical connections.
2. Fuel rail (see procedure below).
3. Injectors.

Install or Connect

1. Injectors. If original injectors are being replaced, new O-rings must be used. If new injector is being installed, O-rings are supplied with the injector.
2. Fuel rail. Injectors are retained by the fuel rail.
3. Electrical connectors.

FUEL RAIL

See Figure C2-6 for 4.3L Turbo fuel rail replacement.

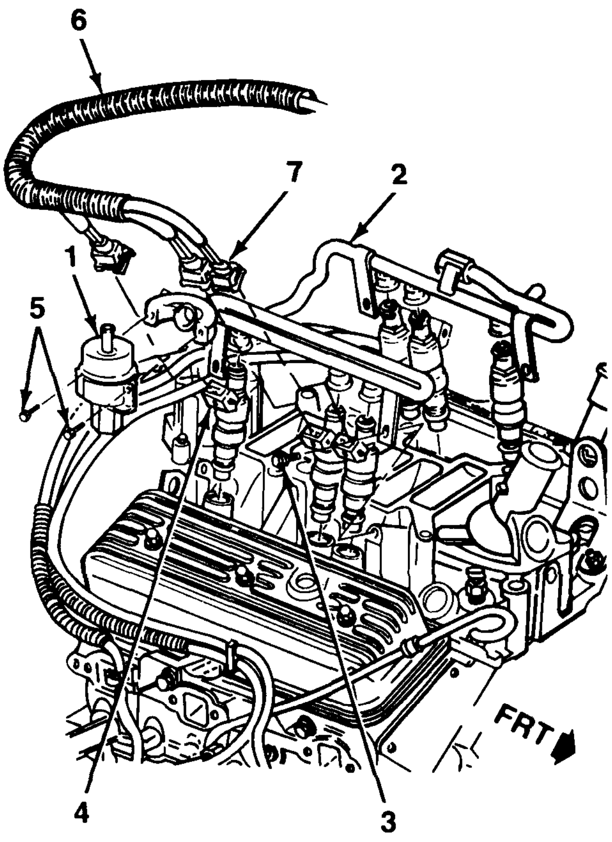
Unit Service Procedures

Important

- When servicing the fuel rail assembly, precautions must be taken to prevent dirt and other contaminants from entering the fuel passages. It is recommended that fittings be capped, and holes be plugged, during servicing.

Important

- At any time the fuel system is opened for service, the O-ring seals used- with related component(s) should be replaced.



1. Fuel Regulator
2. Fuel Rail
3. Bolt – 7 N•m (62 In. Lbs.)
4. Fuel Injector
5. Bolt – 7 N•m (62 In. Lbs.)
6. Injector Sub Harness
7. Injector Harness Connector

V1688

Figure C2-6 - Fuel Rail and Injectors

Cleaning and Inspection

- Before disassembly, the fuel rail assembly may be cleaned with a spray type engine cleaner, such as AC Delco X-30A, or equivalent, following package instructions. The fuel rail should not be immersed in liquid solvent.

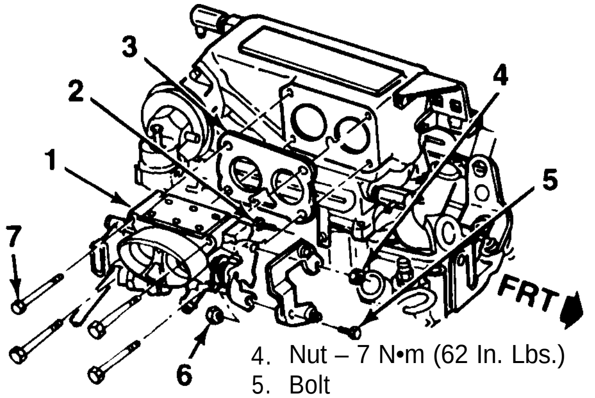
FUEL PRESSURE REGULATOR (Figure C2-6)

Remove or Disconnect

1. Relieve fuel pressure (see previous procedure).
2. Pressure regulator from fuel rail. Place shop cloth around base of regulator to catch any spilled fuel

Install or Connect

1. Pressure regulator on fuel rail.



1. Throttle Body
2. Bolt
3. Gasket
4. Nut – 7 N•m (62 In. Lbs.)
5. Bolt
6. Nut – 7 N•m (62 In. Lbs.)
7. Bolt – 23 N•m (17 Ft. Lbs.)

Figure C2-7 - 4.3L Turbo Throttle Body

THROTTLE BODY (Figure C2-7)

Remove or Disconnect

1. Air inlet duct.
2. IAC and TPS connectors.
3. Vacuum lines
4. Throttle, TV and cruise control cables.
5. Throttle body retaining bolts.

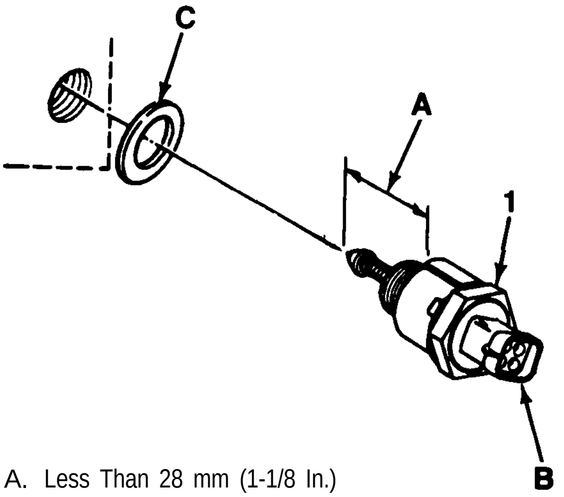
Install or Connect

1. Reverse procedure to reinstall.
2. Torque bolts to 23 N•m (17 ft. lbs.).

IDLE AIR CONTROL VALVE

Remove or Disconnect

1. Electrical connector from idle air control valve.
2. Idle air control valve, using a 32mm (1-1/4”) wrench (J 33031 or equivalent). (See Figure C2-8)



A. Less Than 28 mm (1-1/8 In.)
B. Type I (With Collar)
C. Gasket (Part of IAC Valve Service Kit)
1. Idle Air Control Valve

Figure C2-8 - IAC Valve Installation

Important

- Before installing new idle air control valve, measure the distance that the valve is extended (see Figure C2-8). Measurement should be made from motor housing to end of cone. Distance should be no greater than 28mm (1-1/8 in.). If the cone is extended too far, damage may occur to the valve when installed.

If measured dimension “A” is greater than 28mm (1-1/8”), distance must be reduced as follows:

Exert firm pressure on valve to retract it. (A slight side-to-side movement may be helpful.)

1. New idle air control valve to throttle body. Use new gasket supplied with assembly. Tighten valve to 18 N•m (13 ft. lbs.).
2. Electrical connector to idle air control valve.
3. Start engine and allow engine to reach operating temperature.
4. ECM will reset IAC valve when vehicle is driven above 35 mph.

Unit Repair Procedures

The unit repair procedures cover component replacement with the unit on the vehicle. However, throttle body replacement requires that the complete unit be removed from the engine. If removed, it may be placed on a holding fixture, such as J 9789-118, BT-3553, or equivalent, to prevent damage to the throttle valve.

Cleaning and Inspection

- Throttle body parts, except as noted below, may be cleaned in a cold immersion-type cleaner such as AC Delco X-55 or equivalent.

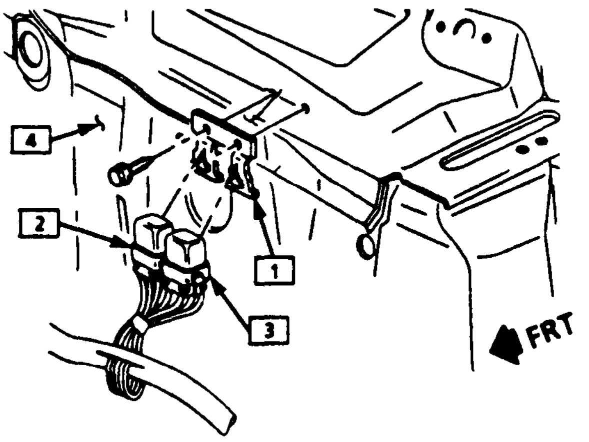
NOTICE: The Throttle Position Sensor (TPS), Idle Air Control (IAC) valve, throttle body with cover and seals or gaskets in place, should NOT be soaked in liquid solvent or cleaner, as they may be damaged. If TPS or IAC valve is still mounted in the throttle body, do not immerse throttle body.

FUEL PUMP RELAY

The fuel pump relay is mounted in the engine compartment (see Figure C2-9). Other than checking for loose connectors, the only service possible is replacement.

PARTS INFORMATION

PART NAME	GROUP
Injector, fuel	3.300
Pump, Fuel (In-Tank)	3.900
Relay, Fuel Pump	3.900
Switch, Oil Pressure	1.800
Control Kit, Idle Air Valve	3.820
Regulator, Fuel Pressure	3.330
Rail, Fuel Feed	3.330
O-Rings, Fuel Lines	3.331



1 BRACKET
2 FUEL PUMP RELAY
3 A/C RELAY
4 COWL

9S 8139-6E

Figure C2-9 - Fuel Pump Relay

CHART C-2A

INJECTOR BALANCE TEST

The injector balance tester is a tool used to turn the injector on for a precise amount of time, thus spraying a measured amount of fuel into the manifold. This causes a drop in fuel rail pressure that we can record and compare between each injector. All injectors should have the same amount of pressure drop (± 10 kPa). Any injector with a pressure drop that is 10 kPa (or more) greater or less than the average drop of the other injectors should be considered faulty and replaced.

STEP 1

Engine "cool down" period (10 minutes) is necessary to avoid irregular readings due to "Hot Soak" fuel boiling. With ignition "OFF" connect fuel gage J 34730-1 or equivalent to fuel pressure tap. Wrap a shop towel around fitting while connecting gage to avoid fuel spillage.

Disconnect harness connectors at all injectors, and connect injector tester J 34730-3, or equivalent, to one injector. Ignition must be "OFF" at least 10 seconds to complete ECM shutdown cycle. Fuel pump should run about 2 seconds after ignition is turned "ON." At this point, insert clear tubing attached to vent valve into a suitable container and bleed air from gage and hose to insure accurate gage operation. Repeat this step until all air is bled from gage.

STEP 2

Turn ignition "OFF" for 10 seconds and then "ON" again to get fuel pressure to its maximum. Record this initial pressure reading. Energize tester one time and note pressure drop at its lowest point (Disregard any slight pressure increase after drop hits low point). By subtracting this second pressure reading from the initial pressure, we have the actual amount of injector pressure drop.

STEP 3

Repeat step 2 on each injector and compare the amount of drop. Usually, good injectors will have virtually the same drop. Retest any injector that has a pressure difference of 10 kPa, either more or less than the average of the other injectors on the engine. Replace any injector that also fails the retest. If the pressure drop of all injectors is within 10 kPa of this average, the injectors appear to be flowing properly. Reconnect them and review "Symptoms," Section "B."

NOTE: ***The entire test should <u>not</u> be repeated more than once* without *running the engine to prevent flooding. (This includes* any *retest on faulty injectors).***

CHART C-2A

INJECTOR BALANCE TEST
4.3L TURBO (VIN Z)
SYCLONE AND TYPHOON (PORT)

NOTE: If injectors are suspected of being dirty, they should be cleaned using an approved tool and procedure prior to performing this test. The fuel pressure test in Section "A," Chart A-7, should be completed prior to this test.

Step 1. If engine is at operating temperature, allow a 10 minute "cool down" period then connect fuel pressure gage and injector tester.

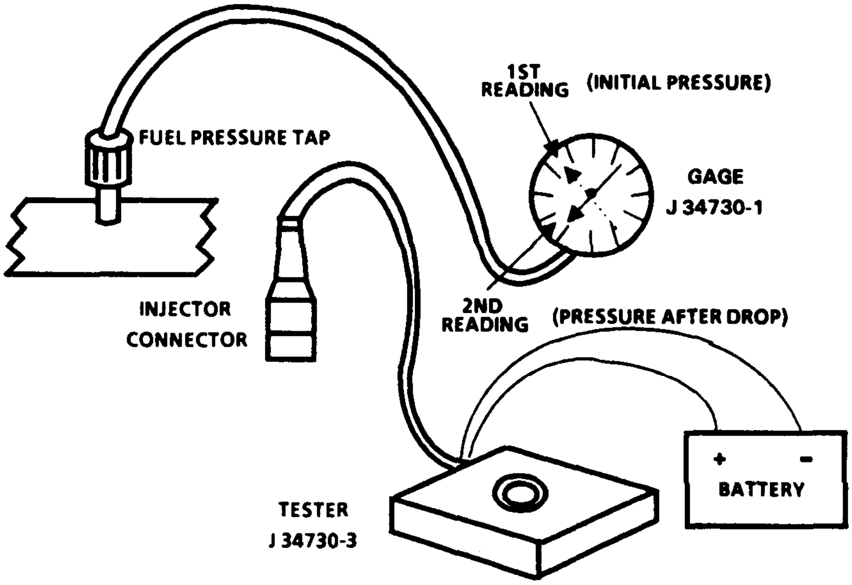
1. Ignition "OFF."
2. Connect fuel pressure gage and injector tester.
3. Ignition "ON."
4. Bleed off air in gage. Repeat until all air is bled from gage.

Step 2. Run test:

1. Ignition "OFF" for 10 seconds.
2. Ignition "ON." Record gage pressure. (Pressure must hold steady, if not see the Fuel System diagnosis, Chart A-7, in Section "A".)
3. Turn injector on, by depressing button on injector tester, and note pressure at the instant the gage needle stops.

Step 3.

1. Repeat step 2 on all injectors and record pressure drop on each.
   Retest injectors that appear faulty (any injectors that have a 10 kPa difference, either more or less, in pressure from the average). If no problem is found, review "Symptoms" Section "B."



- EXAMPLE -

CYLINDER	1	2	3	4	5	6
1ST READING	225	225	225	225	225	225
2ND READING	100	100	100	90	100	115
AMOUNT OF DROP	125	125	125	135	125	110
	OK	OK	OK	FAULTY, RICH (TOO MUCH) (FUEL DROP)	OK	FAULTY, LEAN (TOO LITTLE) (FUEL DROP)

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SECTION C3

EVAPORATIVE EMISSION CONTROL SYSTEM (EECS)

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The Evaporative Emission Control System (EECS) limits fuel vapor escape into the atmosphere. The system (EECS) transfers fuel vapor from a sealed fuel tank, through a single vapor pipe to an activated carbon (charcoal) storage device (vapor canister) (Figure C3-1) to store the vapors when the vehicle is not operating. When the engine is running, the fuel vapor is purged from the carbon element by intake air flow and consumed in the normal combustion process.

The fuel tank has a fuel cap that is not normally vented to the atmosphere, but has a valve which allows both pressure and vacuum relief.

Evaporative System
Figure C3-2

Fuel vapors from the fuel tank are purged and flow into the vapor canister tube labeled "fuel tank" and are absorbed by the carbon. The canister (Figure C3-1) is purged when the engine is running above idle speed. A timed vacuum source is applied to the vapor canister tube labeled "canister purge" to draw fresh air through the air inlet, at the top of the canister. This air flows through a tube to the bottom of the canister and forces the vapors out the purge line.

DIAGNOSIS

RESULTS OF INCORRECT OPERATION

- Poor idle, stalling and poor driveability can be caused by:
  - Damaged canister.
  - Hoses split, cracked and or, not connected to the proper tubes.
- Evidence of fuel loss or fuel vapor odor can be caused by:
  - Liquid fuel leaking from fuel lines or fuel rails.
  - Cracked or damaged vapor canister.
  - Disconnected, misrouted, kinked, deteriorated or damaged vapor pipe, or canister hoses.

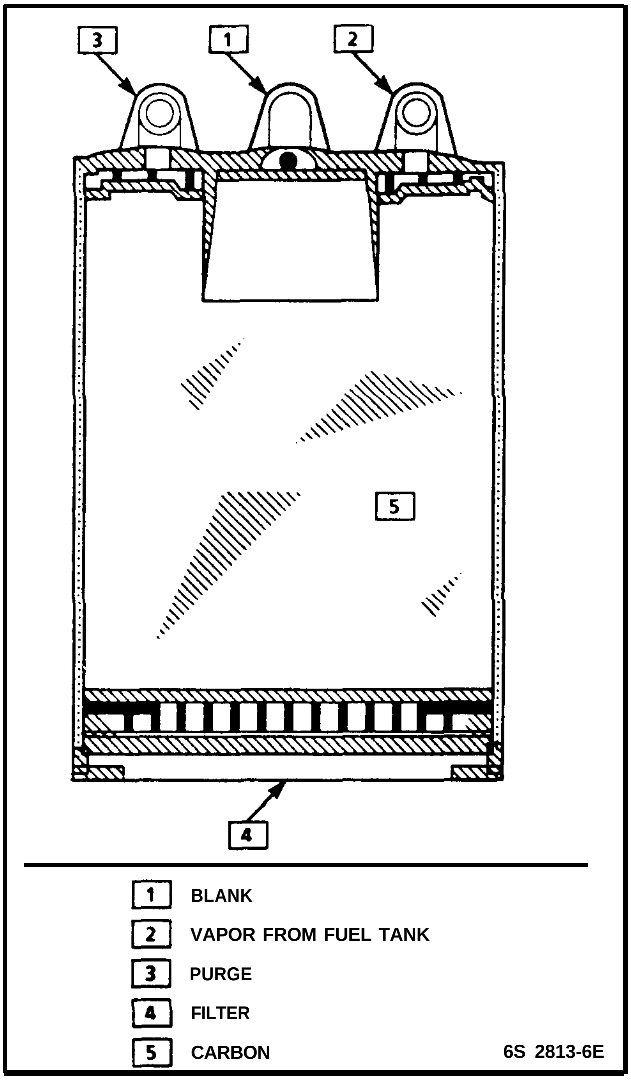

Figure C3-1 - Vapor Canister - (1500cc)

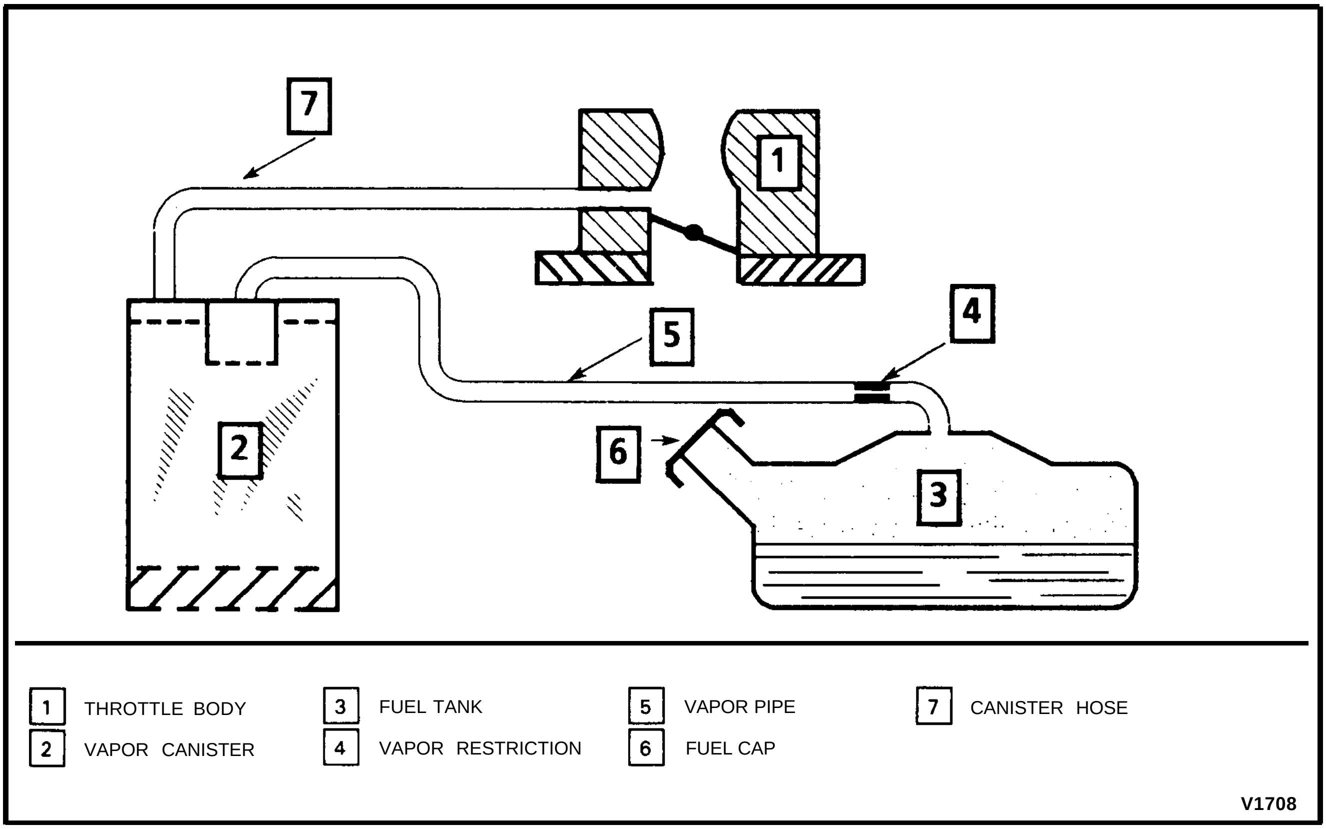

Figure C3-2 - Evaporative Emissions Control System Schematic

VISUAL CHECK OF VAPOR CANISTER

- Replace vapor canister if cracked or damaged.
- Replace vapor canister if fuel is leaking from bottom and check operation of the total system.
- Replace filter at the bottom of the canister if dirty, plugged or damaged.

FUNCTIONAL TESTS

Vapor Canister

Apply a short length of hose to the lower tube of purge valve, and attempt to blow through it. Little or no air should pass into the canister. (A small amount of air will pass if the canister has a constant purge hole.)

With hand vacuum pump, apply vacuum (15” Hg or 51 kPa) to the control valve tube (upper tube). If the diaphragm does not hold vacuum for at least 20 seconds, the diaphragm is leaking, and the canister must be replaced.

If the diaphragm holds vacuum, again try to blow through the hose connected to the lower tube while vacuum is still being applied. An increased flow of air should be observed. If not, the canister must be replaced.

ON-VEHICLE SERVICE

VAPOR CANISTER

Remove or Disconnect

1. Air cleaner.
2. Oil cooler pipes.
3. Hoses from canister.
   - Mark hoses for installation on new canister.
4. Screw from bracket holding canister.
5. Canister.

Install or Connect

1. Canister to bracket.
2. Screw to bracket holding canister.
3. Hoses to canister.
   - Align hoses to marks made in removal.
4. Oil cooler pipes.
5. Air cleaner.

VAPOR CANISTER HOSES

Refer to “Vehicle Emission Control Information” label for routing of canister hoses. When replacing hoses, use hose identified with the word “Fluoroelastomer.”

VAPOR PIPE

The vapor pipe is secured to the underbody with clamp and screw assemblies. Flexible hoses are connected at the fuel tank and the fuel vapor canister. The pipe should be inspected occasionally for leaks, kinks, or dents and repaired as required.

Vapor Pipe Repair

Repair vapor pipe in sections using brazed seamless steel tubing meeting CM Specification 123M or its equivalent or hose identified with the words "Fluoroelastomer." Hose not so marked could cause early failure or failure to meet emission standard.

- Do not use copper or aluminum tubing to replace steel tubing. Those materials do not have satisfactory durability to withstand normal vehicle vibrations.
- Do not use rubber hose within 4" (100 mm) of any part of the exhaust system or within 10" (254 mm) of the catalytic converter. Hose inside diameter must match steel tubing outside diameter.
  1. In repairable areas, cut a piece of fuel hose 4" (100 mm) longer than portion of the line removed. If more than a 6 inch (152 mm) length of pipe is removed, use a combination of steel tubing and hose so that hose lengths will not be more than 10 inches (254mm).
  2. Cut ends of pipe remaining on vehicle square with a tube cutter. Using the first step of a double flaring tool, form a bead on the end of both pipe sections. If pipe is too corroded to withstand bead operation without damage, the pipe should be replaced. If a new section of pipe is used, form a bead on both ends of it also.
  3. Use screw type hose clamp. part number 2494772 or equivalent. Slide clamps onto pipe and push hose 2" (51 mm) onto each portion of fuel pipe. Tighten clamps on each side of repair.

FUEL CAP

If a fuel tank tiller cap requires replacement, use only a cap with the same features. Failure to use the correct cap can result in a malfunctioning of the system.

PARTS INFORMATION

PART NAME	GROUP
Canister, Fuel Vapor	3.130

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SECTION C4

IGNITION SYSTEM/EST

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The High Energy Ignition (HEI) system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide improved engine performance, fuel economy, and control of exhaust emissions, the ECM controls distributor spark advance (timing) with the Electronic Spark Timing (EST) system.

Only the Electronic Spark Timing (EST) system will be described here. Additional information on the HEI system is found in Engine Electrical (Section "6D") in the 1992 Service Manual Sonoma and Jimmy Models.

OPERATION

To properly control ignition/combustion timing the ECM requires the following data:

- engine speed (rpm)
- engine load (manifold pressure or vacuum)
- atmospheric (barometric) pressure
- engine temperature.

The EST system consists of the distributor module, ECM, and connecting wires. The distributor connector terminals are lettered as shown in Figure C4-1.

These circuits perform the following functions

- Distributor reference - CKT 430
  This provides the ECM with engine speed.
- Reference around - CKT 453
  This wire is grounded in the distributor and ensures that the ground circuit has no voltage drop which could affect performance. If it is open, it may cause poor performance.
- Bypass-CKT 424
  At about 400 rpm, the ECM applies 5 volts to this circuit to switch spark timing control from the HEI module to the ECM. An open or grounded bypass circuit will set a Code 42 and the engine will run with a small amount of advance programmed into the HEI module.
- EST-CKT 423
  The ECM uses this circuit to trigger the HEI module. The ECM uses the reference signal in its calculation of the amount of spark advance required. If the base timing is incorrect, the entire spark curve will be incorrect.

RESULTS OF INCORRECT OPERATION

An open or ground in the EST circuit will set a Code 42 and cause the engine to run on the HEI module timing.

The ECM uses information from the MAP and coolant sensors in addition to engine speed to calculate spark advance as follows:

- Low MAP output voltage = More spark advance
- Cold engine = More spark advance
- High MAP output voltage = Less spark advance
- Hot engine = Less spark advance

Detonation may be caused by low MAP output or high resistance in the coolant sensor circuit.

Poor performance may be caused by high MAP output or low resistance in the coolant sensor circuit.

DIAGNOSIS

HOW CODE 42 IS DETERMINED

When the system is running on the HEI module, that is, no voltage on the bypass line, the HEI module grounds the EST signal. The ECM expects to see no voltage on the EST line during this condition. If it sees voltage, Code 42 is set and will not enter the EST mode.

When the engine speed for EST is reached (about 400 rpm), the ECM applies 5 volts to the bypass line and the EST should no longer be grounded in the HEI module. The EST voltage should be varying.

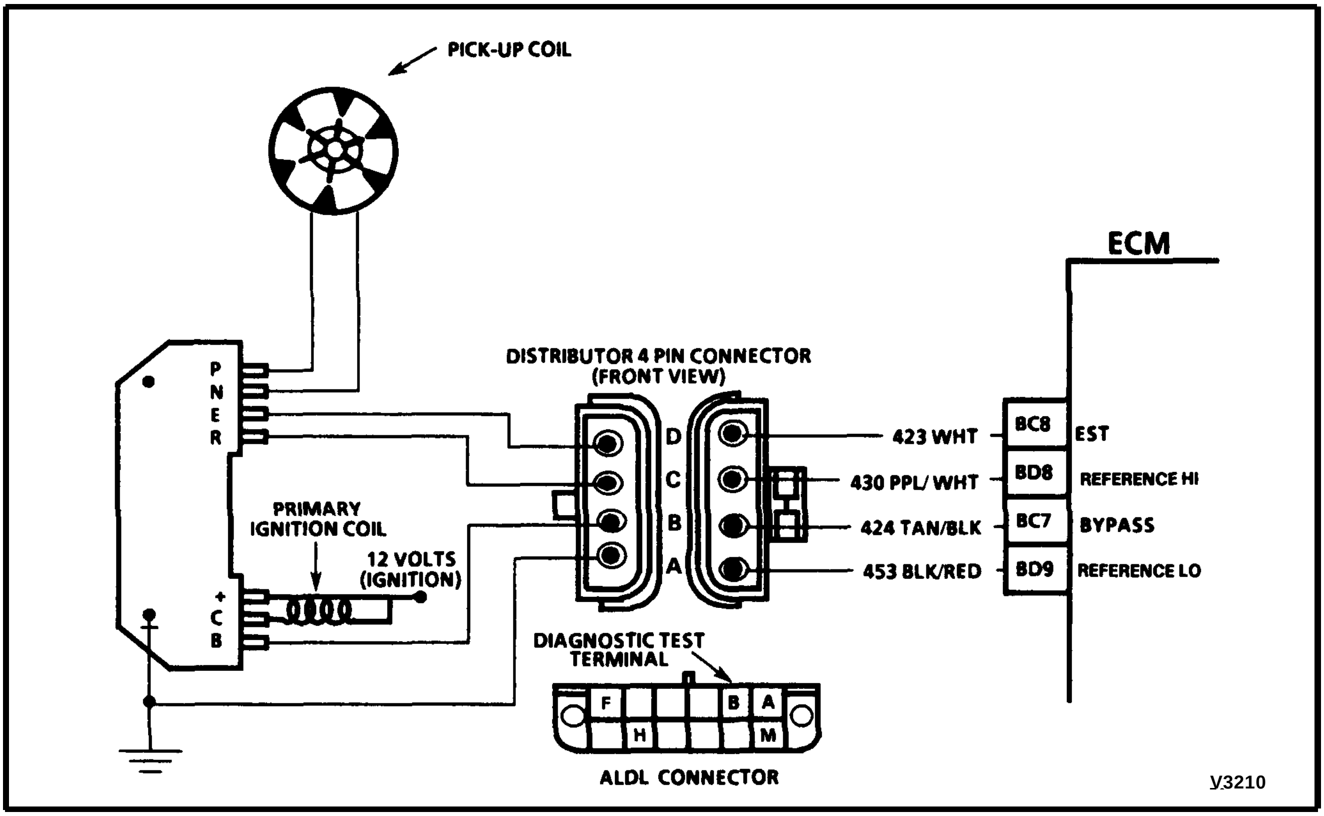

Figure C4-1 - HEI System With EST

If the bypass line is open or grounded, the HEI module will not switch to EST mode. The EST voltage will be low, and Code 42 will be set.

If the EST line is grounded, the HEI module will switch to EST, but because the line is grounded there will be no EST signal. A Code 42 will be set.

The description and operation of the HEI system are found in Engine Electrical (Sec "6D") in the 1992 Service Manual Sonoma and Jimmy Models. Diagnosis is covered in the chart at the end of this section.

- CHART C-4C, Ignition System Check, 4.3L Turbo.

ON-VEHICLE SERVICE

SETTING TIMING

Set ignition timing according to the specifications found on the underhood Vehicle Emission Control Information label. Follow procedure in Ignition System ("6D4").

PARTS INFORMATION

PART NAME	GROUP
Module, Distr	2.383
Coil, Distr	2.372

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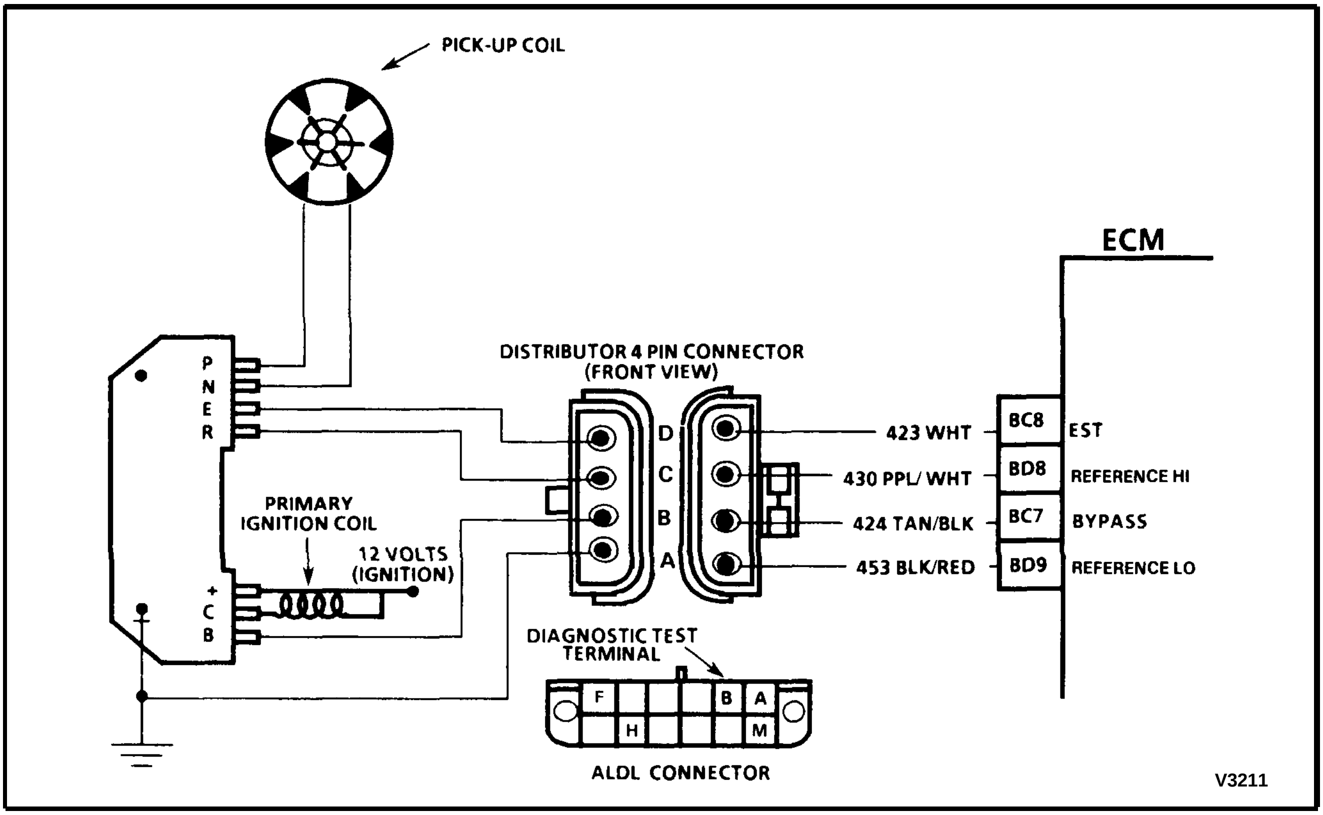


CHART C-4C

IGNITION SYSTEM CHECK

(REMOTE COIL)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. Two wires are checked to ensure that an open is not present in a spark plug wire.

1A. If spark occurs with 4 terminal distributor connector disconnected, pick-up coil output is too low for EST operation.

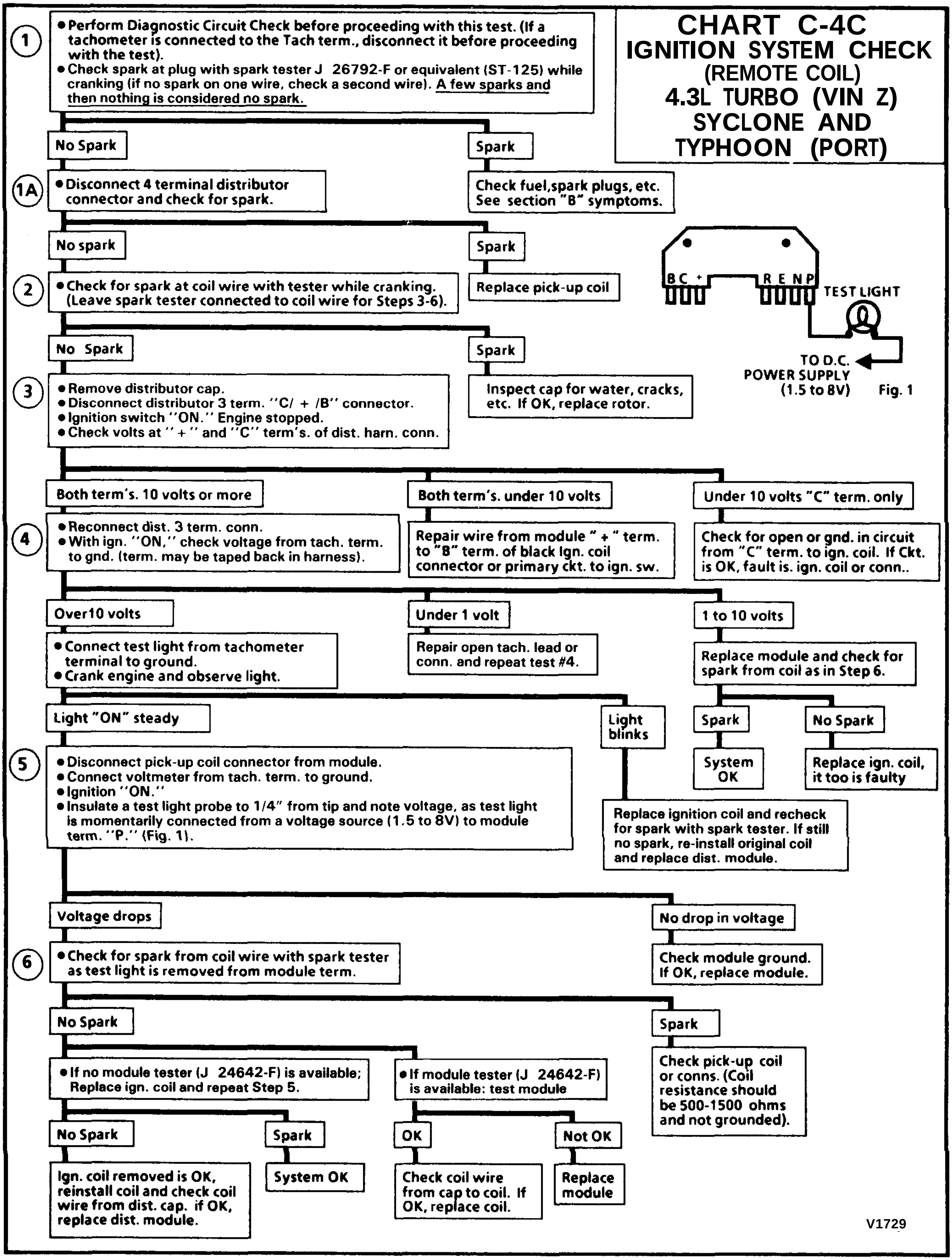
2. A spark indicates the problem must be the distributor cap or rotor.
3. Normally, there should be battery voltage at the "C" and "+" terminals. Low voltage would indicate an open or a high resistance circuit from the distributor to the coil or ignition switch. If "C" terminal voltage was low, but "+" terminal voltage is 10 volts or more, circuit from "C" terminal to ignition coil or ignition coil primary winding is open.
4. Check for a shorted module or grounded circuit from the ignition coil to the module. The distributor module should be turned "OFF." Normal voltage should be about 12 volts.

   If the module is turned "ON," the voltage would be low, but above 1 volt. This could cause the ignition coil to fail from excessive heat.

   With an open ignition coil primary winding, a small amount of voltage will leak through the module from the "BATT" to the "TACH" terminal.
5. Applying voltage (1.5 to 8 volts) to module terminal "P" should turn the module "ON" and the tachometer terminal voltage should drop to about 7-9 volts. This test will determine whether the module or coil is faulty or if the pick-up coil is not generating the proper signal to turn the module "ON." This test can be performed by using a DC battery with a rating of 1.5 to 8 volts. The use of the test light is mainly to allow the "P" terminal to be probed more easily.

   Some digital multi-meters can also be used to trigger the module by selecting ohms, usually the diode position. In this position the meter may have a voltage across its terminals which can be used to trigger the module. The voltage in the ohms position can be checked by using a second meter or by checking the manufacturer's specification of the tool being used.
6. This should turn "OFF" the module and cause a spark. If no spark occurs, the fault is most likely in the ignition coil because most module problems would have been found before this point in the procedure. A module tester (J 24642-F) could determine which is at fault.

CHART C-4C
IGNITION SYSTEM CHECK
(REMOTE COIL)
4.3L TURBO (VIN Z)
SYCLONE AND TYPHOON (PORT)



①
- Perform Diagnostic Circuit Check before proceeding with this test. (If a tachometer is connected to the Tach term., disconnect it before proceeding with the test).
- Check spark at plug with spark tester J 26792-F or equivalent (ST-125) while cranking (if no spark on one wire, check a second wire). A few sparks and then nothing is considered no spark.

No Spark → ⑴A
Spark → Check fuel,spark plugs, etc. See section "B" symptoms.

(1A)
- Disconnect 4 terminal distributor connector and check for spark.

No spark → ②
Spark → Replace pick-up coil

②
- Check for spark at coil wire with tester while cranking. (Leave spark tester connected to coil wire for Steps 3-6).

No Spark → ③
Spark → Inspect cap for water, cracks, etc. If OK, replace rotor.

③
- Remove distributor cap.
- Disconnect distributor 3 term. "C/ + /B" connector.
- Ignition switch "ON." Engine stopped.
- Check volts at " + " and "C" term's. of dist. harn. conn.

Both term's. 10 volts or more → ④
Both term's. under 10 volts → Repair wire from module " + " term. to "B" term. of black Ign. coil connector or primary ckt. to ign. sw.
Under 10 volts "C" term. only → Check for open or gnd. in circuit from "C" term. to ign. coil. If Ckt. is OK, fault is. ign. coil or conn..

④
- Reconnect dist. 3 term. conn.
- With ign. "ON," check voltage from tach. term. to gnd. (term. may be taped back in harness).

Over10 volts
- Connect test light from tachometer terminal to ground.
- Crank engine and observe light.
  - **Light "ON" steady** → ⑤
  - **Light blinks** → Replace ignition coil and recheck for spark with spark tester. If still no spark, re-install original coil and replace dist. module.

Under 1 volt → Repair open tach. lead or conn. and repeat test #4.

1 to 10 volts → Replace module and check for spark from coil as in Step 6.
- **Spark** → System OK
- **No Spark** → Replace ign. coil, it too is faulty

⑤
- Disconnect pick-up coil connector from module.
- Connect voltmeter from tach. term. to ground.
- Ignition "ON."
- Insulate a test light probe to 1/4" from tip and note voltage, as test light is momentarily connected from a voltage source (1.5 to 8V) to module term. "P." (Fig. 1).

Voltage drops → ⑥
No drop in voltage → Check module ground. If OK, replace module.

⑥
- Check for spark from coil wire with spark tester as test light is removed from module term.

No Spark
- If no module tester (J 24642-F) is available; Replace ign. coil and repeat Step 5.
  - **No Spark** → Ign. coil removed is OK, reinstall coil and check coil wire from dist. cap. if OK, replace dist. module.
  - **Spark** → System OK
- If module tester (J 24642-F) is available: test module
  - **OK** → Check coil wire from cap to coil. If OK, replace coil.
  - **Not OK** → Replace module

Spark → Check pick-up coil or conns. (Coil resistance should be 500-1500 ohms and not grounded).

BLANK

SECTION C5

ELECTRONIC SPARK CONTROL (ESC) SYSTEM

CONTENTS

GENERAL DESCRIPTION

Ignition timing is the relationship between the time the spark plug is fired and the time that the piston reaches the top of its travel in the cylinder. If the spark plug ignites the compressed air/fuel mixture too late, not all of the air/fuel mixture has time to burn while it is highly compressed. This causes losses in fuel efficiency, power, and the production of undesired emissions. If the spark plug fires too soon, the air/fuel mixture starts burning too early before the piston reaches the top of its stroke. This causes detonation, also called spark knock. Power and fuel efficiency are reduced, but most important, it can cause severe damage to the engine, if it persists.

For every engine, there is an optimum timing value. This value is usually the earliest or most advanced firing of the spark plug without causing detonation. As the engine load, temperature, and quality and octane rating of the fuel vary, the optimum timing value changes. As a result, an engine% optimum ignition timing is set up for the most advanced timing possible during the most demanding conditions.

In ignition systems equipped with Electronic Spark Control (ESC), the optimum timing value can be set up for the best possible conditions. This is because the system is designed to reduce the spark advance when conditions require it. The ESC system is activated when the engine experiences detonation. It then retards the spark advance until detonation is no longer detected. The timing can be retarded up to 20° by the ESC equipped ignition system.

OPERATION

The ESC system has two major components:

- ECM
- ESC knock sensor

The ESC knock sensor (Figure C5-l) detects abnormal vibration (detonation) in the engine. The sensor is mounted in the engine block near the cylinders. The knock sensor sends a signal to the ECM. The ECM then adjusts the timing to reduce detonation.

The knock sensor sends a voltage signal (8 to 10 volts) to the ECM when no detonation is detected by the ESC knock sensor. Under this condition, the ECM provides normal spark advance as specified by the HEI/EST system.

When the knock sensor detects detonation, the ECM retards spark advance to reduce detonation. The amount of timing retard that the ESC system applies is based on the amount of time that the detonation is detected and the engine speed. Once the timing retard is applied, the ECM performs a calculation every 12.5 milliseconds to determine the amount of retard that it can reduce. The timing is changed every 200 milliseconds until zero retard (normal advance) is re-established. If detonation occurs again, the whole cycle will repeat itself. This can occur over and over, but since the knock sensor is so sensitive, most of the detonation will not be detected by human ears before the ESC system eliminates it.

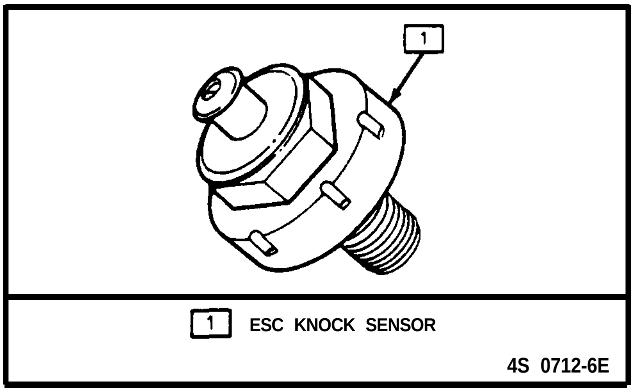


Figure C5-1 - ESC Knock Sensor

Results of Faulty ESC Operation

Loss of the ESC knock sensor signal would cause the signal to the ECM to remain high. This condition would cause the ECM to control EST as if no detonation were occurring. No retarding by the ESC system would occur, and detonation could become severe under heavy engine load conditions.

Loss of the ESC signal to the ECM would cause the ECM to constantly retard EST. This could result in sluggish performance and cause a diagnostic trouble

Code 43 to set. Spark retard without the knock sensor connected could indicate a noise signal on the wire to the ECM.

Code 43 indicates that the ECM is receiving less than 6 volts for a 4 second period with the engine running. The ESC system is disabled when a Code 43 has been set. See the diagnostic chart for Code 43 in Section "A" for diagnosis if the code has been set.

When no Code 43 has been set, but the ESC system is a potential cause of excessive detonation, refer to CHART C-5.

DIAGNOSIS

The "Scan" tool will have two positions to check for diagnosing this circuit. Knock signal is used to monitor the input signal from the knock sensor. This position should display "yes" to indicate knock is being detected. Knock retard is the indication of how much the ECM is retarding the spark.

ON-VEHICLE SERVICE

ESC SENSOR

Remove or Disconnect

1. Negative battery cable.
2. ESC wiring harness connector from ESC sensor.
3. ESC sensor from engine block.

Install or Connect

1. ESC sensor into engine block.
   - Ensure that threads are clean,

Tighten

   - ESC sensor to 19 N•m (14 ft. lbs.).
2. ESC wiring harness connector to the ESC sensor.
3. Negative battery cable.

MEM-CAL

Refer to Section "Cl" for replacement procedure.

PARTS INFORMATION

PART NAME	GROUP
Sensor, ESC Knock	2.383

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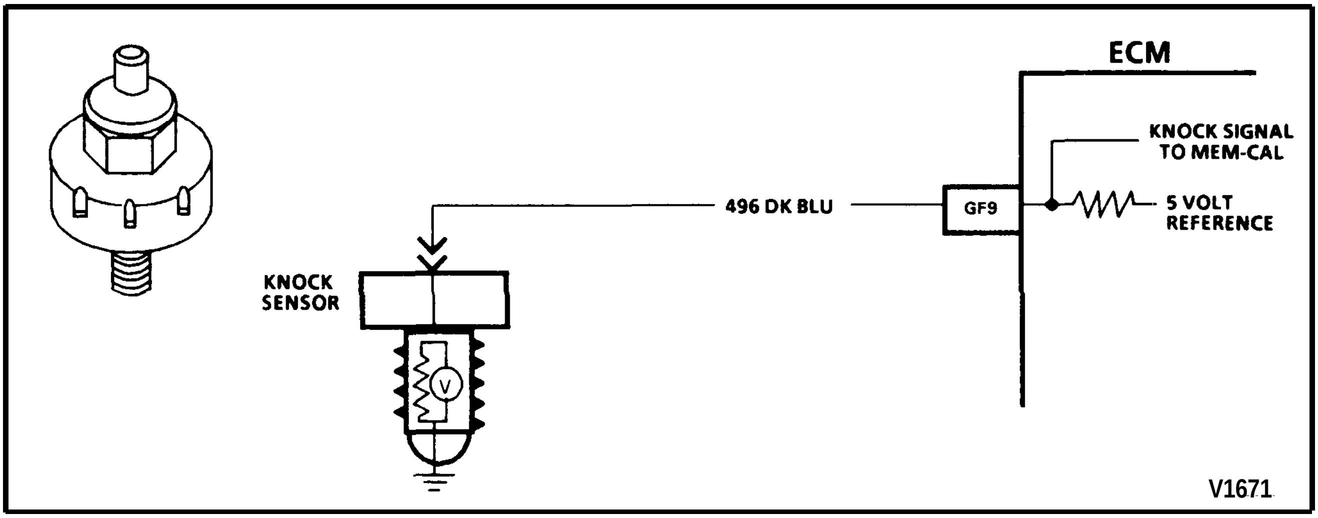


CHART C-5

ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK 4.3L TURBO WIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The ESC knock sensor is used to detect engine detonation and the ECM will retard the electronic spark timing based on the signal being received. The circuitry, within the knock sensor, causes the ECM's 5 volts to be pulled down so that under a no knock condition, CKT 496 would measure about 2.5 volts. The knock sensor produces an A/C signal, which rides on the 2.5 volts DC voltage. The amplitude and frequency are dependent upon the knock level.

The Mem-Cal, used with this engine, contains the functions which were part of remotely mounted ESC modules used on other GM vehicles. The ESC portion of the Mem-Cal then sends a signal to other parts of the ECM which adjusts the spark timing to retard the spark and reduce the detonation.

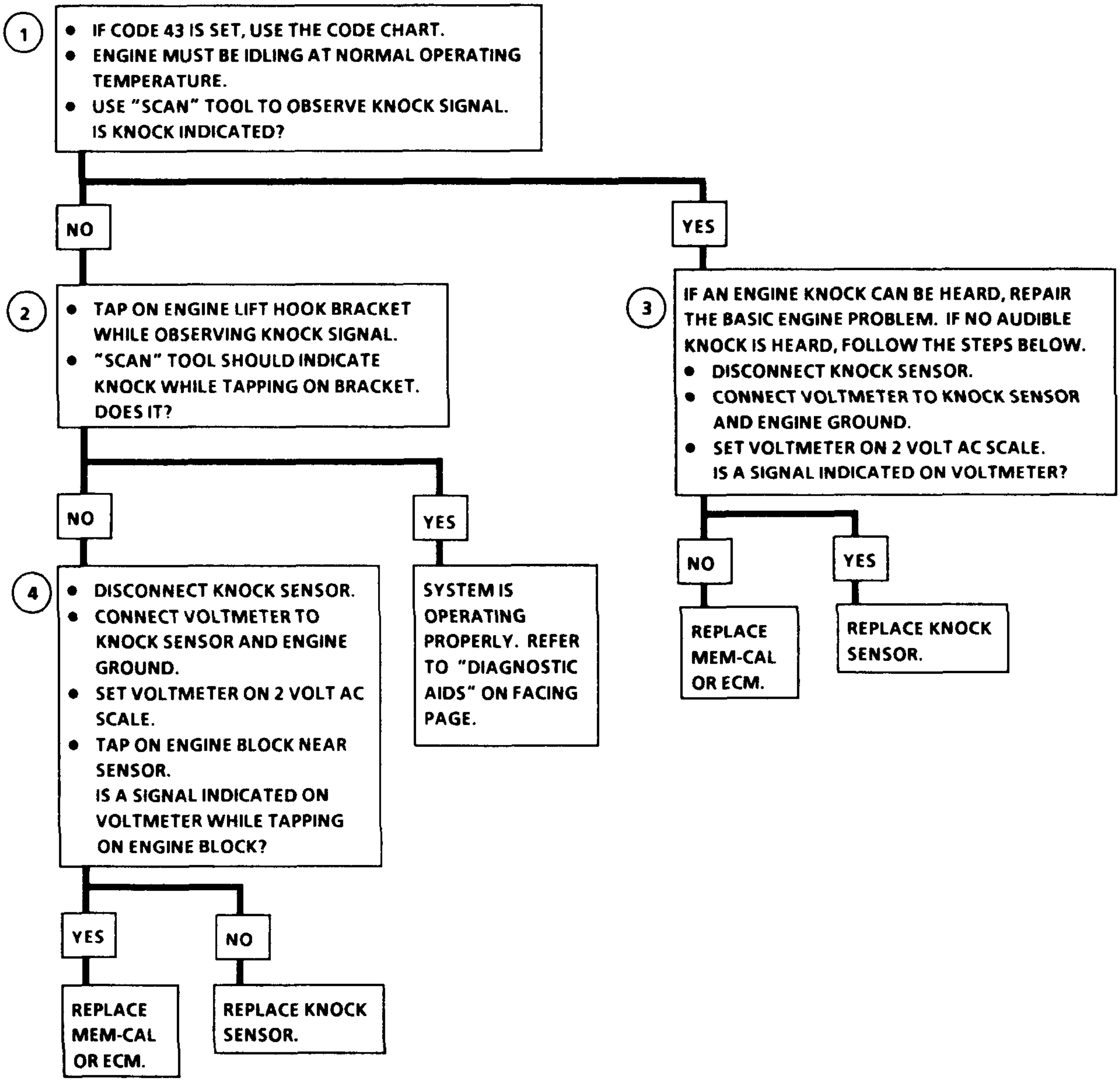
Test Description: Numbers below refer to circled numbers on the diagnostic chart.

1. With engine idling, there should not be a knock signal present at the ECM, because detonation is not likely under a no load condition.
2. Tapping on the engine lift hood bracket should simulate a knock signal to determine if the sensor is capable of detecting detonation. If no knock is detected, try tapping on engine block closer to sensor before replacing sensor.
3. If the engine has an internal problem, which is creating a knock, the knock sensor may be responding to the internal failure.
4. This test determines if the knock sensor is faulty, or, if the ESC portion of the Mem-Cal is faulty. If it is determined that the Mem-Cal is faulty, be sure that it is properly installed and latched into place. If not properly installed, repair and retest.

Diagnostic Aids:

While observing knock signal on the "Scan," there should be an indication that knock is present, when detonation can be heard. Detonation is most likely to occur under high engine load conditions.

CHART C-5
ELECTRONIC SPARK CONTROL (ESC) SYSTEM CHECK 4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



①
- IF CODE 43 IS SET, USE THE CODE CHART.
- ENGINE MUST BE IDLING AT NORMAL OPERATING TEMPERATURE.
- USE "SCAN" TOOL TO OBSERVE KNOCK SIGNAL.

IS KNOCK INDICATED?

②
- TAP ON ENGINE LIFT HOOK BRACKET WHILE OBSERVING KNOCK SIGNAL.
- "SCAN" TOOL SHOULD INDICATE KNOCK WHILE TAPPING ON BRACKET.

DOES IT?

③ IF AN ENGINE KNOCK CAN BE HEARD, REPAIR THE BASIC ENGINE PROBLEM. IF NO AUDIBLE KNOCK IS HEARD, FOLLOW THE STEPS BELOW.
- DISCONNECT KNOCK SENSOR.
- CONNECT VOLTMETER TO KNOCK SENSOR AND ENGINE GROUND.
- SET VOLTMETER ON 2 VOLT AC SCALE.

IS A SIGNAL INDICATED ON VOLTMETER?

REPLACE MEM-CAL OR ECM.

REPLACE KNOCK SENSOR.

④
- DISCONNECT KNOCK SENSOR.
- CONNECT VOLTMETER TO KNOCK SENSOR AND ENGINE GROUND.
- SET VOLTMETER ON 2 VOLT AC SCALE.
- TAP ON ENGINE BLOCK NEAR SENSOR.

IS A SIGNAL INDICATED ON VOLTMETER WHILE TAPPING ON ENGINE BLOCK?

SYSTEM IS OPERATING PROPERLY. REFER TO "DIAGNOSTIC AIDS" ON FACING PAGE.

REPLACE MEM-CAL OR ECM.

REPLACE KNOCK SENSOR.

CLEAR CODES AND CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT

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SECTION C7

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

CONTENTS

GENERAL DESCRIPTION

PURPOSE

The Exhaust Gas Recirculation (EGR) system is designed to decrease NO_X (oxides of nitrogen) in exhaust emissions.

It does this by introducing exhaust gas, which contains very little oxygen, into the intake manifold. The exhaust gas will not support combustion, but does occupy volume, reducing the total amount of air/fuel mixture which burns in the cylinder. This reduces combustion temperatures.

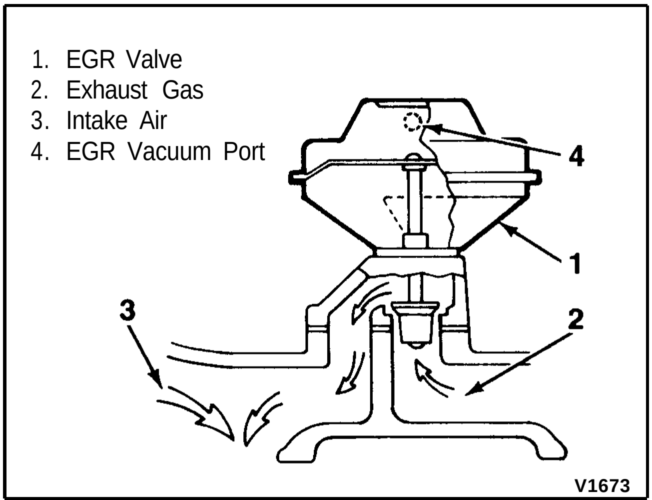


Figure C7-1 - Exhaust Gas Recirculation

OPERATION

The EGR valve is opened by ported vacuum to allow exhaust gas to flow into the intake manifold. The exhaust gas then flows with the air/fuel mixture into the combustion chamber. If too much exhaust. gas enters, combustion may not occur. For this reason, very little exhaust gas is allowed to pass through the valve, and none at idle. The EGR valve is usually open when the engine is at normal operating temperature.

EGR CONTROL

To regulate EGR flow, an ECM controlled solenoid is used in the vacuum line. The ECM uses information from the following sensors to regulate the solenoid:

- Coolant temperature
- Throttle position (TPS)

The EGR vacuum control has a vacuum solenoid that uses “pulse width modulation.” This means the ECM turns the solenoid “ON” and “OFF” many times a second and varies the amount of “on-time” (“pulse width”) to vary the amount of EGR.

PORT EGR VALVE

The port EGR valve (Figure C7-2) is controlled by a flexible diaphragm which is spring loaded to hold the valve closed. Ported vacuum applied to the top side of the diaphragm overcomes the spring pressure and opens the valve in the exhaust gas port. This allows exhaust gas to be pulled into the intake manifold and enter the engine cylinders.

EGR VALVE IDENTIFICATION

- Port EGR valves have no identification stamped after the part number. (Figure C7-3)
- Negative backpressure EGR valves will have an “N” stamped on the top side of the valve after the part number.

- Positive backpressure EGR valves will have a “P” stamped on the top side of the valve, after the part number.

When replacing an EGR valve, always check for correct part number in the parts catalog or supplemental bulletin.

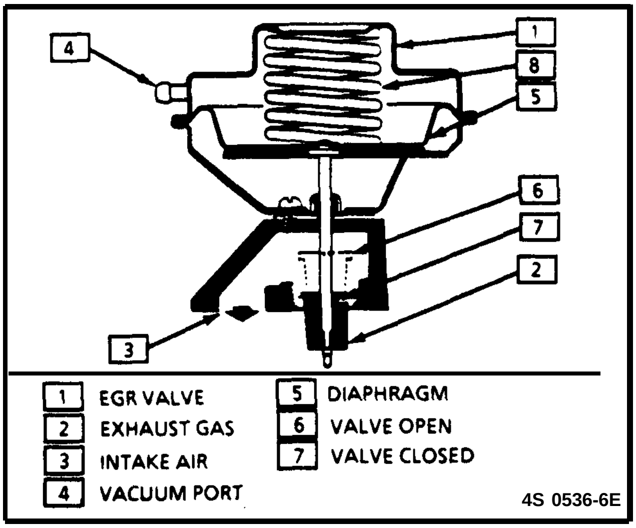
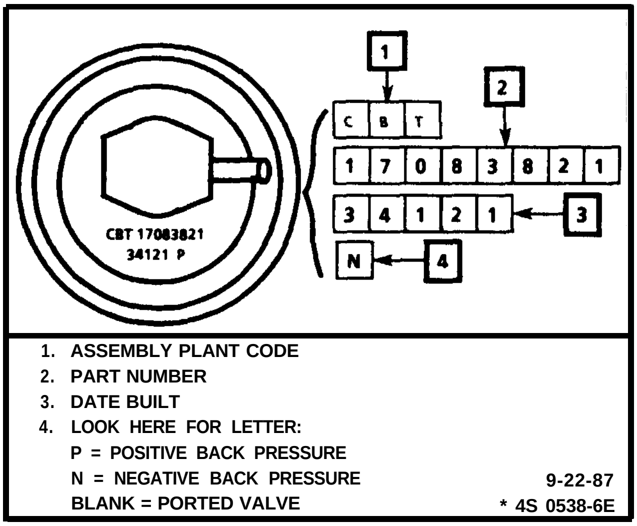


Figure C7-2 - Port EGR Valve



1. ASSEMBLY PLANT CODE
2. PART NUMBER
3. DATE BUILT
4. LOOK HERE FOR LETTER:
   P = POSITIVE BACK PRESSURE
   N = NEGATIVE BACK PRESSURE
   BLANK = PORTED VALVE

Figure C7-3 - EGR Valve Identification

RESULTS OF INCORRECT OPERATION

With too much EGR flow at idle, cruise, or cold operation, any of the following conditions may occur:

- Engine stops after cold start.
- Engine stops at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.

If the EGR valve should stay open all of the time, the engine may not idle.

Too little or no EGR flow allows combustion temperatures to get too high, this could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.

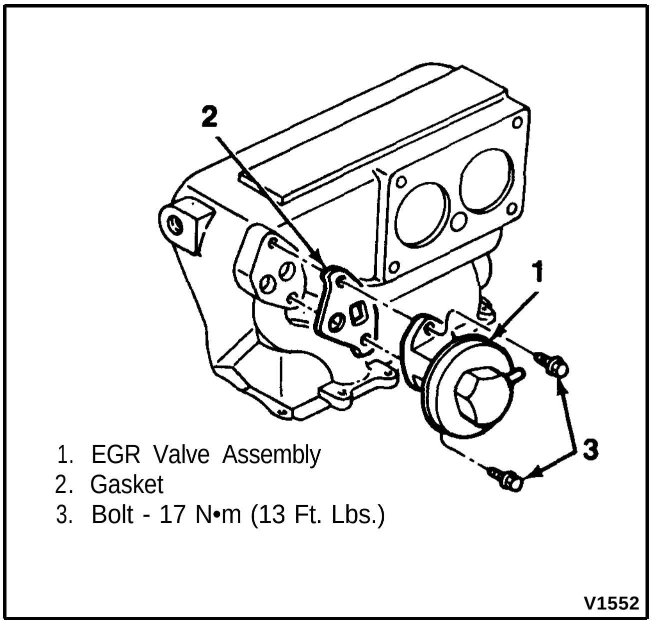


Figure C7-4 - EGR to Manifold Mounting

DIAGNOSIS

Diagnosis of the EGR system is covered in Code 32 chart on page 6E3-A-42.

ON-VEHICLE SERVICE

EGR VALVE

Remove or Disconnect

1. EGR valve vacuum tube at valve.
2. Bolts.
3. EGR valve from manifold.

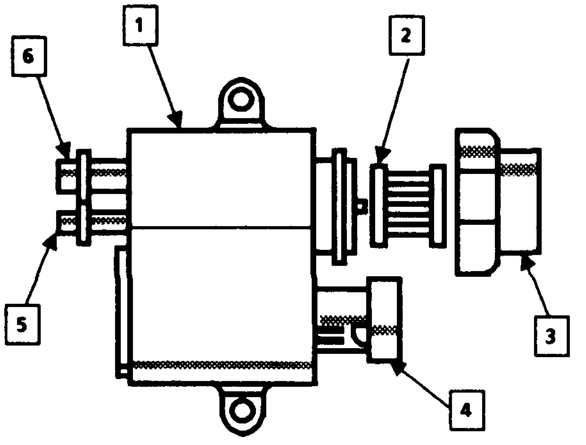
EGR Manifold Passage

Inspect

- If EGR passages in the inlet manifold indicate excessive build-up of deposits, the passages should be cleaned. Care should be taken to ensure that all loose particles are completely removed to prevent them from clogging the EGR valve or from being ingested into the engine.
- Do not wash EGR valve in solvents or degreaser-- permanent damage to valve diaphragm may result. Also, sand blasting of the valve is not recommended since this can affect the operation of the valve.

Clean

1. With a wire wheel, buff the exhaust deposits from the mounting surface and around the valve.
2. Look for exhaust deposits in the valve outlet. Remove deposit build-up with a screwdriver.
3. Clean mounting surfaces of intake manifold and valve assembly.



1 EGR CONTROL SOLENOID ASSEMBLY
2 FILTER
3 COVER
4 ELECTRICAL CONNECTOR
5 VACUUM CONNECTOR FROM SOURCE
6 VACUUM CONNECTOR TO EGR VALVE

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Figure C7-5 - EGR Control Solenoid

Install or Connect

1. EGR valve using new gasket.
2. Bolts.

Tighten

- Bolts to 17 N•m (13 ft. lbs.).

3. Vacuum line to valve.

EGR CONTROL SOLENOID

Remove or Disconnect

1. Negative battery cable.
2. Electrical connector at solenoid (See Figure C7-5).
3. Vacuum hoses.
4. Nut and solenoid.

Install or Connect

1. Solenoid and bracket, tighten nut to 24 N•m (17 ft. lbs.).
2. Vacuum hoses
3. Electrical connector
4. Negative battery cable.

EGR FILTER REPLACEMENT

1. Grasp and pull filter off with a rocking motion.
2. Install new filter. (See Figure C7-5).

- Push new filter on making sure cut-out for wires is properly aligned.

PARTS INFORMATION

PARTS NAME	GROUP
Valve, EGR	3.670
Gasket, EGR Valve	3.680
Control, EGR Vacuum	3.670

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SECTION C8

TORQUE CONVERTER CLUTCH (TCC) SYSTEM

CONTENTS

GENERAL DESCRIPTION

AUTOMATIC TRANSMISSION

TCC System

The Torque Converter Clutch (TCC) system, used on a Hydramatic 4L60 transmission. uses a solenoid operated valve, (Figure C8-1) to couple the engine flywheel to the output shaft of the transmission through the torque converter. This reduces the slippage losses in the converter, which increases fuel economy.

Operation

For the converter clutch to apply, two conditions **must be** met:

- Internal transmission fluid pressure must be correct. For information on internal transmission operation, see 4L60 AUTOMATIC TRANSMISSION (SECTION 7A1) in the 1992 Service Manual Sonoma and Jimmy Models. This section will cover only the electrical operation of the TCC system.
- The ECM completes a ground circuit to energize a TCC apply solenoid in the transmission which moves a check ball in a fluid line (Figure C8-1). This allows the converter clutch to apply, if the hydraulic pressure is correct, as described above.

The ECM controls the TCC apply solenoid by looking at several sensors:

- Coolant Temperature Sensor (CTS). Engine must be warmed up, before clutch can apply.
- Throttle Position Sensor (TPS). After the converter clutch applies, the ECM uses the information from the TPS to release the clutch, when the vehicle is accelerating, or decelerating at a certain rate.
- Brake switch. This switch in the TCC circuit opens, when the brake pedal is depressed. This de-energizes the TCC solenoid.
- Pulse switch. This is a downshift 4-3 pulse switch, which opens the TCC solenoid circuit, momentarily, during a downshift.
- Vehicle Speed Sensor (VSS). The VSS signals vehicle's speed to ECM

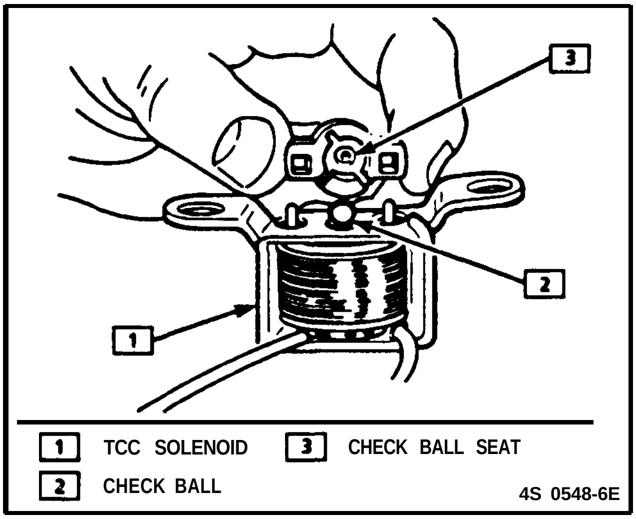

Figure C8-1 - TCC Solenoid

DIAGNOSIS

TCC SYSTEM

If the converter clutch is applied at all times, the engine will stall immediately, just as in a manual transmission with the clutch applied.

If the converter clutch does not apply, fuel economy may be lower than expected. If the vehicle speed sensor fails, the TCC will not apply. If the 4th gear switch does not operate, the TCC will not apply at the right time.

The Torque Converter Clutch (TCC) system has different operating characteristics than an automatic transmission without TCC. If the driver complains of a “chuggle” or “surge” condition, the vehicle should be road tested and compared to a similar vehicle to see if a real problem exists. The Owner's Manual section on TCC operation should be reviewed with the driver. Another TCC complaint may be a downshift felt when going up a grade, especially with cruise control. This may not be a downshift, but a clutch disengagement due to the change in TPS to maintain cruising speed.

The electrical diagnosis of the TCC system is covered in the appropriate "Torque Converter Clutch Electrical Diagnosis" chart.

If the ECM detects a problem in the VSS system, a Code 24 should set. In this case, see Code 24 chart.

ON-VEHICLE SERVICE

TCC SYSTEM

- Refer to "Engine Components/Wiring Diagrams/Diagnostic Charts," Section "6E3-A" for repair of wiring.
- Refer to "Electronic Control Module (ECM) and Sensors," Section "6E3-C1" for replacement of the ECM.
- For replacement of the vehicle speed sensor (VSS), refer to INSTRUMENT PANEL AND GAGES (SEC. 8C) in the 1992 Service Manual Sonoma and Jimmy Models. For the replacement of the TCC solenoid refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models. For replacement of the brake switch (stoplamp switch) refer to HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.

PARTS INFORMATION

PART NAME	GROUP
Sensor, VSS (1)	4.337
Valve, Clutch and Cruise Vac. Sw	3.885
Solenoid, TCC	4.122

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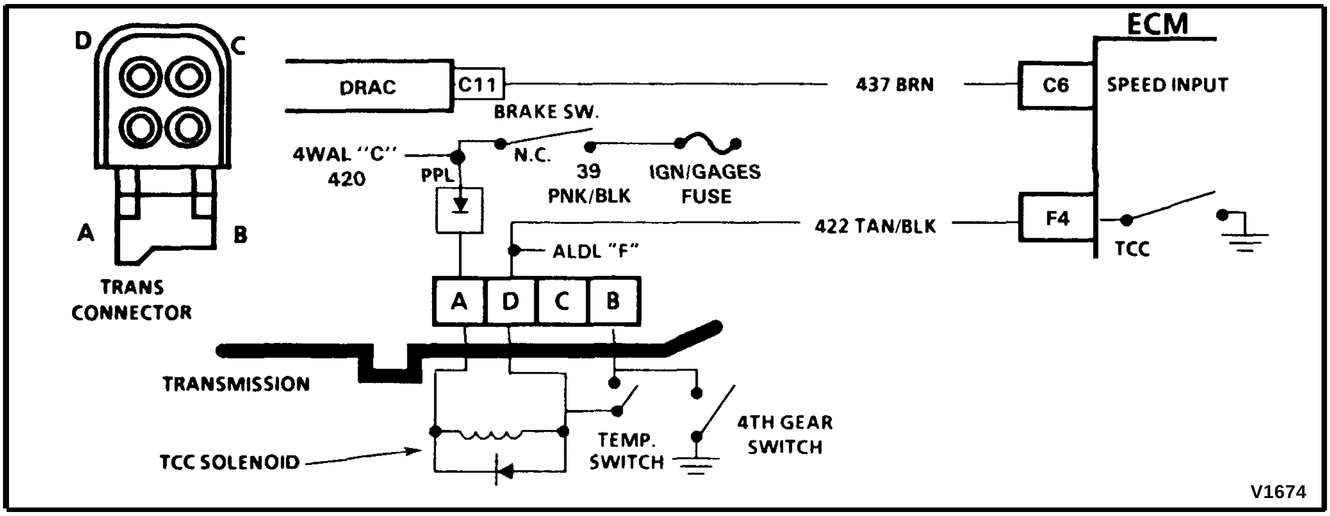


CHART C-8A

TORQUE CONVERTER CLUTCH (TCC)

(ELECTRICAL DIAGNOSIS)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

The purpose of the automatic transmission Torque Converter Clutch (TCC) feature is to eliminate the power loss of the torque converter stage when the vehicle is in a cruise condition. This allows the convenience of the automatic transmission and the fuel economy of a manual transmission.

Fused battery ignition is supplied to the TCC solenoid through the TCC brake switch.

The ECM will engage TCC by grounding CKT 422 to energize the solenoid.

TCC will engage when:

- Vehicle speed above 30 mph (48 km/h).
- Engine at normal operating temperature (above 65°C/149°F)
- Throttle Position Sensor (TPS) output not changing, indicating a steady road speed.
- Brake switch closed.
- 3rd or 4th gears.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

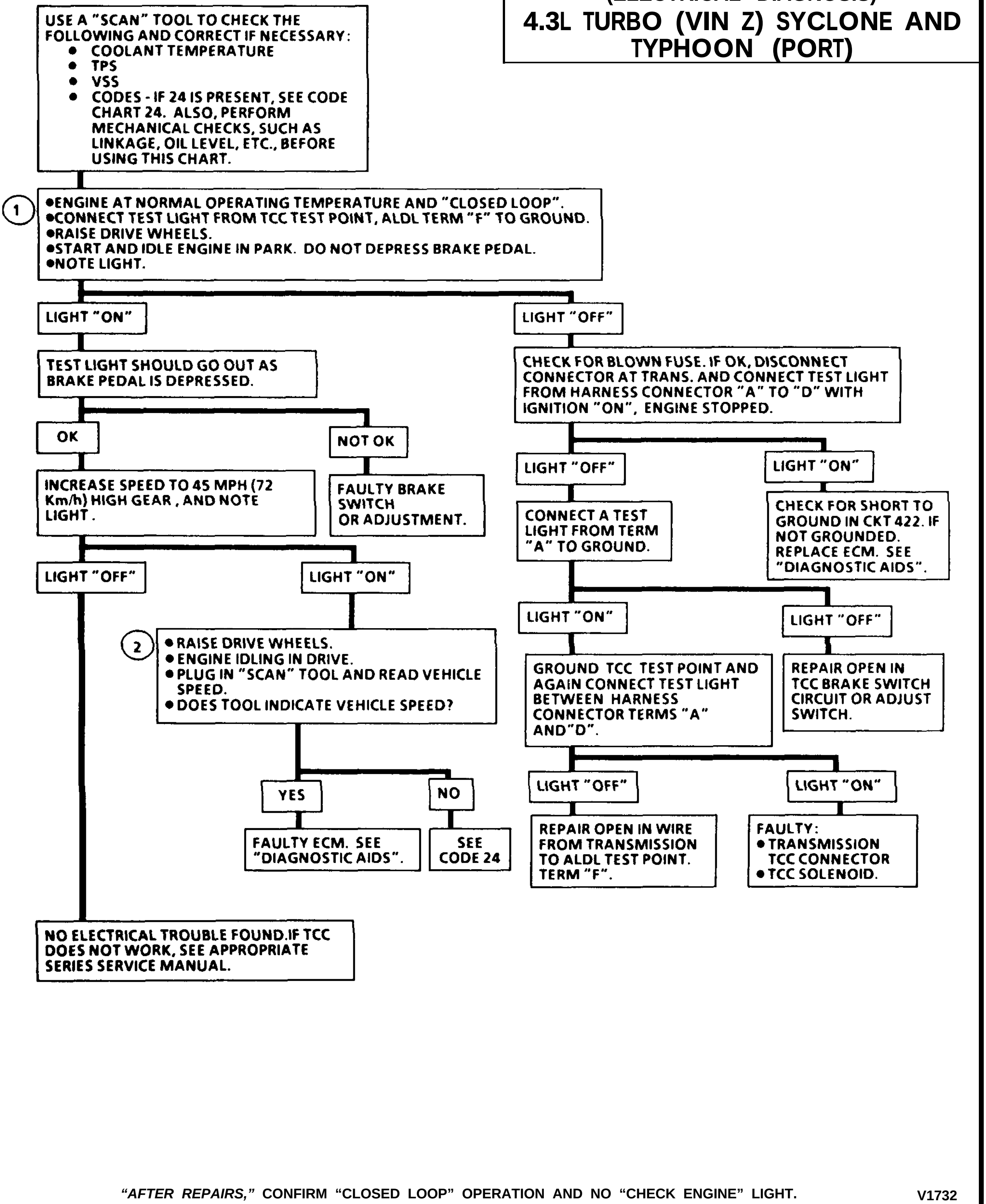
1. A test light "ON" indicates battery voltage and continuity through the TCC solenoid is OK.
2. Checks for vehicle speed sensor signal to ECM using a "Scan" tool.

Diagnostic Aids:

Solenoid coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM "Driver." Refer to "ECM QDR" check CHART C-1A in "Electronic Control Module (ECM) and Sensors," Section "6E3-C1". Using an ohmmeter, check the solenoid coil resistance of all ECM controlled solenoids and relays before installing a replacement ECM. Replace any solenoid or relay that measures less than 20 ohms resistance.

To prevent TCC over heat condition TCC, temperature switch closes at 279°F ± 7° and reopens at 259°F ± 9°.

CHART C-8A
TORQUE CONVERTER CLUTCH (TCC)
(ELECTRICAL DIAGNOSIS)
4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)



USE A "SCAN" TOOL TO CHECK THE FOLLOWING AND CORRECT IF NECESSARY:
- COOLANT TEMPERATURE
- TPS
- VSS
- CODES - IF 24 IS PRESENT, SEE CODE CHART 24. ALSO, PERFORM MECHANICAL CHECKS, SUCH AS LINKAGE, OIL LEVEL, ETC., BEFORE USING THIS CHART.

①
- ENGINE AT NORMAL OPERATING TEMPERATURE AND "CLOSED LOOP".
- CONNECT TEST LIGHT FROM TCC TEST POINT, ALDL TERM "F" TO GROUND.
- RAISE DRIVE WHEELS.
- START AND IDLE ENGINE IN PARK. DO NOT DEPRESS BRAKE PEDAL.
- NOTE LIGHT.

LIGHT "ON"

TEST LIGHT SHOULD GO OUT AS BRAKE PEDAL IS DEPRESSED.

OK

INCREASE SPEED TO 45 MPH (72 Km/h) HIGH GEAR, AND NOTE LIGHT.

LIGHT "OFF"

NO ELECTRICAL TROUBLE FOUND.IF TCC DOES NOT WORK, SEE APPROPRIATE SERIES SERVICE MANUAL.

LIGHT "ON"

②
- RAISE DRIVE WHEELS.
- ENGINE IDLING IN DRIVE.
- PLUG IN "SCAN" TOOL AND READ VEHICLE SPEED.
- DOES TOOL INDICATE VEHICLE SPEED?

YES

FAULTY ECM. SEE "DIAGNOSTIC AIDS".

NO

SEE CODE 24

NOT OK

FAULTY BRAKE SWITCH OR ADJUSTMENT.

LIGHT "OFF"

CHECK FOR BLOWN FUSE. IF OK, DISCONNECT CONNECTOR AT TRANS. AND CONNECT TEST LIGHT FROM HARNESS CONNECTOR "A" TO "D" WITH IGNITION "ON", ENGINE STOPPED.

LIGHT "OFF"

CONNECT A TEST LIGHT FROM TERM "A" TO GROUND.

LIGHT "ON"

GROUND TCC TEST POINT AND AGAIN CONNECT TEST LIGHT BETWEEN HARNESS CONNECTOR TERMS "A" AND "D".

LIGHT "OFF"

REPAIR OPEN IN WIRE FROM TRANSMISSION TO ALDL TEST POINT. TERM "F".

LIGHT "ON"

FAULTY:
- TRANSMISSION TCC CONNECTOR
- TCC SOLENOID.

LIGHT "OFF"

REPAIR OPEN IN TCC BRAKE SWITCH CIRCUIT OR ADJUST SWITCH.

LIGHT "ON"

CHECK FOR SHORT TO GROUND IN CKT 422. IF NOT GROUNDED. REPLACE ECM. SEE "DIAGNOSTIC AIDS".

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

V1732

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SECTION C10

A/C CLUTCH CIRCUIT DIAGNOSIS

CONTENTS

GENERAL DESCRIPTION

In order to improve idle quality and wide open throttle performance, the A/C compressor is controlled by the ECM.

There are two different types of A/C systems used in GM vehicles. One is referred to as CCOT (Cycling Clutch Orifice Tube), which uses a fixed displacement compressor. The other type of system uses a compressor with a variable displacement, and is referred to as the V-5 type system. The V-5 type meets A/C requirements without cycling.

DIAGNOSIS

CHART C-10A should be used for diagnosing the electrical portion of the A/C circuit. AIR CONDITIONING (SECTION 1B) in the 1992 Service Manual Sonoma and Jimmy Models should be used for diagnosing the refrigerant portion of this system.

The “Scan” tool may be used in diagnosing the system, as it has the ability to read the A/C request input to the ECM, as well as displaying when the ECM has commanded the A/C clutch “ON.”

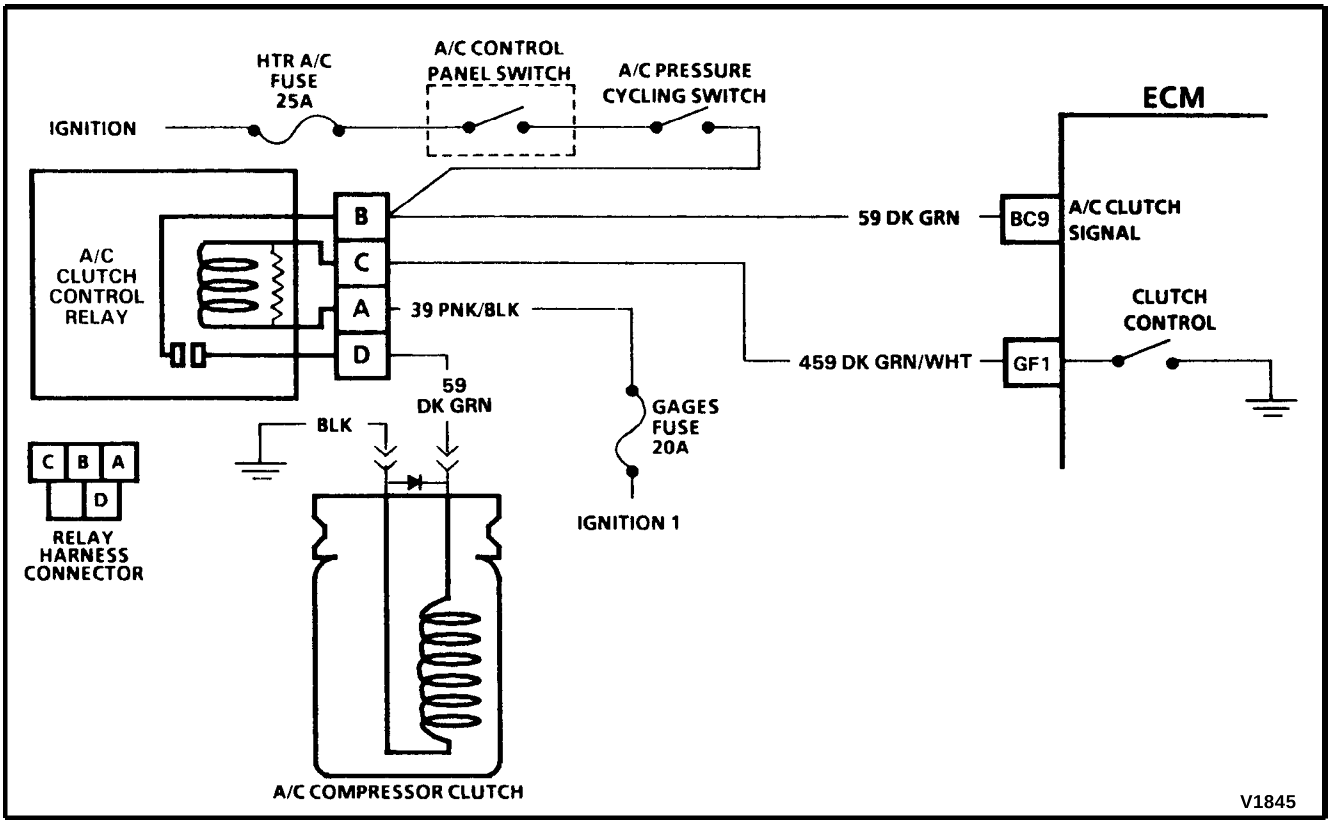


CHART C-10A

(Page 1 of 2)

A/C CLUTCH CONTROL DIAGNOSIS

(AUTOMATIC TRANSMISSION)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by:

- Delaying clutch apply until the idle air rate is increased.
- Releasing clutch when idle speed is too low.
- Releasing clutch at wide open throttle.
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 59 battery voltage to the clutch control relay and terminal “BC9” of the ECM connector. After a time delay of about 1/2 second the ECM will ground terminal “GF1” of the ECM connector, CKT 459, and close the control relay. A/C compressor clutch will engage.

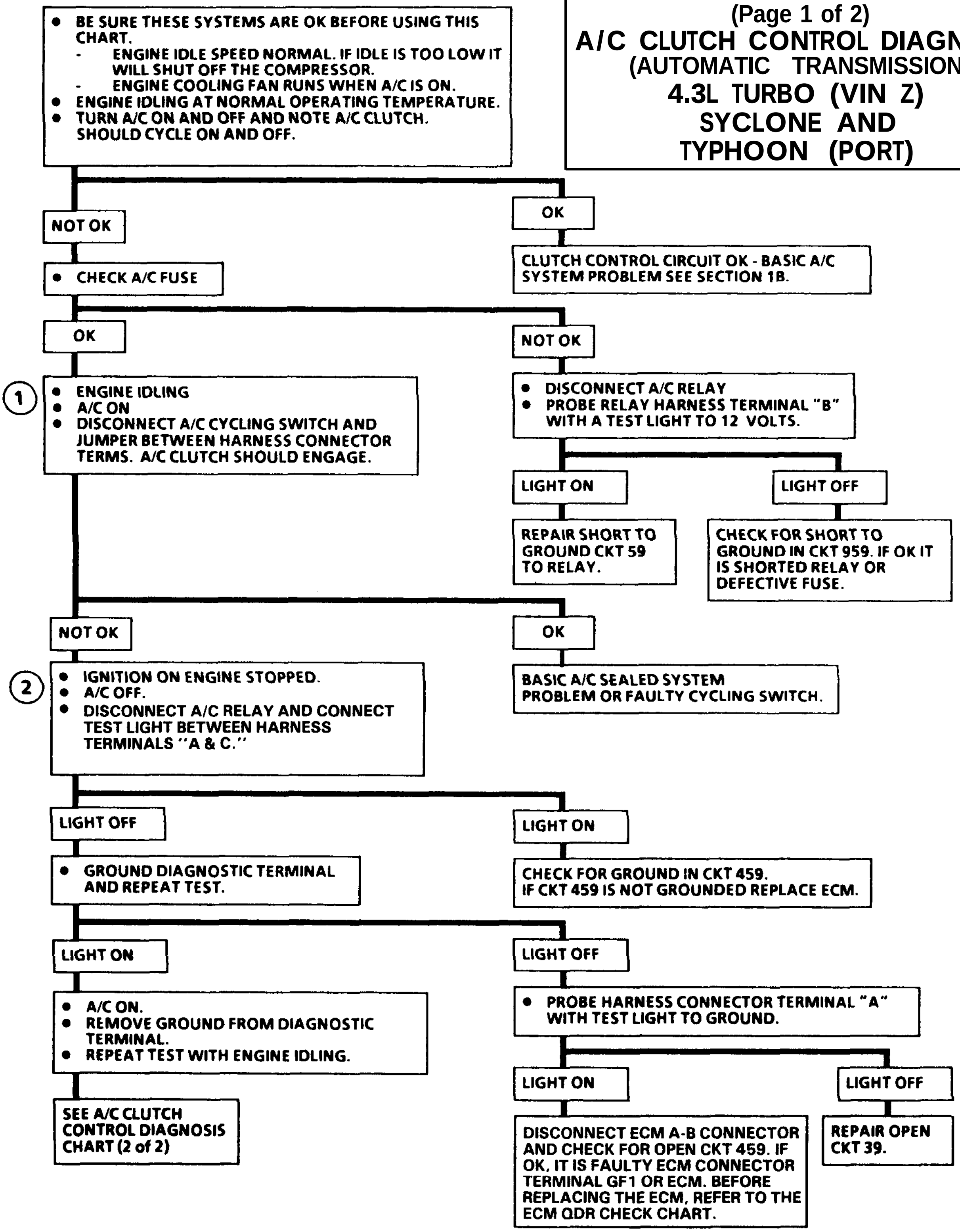
Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. Checks for low refrigerant as cause for no A/C.
2. This and following tests check for faulty A/C control relay.

CHART C-10A

(Page 1 of 2)

A/C CLUTCH CONTROL DIAGNOSIS
(AUTOMATIC TRANSMISSION)
4.3L TURBO (VIN Z)
SYCLONE AND
TYPHOON (PORT)



- BE SURE THESE SYSTEMS ARE OK BEFORE USING THIS CHART.
  - ENGINE IDLE SPEED NORMAL. IF IDLE IS TOO LOW IT WILL SHUT OFF THE COMPRESSOR.
  - ENGINE COOLING FAN RUNS WHEN A/C IS ON.
- ENGINE IDLING AT NORMAL OPERATING TEMPERATURE.
- TURN A/C ON AND OFF AND NOTE A/C CLUTCH. SHOULD CYCLE ON AND OFF.

OK: CLUTCH CONTROL CIRCUIT OK - BASIC A/C SYSTEM PROBLEM SEE SECTION 1B.

NOT OK:
- CHECK A/C FUSE

NOT OK:
- DISCONNECT A/C RELAY
- PROBE RELAY HARNESS TERMINAL "B" WITH A TEST LIGHT TO 12 VOLTS.

LIGHT ON: REPAIR SHORT TO GROUND CKT 59 TO RELAY.

LIGHT OFF: CHECK FOR SHORT TO GROUND IN CKT 959. IF OK IT IS SHORTED RELAY OR DEFECTIVE FUSE.

OK:

①
- ENGINE IDLING
- A/C ON
- DISCONNECT A/C CYCLING SWITCH AND JUMPER BETWEEN HARNESS CONNECTOR TERMS. A/C CLUTCH SHOULD ENGAGE.

OK: BASIC A/C SEALED SYSTEM PROBLEM OR FAULTY CYCLING SWITCH.

NOT OK:

②
- IGNITION ON ENGINE STOPPED.
- A/C OFF.
- DISCONNECT A/C RELAY AND CONNECT TEST LIGHT BETWEEN HARNESS TERMINALS "A & C."

LIGHT ON: CHECK FOR GROUND IN CKT 459. IF CKT 459 IS NOT GROUNDED REPLACE ECM.

LIGHT OFF:
- GROUND DIAGNOSTIC TERMINAL AND REPEAT TEST.

LIGHT ON:
- A/C ON.
- REMOVE GROUND FROM DIAGNOSTIC TERMINAL.
- REPEAT TEST WITH ENGINE IDLING.

SEE A/C CLUTCH CONTROL DIAGNOSIS CHART (2 of 2)

LIGHT OFF:
- PROBE HARNESS CONNECTOR TERMINAL "A" WITH TEST LIGHT TO GROUND.

LIGHT ON: DISCONNECT ECM A-B CONNECTOR AND CHECK FOR OPEN CKT 459. IF OK, IT IS FAULTY ECM CONNECTOR TERMINAL GF1 OR ECM. BEFORE REPLACING THE ECM, REFER TO THE ECM QDR CHECK CHART.

LIGHT OFF: REPAIR OPEN CKT 39.

"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

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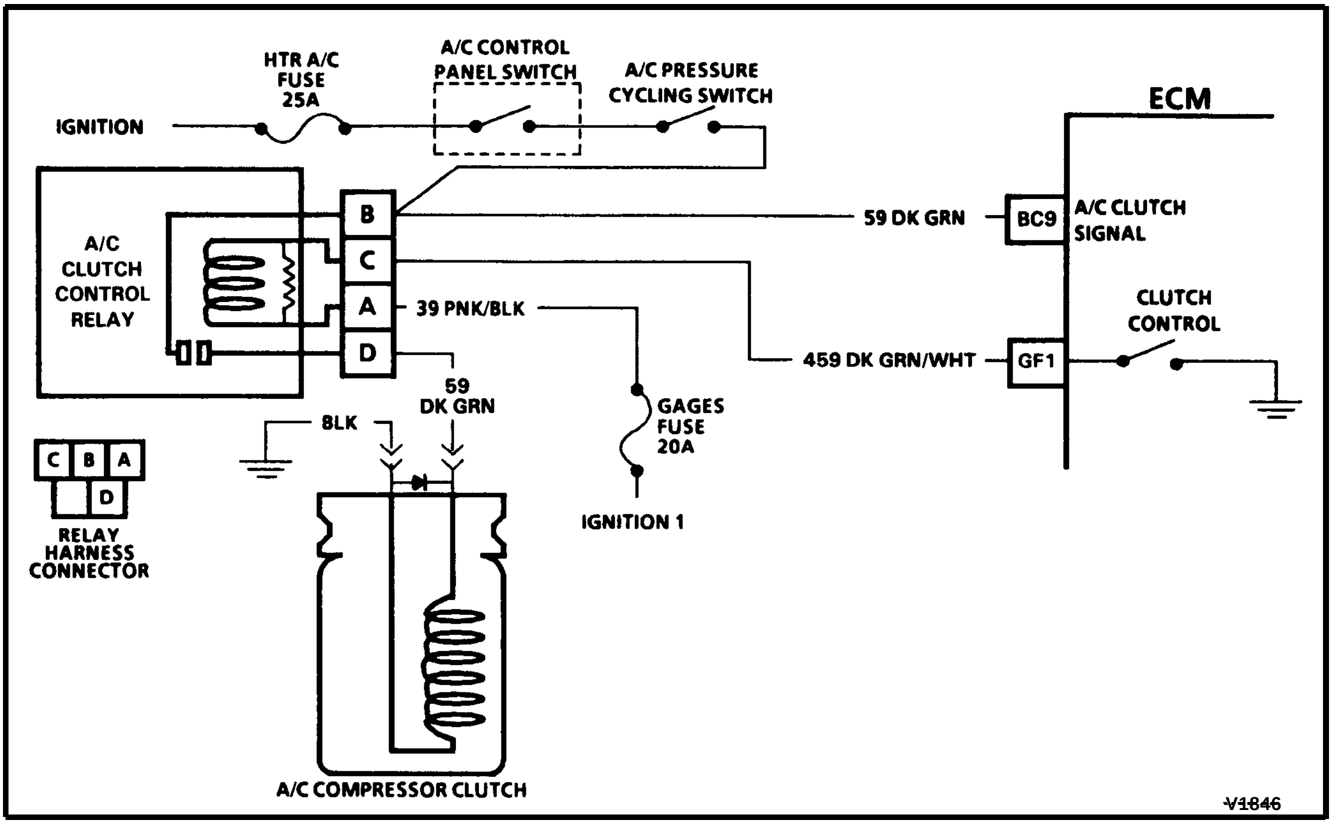


CHART C-10A

(Page 2 of 2)

A/C CLUTCH CONTROL DIAGNOSIS

(AUTOMATIC TRANSMISSION)

4.3L TURBO (VIN Z) SYCLONE AND TYPHOON (PORT)

Circuit Description:

ECM control of the A/C clutch improves idle quality and performance by:

- Delaying clutch apply until the idle air rate is increased.
- Releasing clutch when idle speed is too low.
- Releasing clutch at wide open throttle.
- Smooths cycling of the compressor by providing additional fuel at the instant clutch is applied.

Turning on air conditioning supplies CKT 59 battery voltage to the clutch control relay and terminal “BC9” of the ECM connector. After a time delay of about 1/2 second the ECM will ground terminal “GF1” of the ECM connector, CKT 459, and close the control relay. A/C compressor clutch will engage.

Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

3. Checks for faulty cycling switch.

- Solenoids and relays are turned “ON” or “OFF” by the ECM, using internal electronic switches called “drivers.” Each driver is part of a group of four, called “Quad-Drivers.” Failure of one driver can damage any other driver in the set.

  Solenoid and relay coil resistance must measure more than 20 ohms. Less resistance will cause early failure of the ECM “driver.” Using an ohmmeter, check the coil resistance of the A/C relay before replacing the ECM.

Diagnostic Aids:

Before replacing ECM, use ohmmeter and check resistance of each ECM controlled relay or solenoid coil. Refer to ECM QDR Check, CHART C-1A in “Electronic Control Module (ECM) and Sensors,” Section “6E3-C1.” See ECM wiring diagram for coil terminal identification for solenoid(s) and relay(s) to be checked.

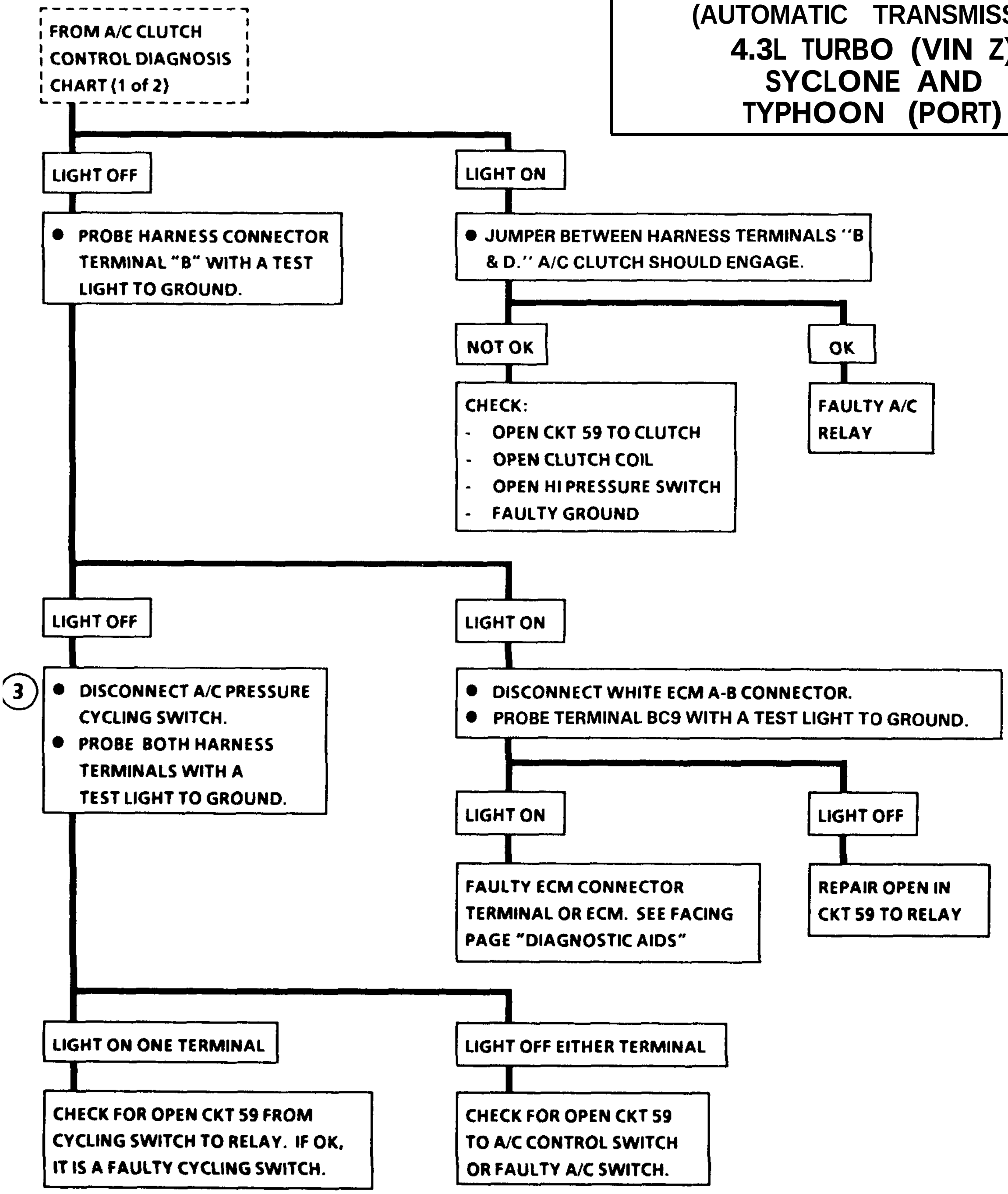
Replace any relay or solenoid that measures less than 20 ohms.

CHART C-10A

(Page 2 of 2)

A/C CLUTCH CONTROL DIAGNOSIS
(AUTOMATIC TRANSMISSION)

4.3L TURBO (VIN Z)
SYCLONE AND
TYPHOON (PORT)



"AFTER REPAIRS," CONFIRM "CLOSED LOOP" OPERATION AND NO "CHECK ENGINE" LIGHT.

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SECTION C12

CHARGE AIR COOLER (CAC) PUMP

CONTENTS

GENERAL DESCRIPTION

The charge air cooler (CAC) pump is used for coolant cooling and is ECM controlled.

OPERATION

The ECM provides a ground path to energize the pump relay, which turns “ON” the CAC pump. The ECM will command the pump “ON” when the CAC coolant temperature is above 95°C. When the CAC coolant cools down to below 95°C, the ECM de-energizes the pump relay, and the pump stops. If the coolant sensor fails (Code 14 or 15 set), the ECM will command constant pump.

DIAGNOSIS

The following charts will diagnose the ECM controlled CAC pump. For specific system components and wiring, refer to ELECTRICAL DIAGRAMS AND DIAGNOSIS.

ON-VEHICLE SERVICE

Charge air cooler pump replacement can be found in TURBOCHARGER (SEC. 6J).

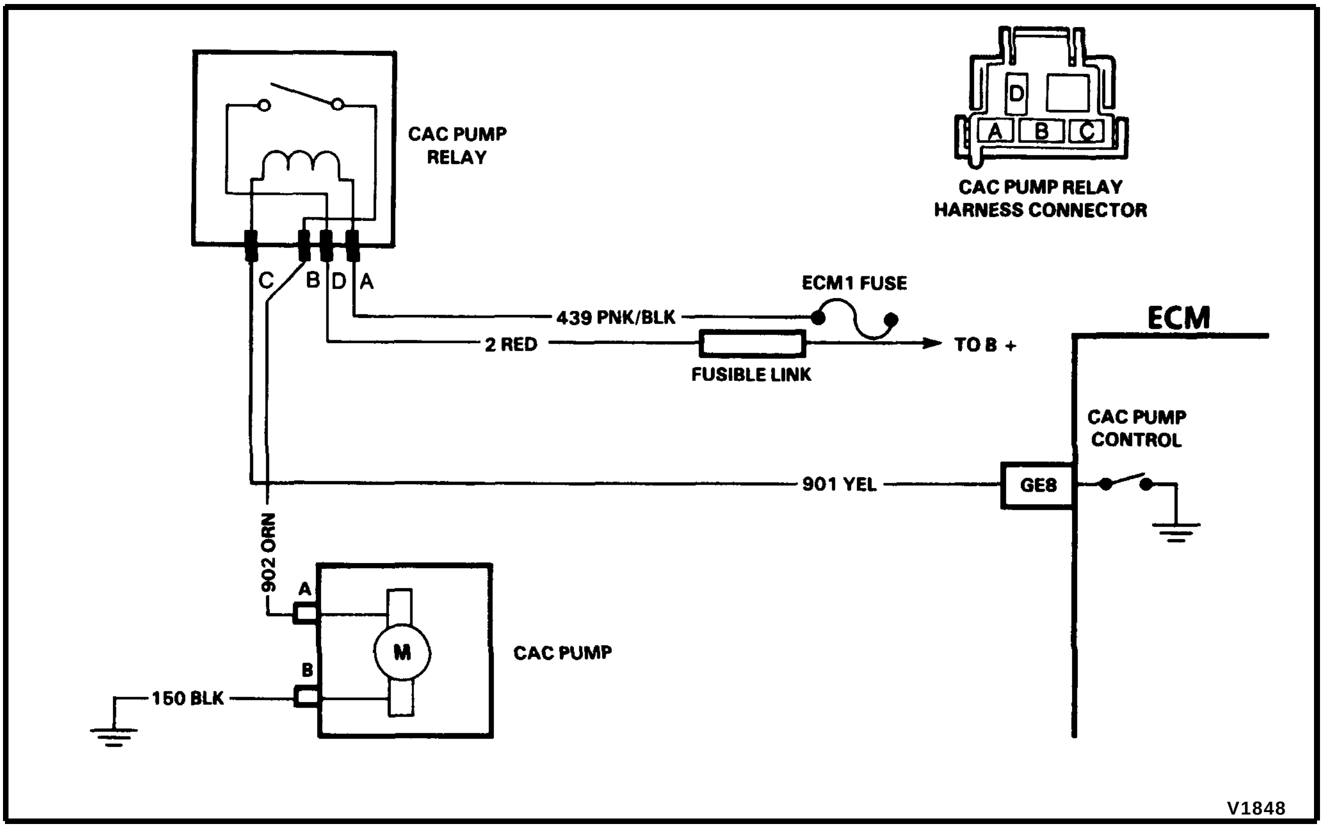


CHART C-12

CHARGE AIR COOLER (CAC) PUMP SYSTEM CHECK
4.3L TURBO (VIN Z) SYCLONE (PORT)

Circuit Description:

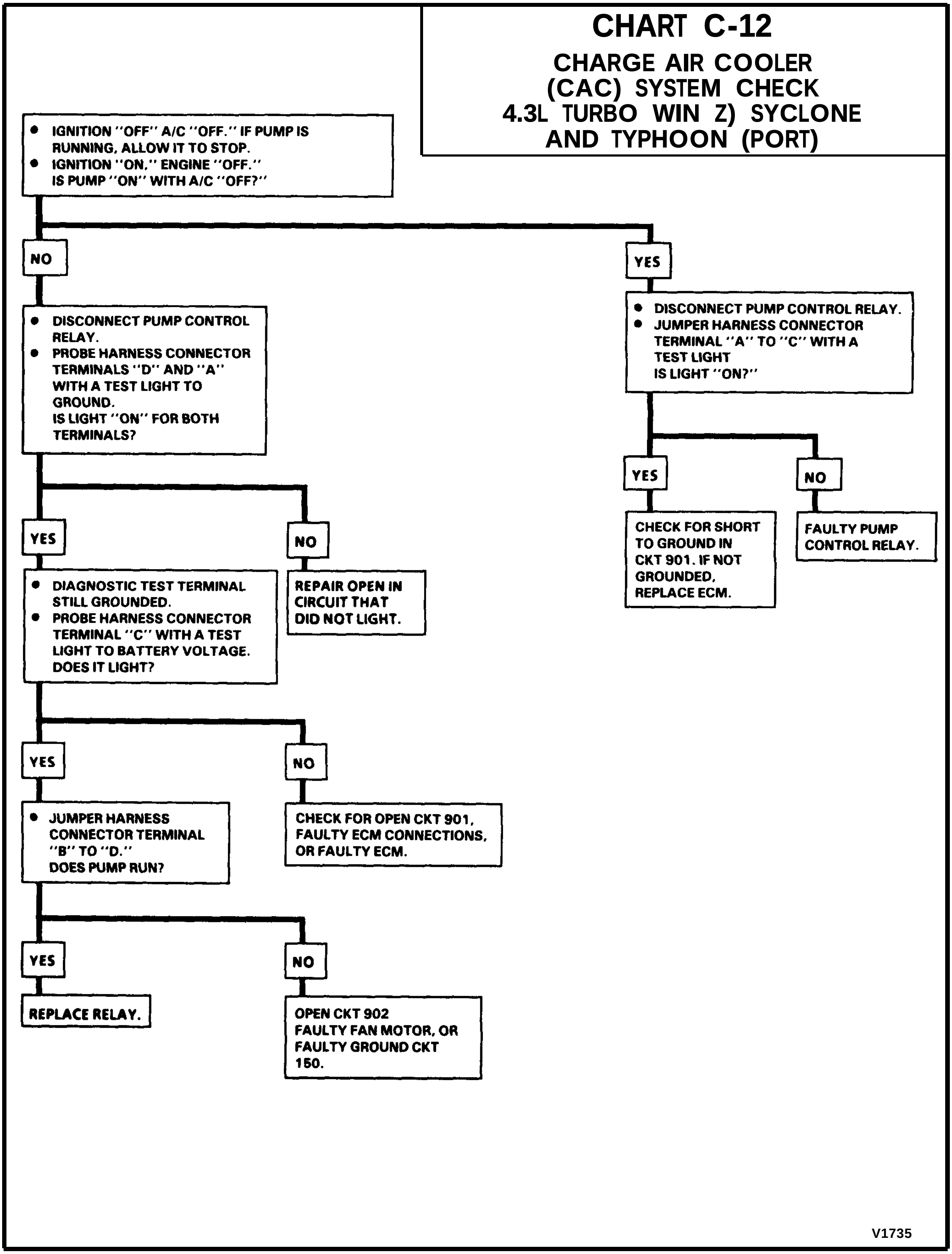
Battery voltage to operate the CAC pump motor is supplied to relay terminal “D.” Ignition voltage to energize the relay is supplied to relay terminal “A.” When the ECM grounds CKT 901, the relay is energized and the CAC pump is turned “ON.” When the engine is running, the ECM will turn the CAC pump “ON” if the conditions for a coolant temperature sensor trouble code (Code 14 or 15) are present or if the coolant temperature is greater than 108°C (230°F).

Diagnostic Aids:

If the vehicle is experiencing poor performance, it may be due to a malfunctioning CAC pump. Refer to diagnostic chart C-12

CHART C-12

CHARGE AIR COOLER (CAC) SYSTEM CHECK 4.3L TURBO WIN Z) SYCLONE AND TYPHOON (PORT)



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SECTION C13

POSITIVE CRANKCASE VENTILATION (PCV)

CONTENTS

GENERAL DESCRIPTION

A Positive Crankcase Ventilation (PCV) system is used to provide purging of crankcase vapors. Fresh air from the air cleaner is supplied to the crankcase, mixed with blow-by gases and then passed through a Positive Crankcase Ventilation (PCV) valve into the throttle body (Figure C13-1).

The primary control is through the PCV valves (Figure C13-2) which meter the flow at a rate depending on manifold pressure.

To maintain idle quality, the PCV valve directs flow to the throttle body when intake manifold pressure is low. At high manifold pressures, the system directs flow to the air cleaner duct.

RESULTS OF INCORRECT OPERATION

- A plugged valve or hose may cause:
  - Rough idle
  - Stalling or slow idle speed
  - Oil leaks
  - Oil in air cleaner
  - Sludge in engine
- A leaking valve or hose would cause:
  - Rough idle
  - Stalling
  - High idle speed

DIAGNOSIS

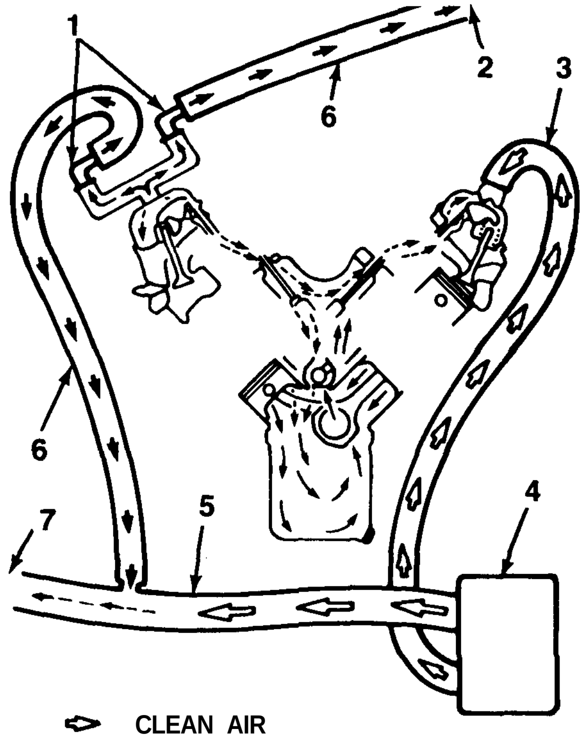
FUNCTIONAL CHECK OF PCV VALVES

If an engine is idling roughly, check for a clogged PCV valve or plugged hose. Replace as required. Use the following procedure for each PCV valve and hose.

1. Remove PCV valve from PCV hose.
2. Run the engine at idle.
3. Place thumb over end of valve to check for vacuum. If there is no vacuum at valve, check for plugged hoses, manifold port, or PCV valve. Replace plugged or deteriorated hoses.
4. Stop the engine and remove PCV valve. Shake valve and listen for the rattle of the needle inside the valve. If the valve does not rattle, replace the valve.
5. Inspect valve for varnish and deposits which may make PCV valve operation sticky, restricted, or unable to seal properly. Replace if necessary.

With this system, any blow-by in excess of the system capacity (from a badly-worn engine, sustained heavy load, etc.) is exhausted into the air cleaner duct and is drawn into the engine.

Proper operation of the PCV system is dependent upon a sealed engine. If oil sludging or dilution is noted, and the PCV system is functioning properly, check engine for possible cause and correct to ensure that system will function as intended.



⇨ CLEAN AIR
➔ VOLATILE OIL FUMES
--➔ MIXTURE OF AIR AND FUMES

1. PCV Valve
2. To Throttle Body
3. Crankcase Vent Hose
4. Air Cleaner
5. Air Cleaner Duct
6. PCV Valve Hose
7. To Turbocharger

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Figure C13-1 - PCV Flow - Typical

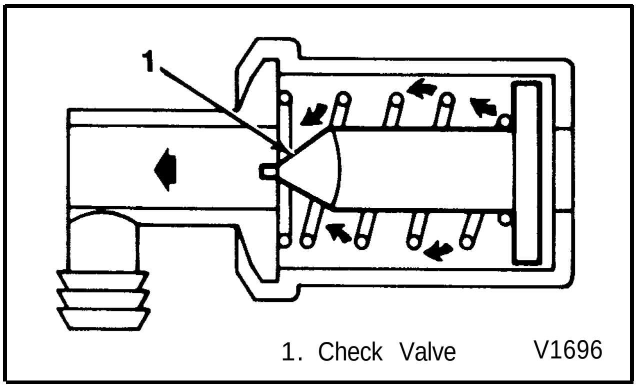


Figure C13-2-PCV Valve Cross Section

ON-VEHICLE SERVICE

See Figure C13-3 for replacement of PCV system components.

An engine which is operated without any crankcase ventilation can be damaged. Therefore, it is important to replace the PCV valves and air inlet filter or separator at intervals given in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.

Periodically inspect the hoses and clamps and replace any showing signs of deterioration.

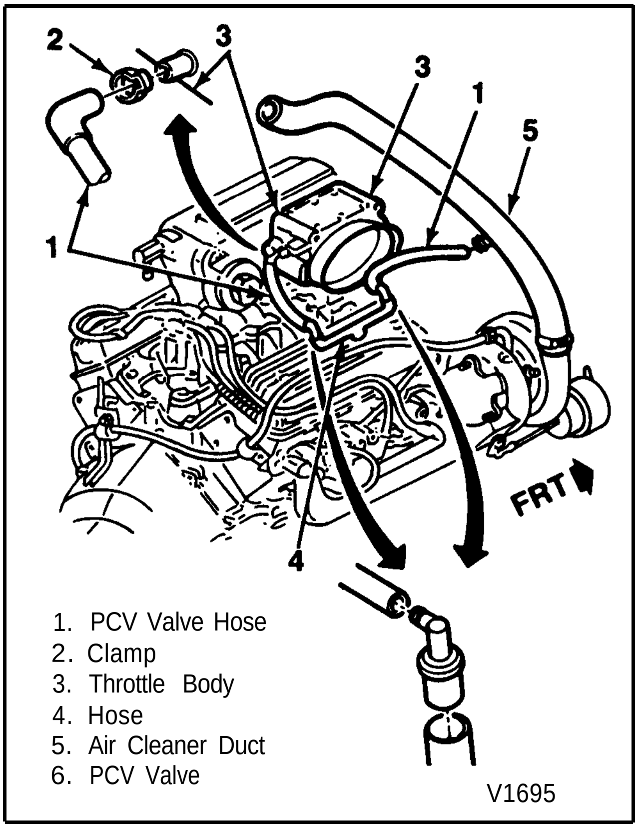


Figure C13-3 – PCV System

PARTS INFORMATION

PART NAME	GROUP
Air Cleaner	3.402
Valve Asm, Cr/Case Vent	1.745
Tube, Cr/Case Vent	1.762

SECTION C14

AIR INDUCTION SYSTEM

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

GENERAL DESCRIPTION

AIR INDUCTION SYSTEM

Air induction system draws outside air in through a remotely mounted air cleaner assembly. (See Figure C14-1). The air then enters the engine by flowing through a flexible air intake duct into the turbocharger, throttle body and plenum. The air is then directed into plenum intake runners, and into the cylinders.

ON-VEHICLE SERVICE

AIR FILTER ELEMENT

Remove or Disconnect

1. Bolt (13) and pull air cleaner assembly (1) up.
2. Unsnap fasteners.
3. Air cleaner cover and element. Inspect air filter element for dust, dirt or water, and clean or replace if required. Refer to MAINTENANCE AND LUBRICATION (SECTION 0B).

Install or Connect

1. Air filter element and cover.
2. Snap fasteners.
3. Air cleaner assembly (1) and bolt (13).

AIR CLEANER ASSEMBLY

Remove or Disconnect

1. Loosen bolt to secure air cleaner assembly to bracket.
2. Loosen clamp from duct assembly.
3. Duct assembly from air cleaner assembly.
4. Vent hose from air cleaner assembly.
5. Carefully remove air cleaner assembly.

Install or Connect

1. Carefully install air cleaner assembly.
2. Vent hose to air cleaner assembly.
3. Clamp to duct assembly.
4. Duct assembly to air cleaner assembly.
5. Bolt to secure air cleaner assembly to bracket.

Tighten

- Clamp to 2.6 N•m (23 lb. in.)

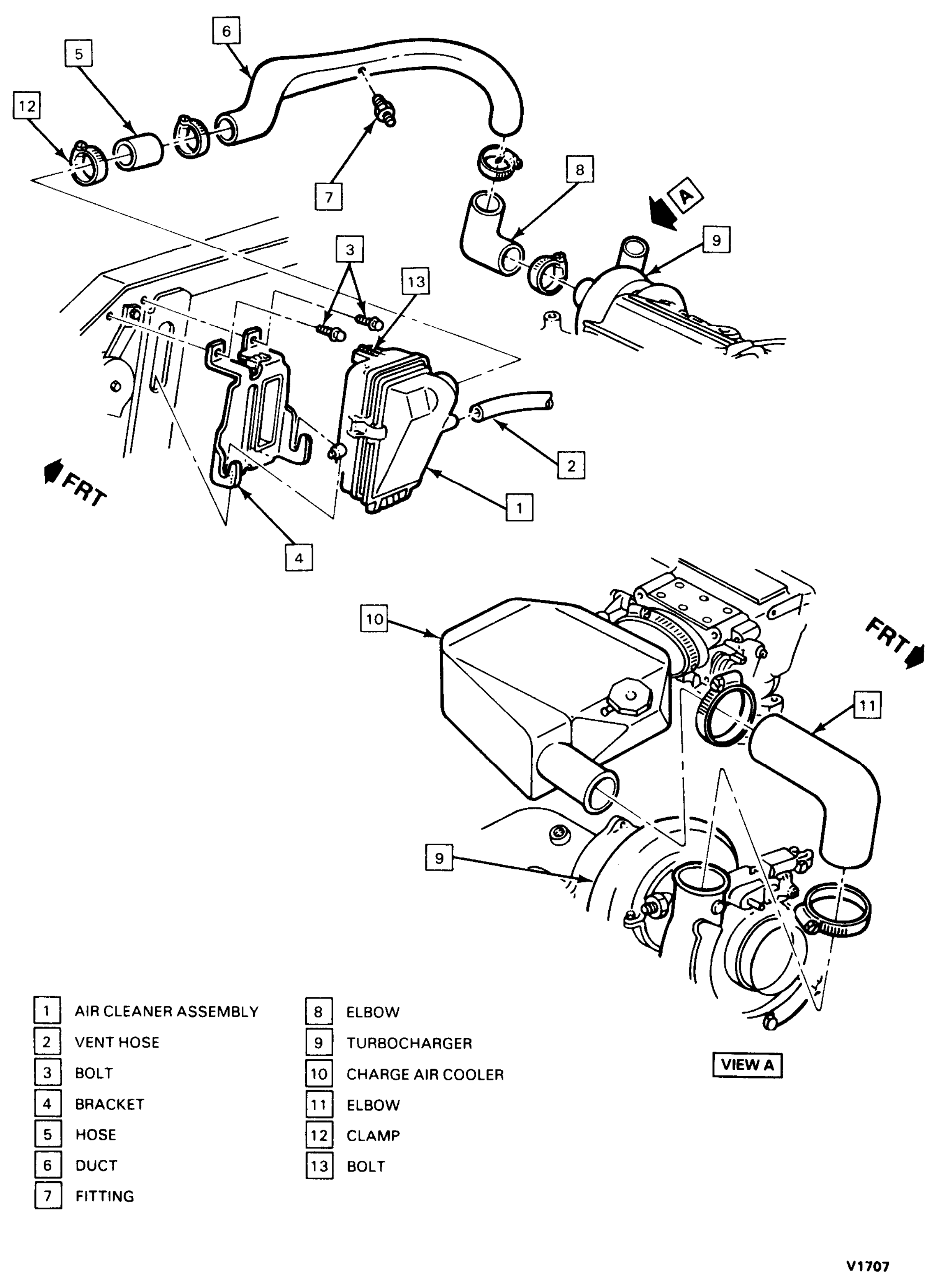


Figure C14-1 – Air Induction System

SECTION 6F

EXHAUST

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The exhaust system consists of the exhaust crossover pipe, turbocharger outlet pipe, catalytic converter, and muffler assembly.

The exhaust system is supported by brackets and hangers with rubber block insulators that allow some movement of the exhaust system but prevents the transfer of noise and vibration.

Further information and diagnosis of the exhaust system is available in the 1992 Service Manual Sonoma and Jimmy Models.

ON-VEHICLE SERVICE

CAUTION: Always wear protective goggles and gloves when removing exhaust parts as falling rust and sharp edges from worn exhaust components could result in serious personal injury.

EXHAUST CROSSOVER PIPE

Remove or Disconnect (Figure 1)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Nuts (1) from left exhaust manifold (3).
2. Nuts (1) from right exhaust manifold (4).
3. Exhaust crossover pipe (2).

Install or Connect (Figure 1)

NOTICE: For steps 2 and 3 see "Notice" on page 6F-1 of this section.

1. Exhaust crossover pipe (2) to exhaust manifolds (3 and 4).
2. Nuts (1) to right exhaust manifold (4).
3. Nuts (1) to left exhaust manifold (3).

Tighten

- Nuts (1) evenly to 16 N•m (12 ft. lbs.).

Inspect

- Idler arm and exhaust crossover pipe (2) for adequate clearance with wheels turned full left.
- Lower vehicle.

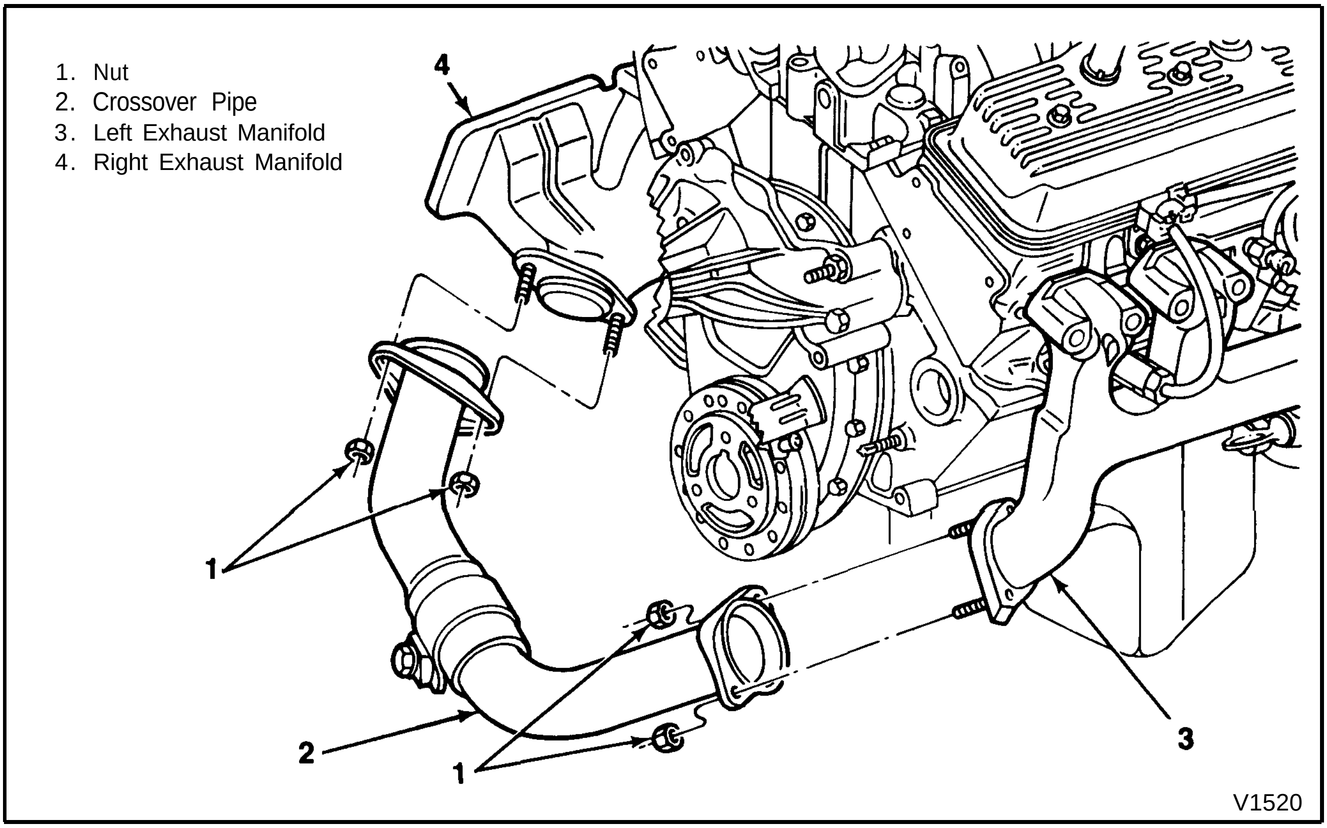


Figure 1 - Exhaust Crossover Pipe

TURBOCHARGER OUTLET PIPE

Remove or Disconnect (Figures 2 through 4)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Right front tire and wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.
2. Right front wheelhouse panel screws.
3. Right front wheelhouse panel.
4. Electrical connector (25) of oxygen sensor (5) from wiring harness.
5. Nuts (19) from turbocharger (18).
6. Bolt (22) from outlet pipe support bracket (21).
7. Clamp (23) from catalytic converter (6).
8. Bolts from catalytic converter supports (8).
9. Turbocharger outlet pipe (9).

Install or Connect (Figures 2 through 4)

NOTICE: For steps 2, 3, 4, 5 and 9 see "Notice" on page 6F-1 of this section.

1. Turbocharger outlet pipe (9) to catalytic converter (6) and turbocharger (18).
2. Nuts (19) to turbocharger (18).
3. Clamp (23) to catalytic converter (6).
4. Bolts to catalytic converter supports (8).
5. Bolt (22) to outlet pipe support bracket (21).

Tighten

- Nuts (19) to 55 N•m (41 ft. lbs.).
- Catalytic converter clamp nuts to 57 N•m (42 ft. lbs.).
- Support bracket bolt (22) to 30 N•m (22 ft. lbs.).
- Converter support bolts to 34 N•m (25 ft. lbs.).

8. Electrical connector (25) of oxygen sensor (5) to the wiring harness.
7. Right front wheelhouse panel.
8. Right front wheelhouse panel screws.
9. Right front tire and wheel. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

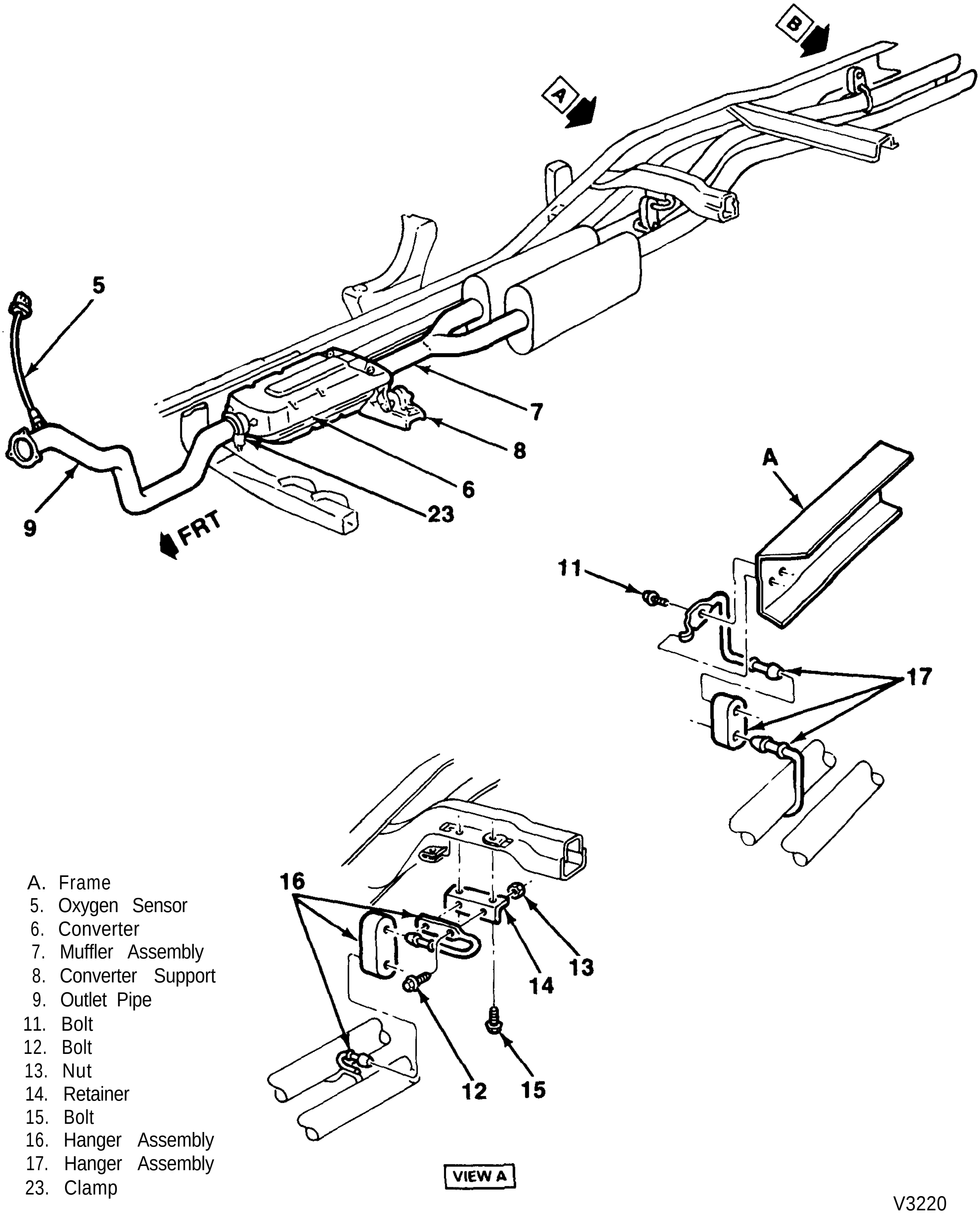
- Lower vehicle.

CATALYTIC CONVERTER

Remove or Disconnect (Figures 2, 3 and 5)

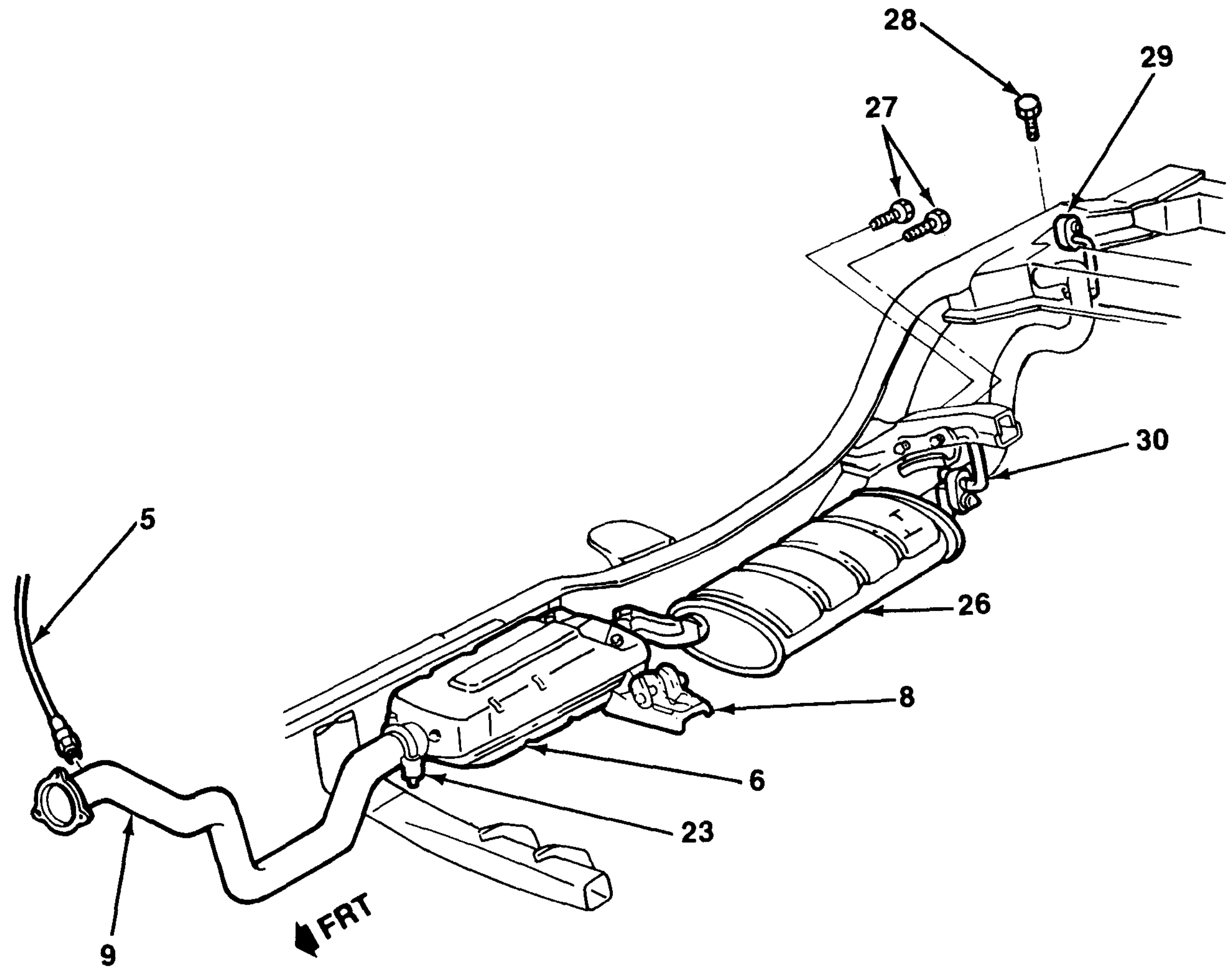
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Clamp (23) from catalytic converter (6) and outlet pipe (9).
2. Bolts (24) from muffler assembly (7 or 26) to catalytic converter (6).
3. Bolts from catalytic converter supports (8).
4. Catalytic converter (6).



A. Frame
5. Oxygen Sensor
6. Converter
7. Muffler Assembly
8. Converter Support
9. Outlet Pipe
11. Bolt
12. Bolt
13. Nut
14. Retainer
15. Bolt
16. Hanger Assembly
17. Hanger Assembly
23. Clamp

Figure 2 - Exhaust System (Syclone)



- 5. Oxygen Sensor
- 6. Converter
- 8. Converter Support
- 9. Outlet Pipe
- 23. Clamp
- 26. Muffler Assembly
- 27. Bolt
- 28. Bolt
- 29. Hanger Assembly
- 30. Hanger Assembly

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Figure 3 - Exhaust System (Typhoon)

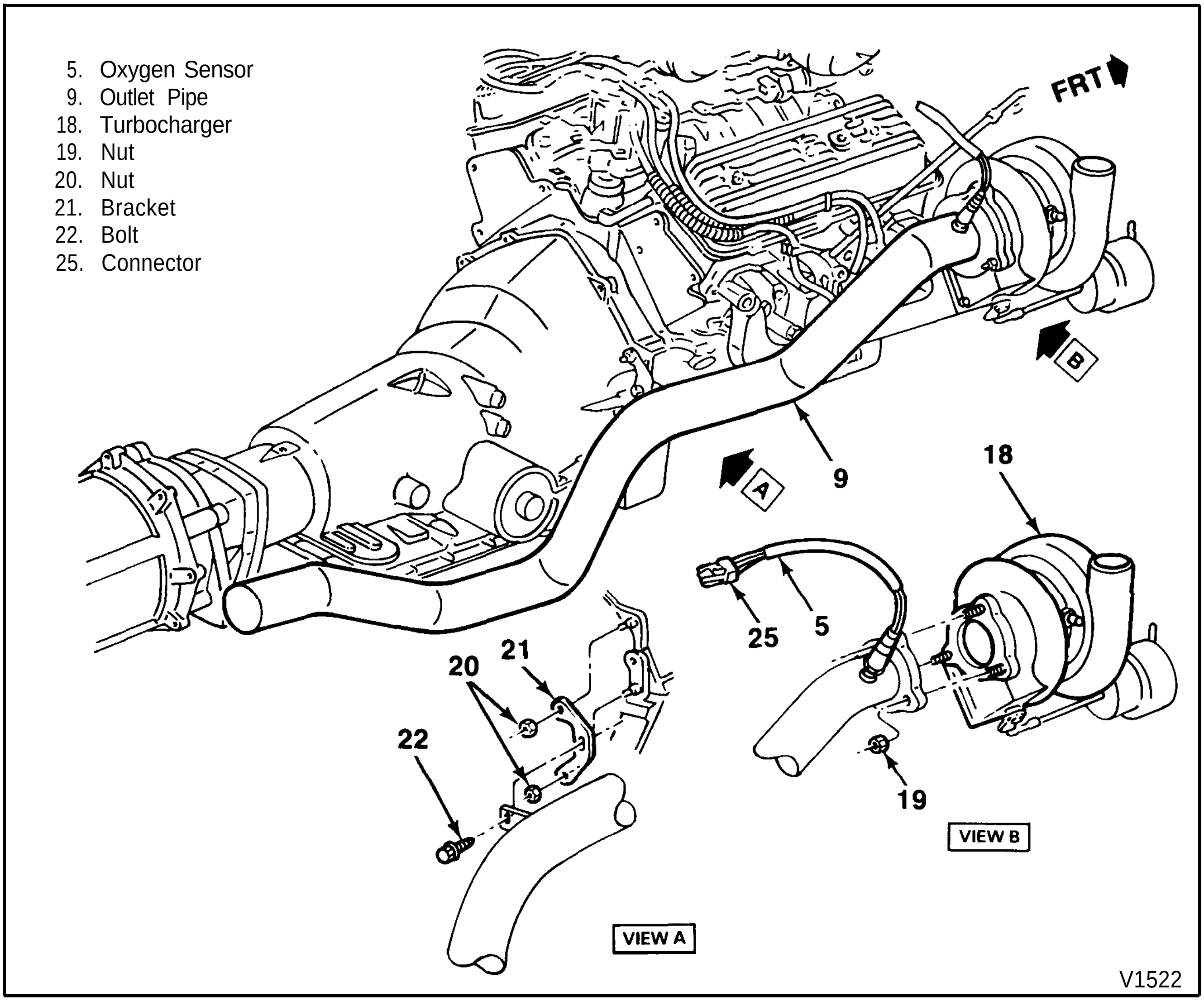

Figure 4 - Turbocharger Outlet Pipe

Install or Connect (Figures 2 and 4)

NOTICE: For steps 1, 2 and 3 see "Notice" on page 6F-1 of this section.

1. Catalytic converter (6) to outlet pipe (9) with clamp (23).
2. Catalytic converter (6) and bolts to converter supports (8).
3. Muffler assembly (7 or 26) and bolts (24) to catalytic converter (6).

Tighten

- Nuts on clamp (23) to 57 N•m (42 ft. lbs.).
- Converter support bolts to 34 N•m (25 ft. lbs.).
- Muffler assembly bolts (24) to 32 N•m (27 ft. lbs.).

- Lower vehicle.

MUFFLER ASSEMBLY

SYCLONE

Remove or Disconnect (Figures 2 and 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Bolts (24) from catalytic converter (6).
2. Muffler assembly (7).
   - Remove nuts (13) bolts (12) and hanger assembly (16) from retainer (14).
   - Remove bolt (11) and hanger assembly (17) from frame.

Install or Connect (Figures 2 and 5)

1. Muffler assembly (7).
   - Install bolt (11) and hanger assembly (17) to frame.

- Install bolts (12), nuts (13) and hanger assembly (16) to retainer (14).

NOTICE: See "Notice" on page 6F-1 of this section.

2. Bolts (24).

Tighten

  - Bolts (24) to 32 N•m (24 ft. lbs.).
  - Bolts (12) to 25 N•m (18 ft. lbs.).
  - Bolt (11) to 17 N•m (13 ft. lbs.).

- Lower vehicle.

TYPHOON

Remove or Disconnect (Figures 3 and 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Bolts (24) from catalytic converter (6).
2. Muffler assembly (26).
   - Remove bolts (27) from hanger assembly (30).
   - Remove bolt (28) from hanger assembly (29).

Install or Connect (Figures 3 and 5)

1. Muffler assembly (26).
   - Install bolts (27) to hanger assembly (30).
   - Install bolt (28) to hanger assembly (29).

NOTICE: See "Notice" on page 6F-1 of this section.

2. Bolts (24) to catalytic converter (6).

Tighten

  - Bolts (24) to 32 N•m (24 ft. lbs.).

- Lower vehicle.

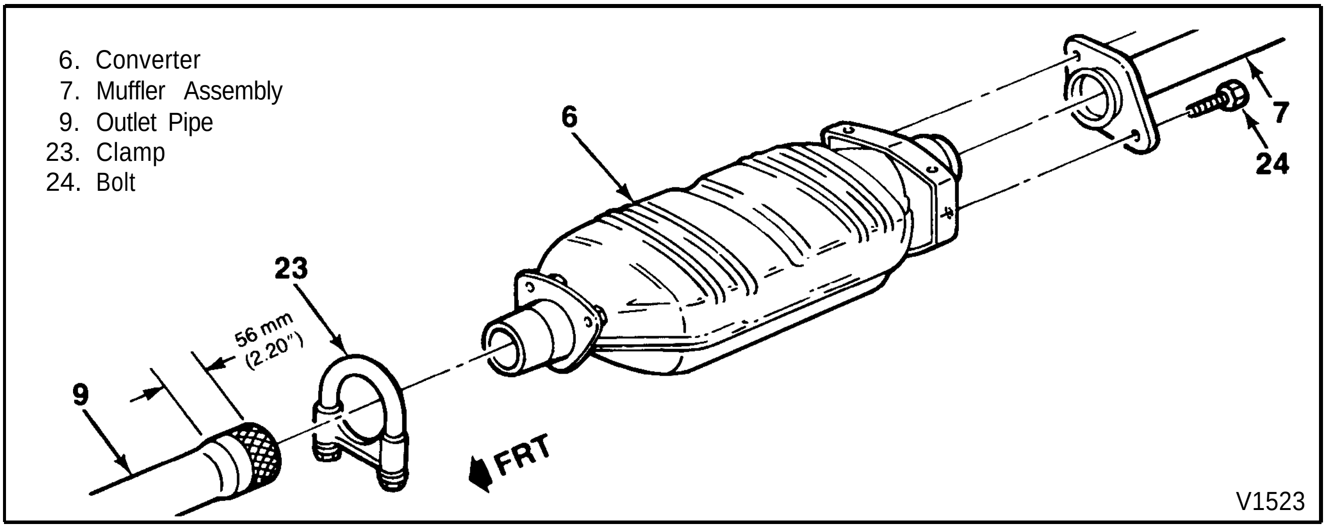

Figure 5 - Catalytic Converter

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Exhaust Crossover Pipe Nut	16	12
Turbocharger Outlet Pipe Nut	55	41
Outlet Pipe Support Bracket Bolt	30	22
Converter Support Bolt	34	25
Converter Clamp Nut	57	42
Muffler Assembly Bolt	32	24
Muffler Assembly Hanger Bolt	17	13
Hanger Assembly-to-Retainer Bolt	25	18

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SECTION 6J

TURBOCHARGER

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

TURBOCHARGER

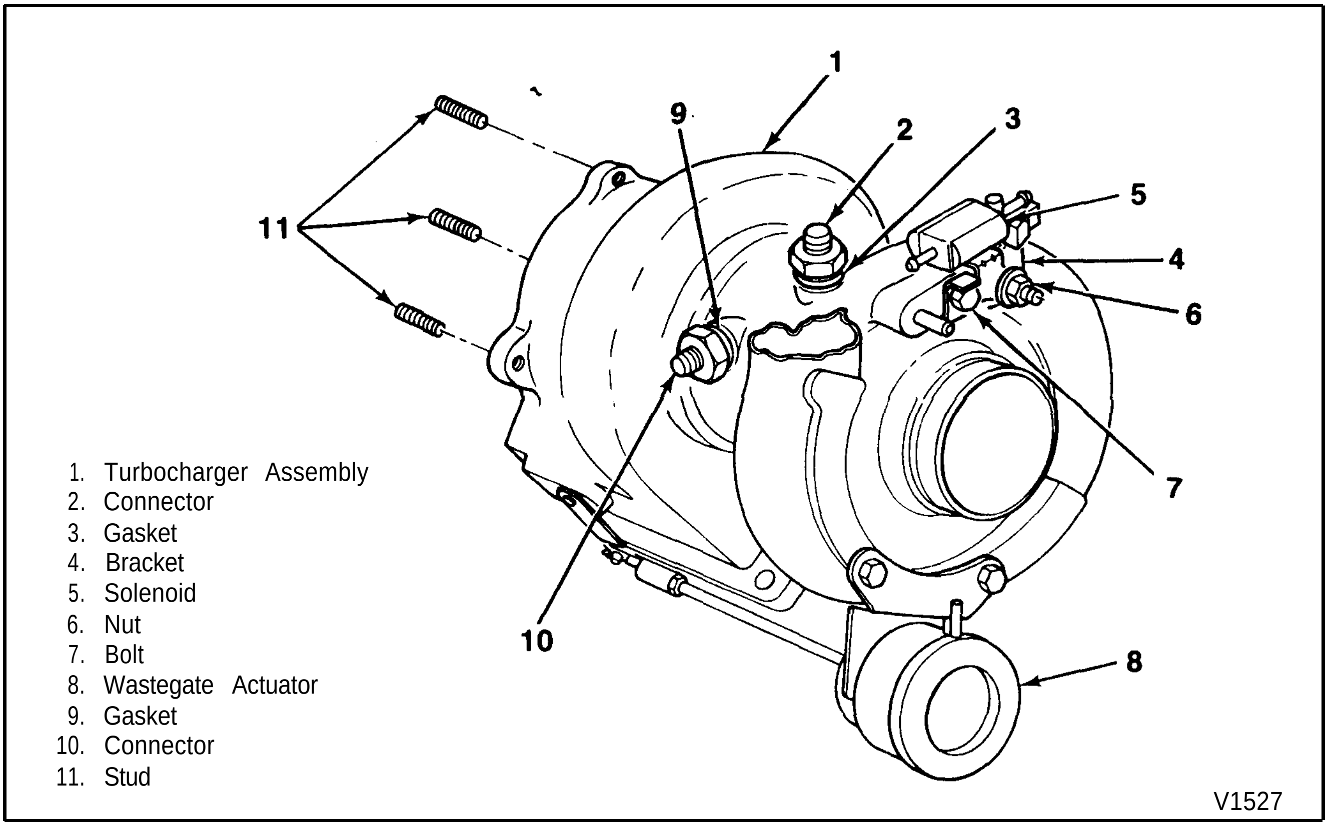
The turbocharger is basically an air compressor or air pump. Its major parts include a turbine wheel, shaft, compressor wheel, turbine housing, compressor housing and center housing. The center housing contains a turbine seal, compressor seal and bearings. Refer to Figures 1 and 2.

The internal combustion engine is an air-breathing machine. The amount of power obtained is determined by the amount of air the engine breathes in a certain period of time, not by the amount of fuel it uses. Air must mix with fuel to complete the combustion cycle. When the air/fuel ratio reaches a certain point, additional fuel will not produce more power, only black smoke; the more dense the smoke, the more the engine is being overfueled.

The turbocharger increases the quantity and density of air in the engine combustion chambers. The increased volume of air allows more fuel to be used while maintaining the proper air/fuel ratio. The increased air and fuel allows the engine to produce more horsepower than a non-turbocharged engine.

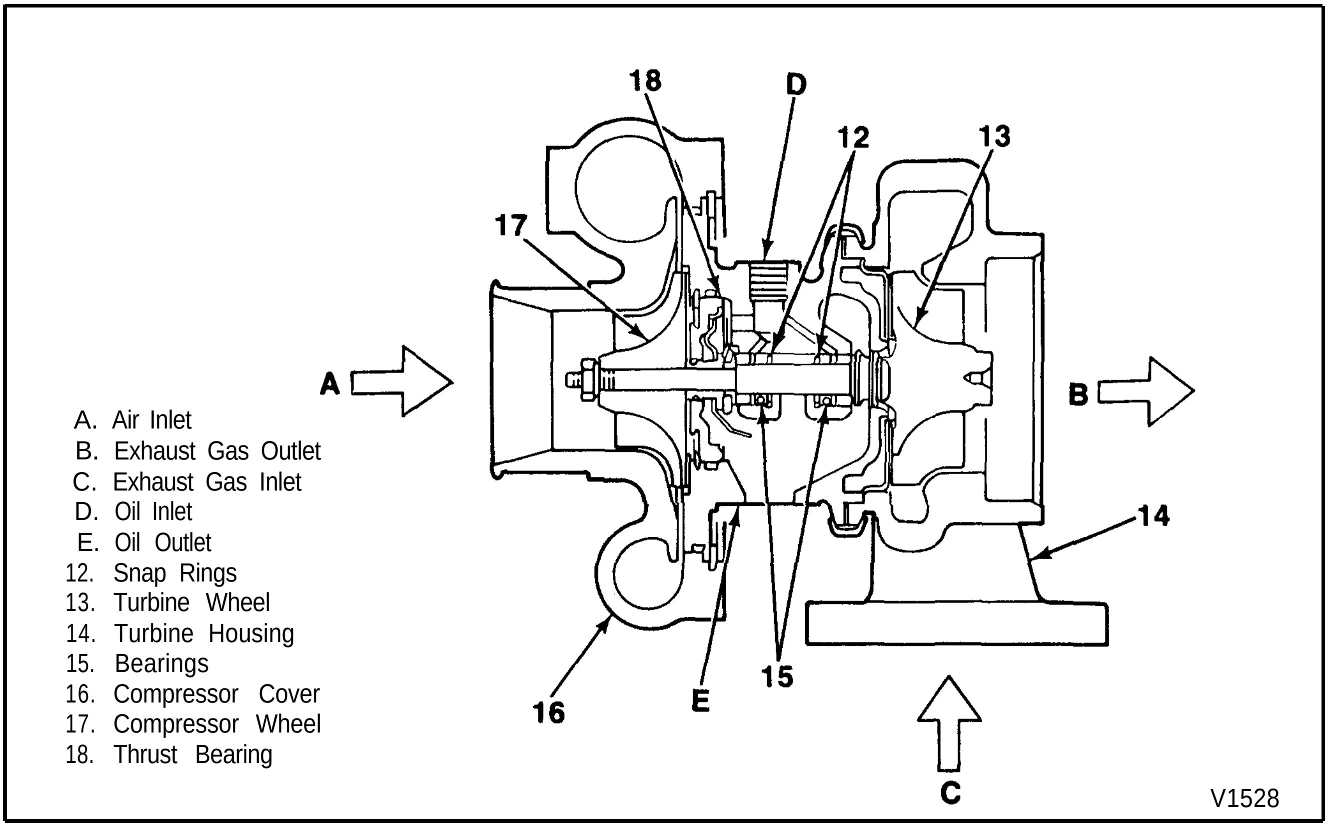
The turbocharger uses the normally wasted energy in the engine exhaust gas. As load on the engine is increased and the throttle is opened, more air/fuel mixture flows into the combustion chambers. The increased flow is burned and produces a larger volume of exhaust gas. The gas enters the exhaust manifolds, flows through the turbocharger turbine housing and turns the turbine wheel and shaft. The shaft is coupled to the compressor wheel. The compressor wheel compresses the air it receives and sends it to the intake manifold. The higher pressure in the intake manifold allows a denser charge to enter the combustion chambers.

Intake manifold pressure, or boost, is controlled by an exhaust bypass valve, or wastegate. The wastegate is operated by a spring-loaded diaphragm type actuator that responds to boost pressure. The actuator, which is controlled by the wastegate solenoid, opens the wastegate to allow exhaust gases to bypass the turbine wheel so that the correct boost level is maintained. The wastegate solenoid is controlled by the electronic control module (ECM). For diagnostic and service procedures of the ECM, refer to DRIVEABILITY AND EMISSIONS GENERAL INFORMATION (SEC. 6E) in this manual.



1. Turbocharger Assembly
2. Connector
3. Gasket
4. Bracket
5. Solenoid
6. Nut
7. Bolt
8. Wastegate Actuator
9. Gasket
10. Connector
11. Stud

Figure 1 - Turbocharger Components



A. Air Inlet
B. Exhaust Gas Outlet
C. Exhaust Gas Inlet
D. Oil Inlet
E. Oil Outlet
12. Snap Rings
13. Turbine Wheel
14. Turbine Housing
15. Bearings
16. Compressor Cover
17. Compressor Wheel
18. Thrust Bearing

Figure 2 - Turbocharger Assembly

NOTICE: A turbocharged engine is a finely tuned assembly. Any alteration to the air intake or exhaust system that upsets the air flow balance may result in serious damage to the engine.

The rotating assembly in the turbocharger can reach speeds of 130,000 to 140,000 rpm. An adequate supply of clean engine oil is essential for cooling and lubrication. Any time a basic engine bearing has been damaged or the turbocharger is replaced, the oil and oil filter should be changed and the turbocharger flushed with clean engine oil.

NOTICE: Interruption or contamination of the oil supply to the turbocharger bearings can result in major turbocharger damage.

CHARGE AIR COOLER

Before entering the combustion chambers, the air from the turbocharger is routed through an air-to-water charge air cooler. When the turbocharger compresses air, its temperature rises. The heated, compressed air then flows through the charge air cooler core where it is cooled by coolant passing through the charge air cooler. The cooler, denser air allows a denser air/fuel charge to enter the combustion chambers, producing significantly more power.

The hot coolant is then routed through the charge air cooler radiator, where it releases the heat it absorbed at the charge air cooler. An electric pump mounted to the charge air cooler radiator circulates coolant through the system. For diagnostic procedures of the charge air cooler pump, see CHARGE AIR COOLER PUMP (SEC. 6E3-C12) in this manual.

MAINTENANCE

Good maintenance practices must be followed to maintain the service life and performance of the turbocharger. Turbocharger failures are most often caused by oil lag, restriction or lack of oil flow, dirty oil, or foreign objects entering the turbocharger.

1. Do not allow dust, sand or other foreign material to enter the turbocharger. Dust or sand entering the compressor housing from a leaky air inlet system can erode the compressor wheel blades. Uneven blade wear can produce shaft motion that can cause bearing failure. Dust and sand also wears engine parts. Large or heavy objects will completely destroy the turbocharger and may cause severe damage to the engine. Soft materials, such as towels or rubber items, will roll the blades backward. If a turbocharger fails due to foreign material, a thorough cleaning of the air and exhaust systems is necessary. No foreign objects should be in the piping, and all connections must be secure.
2. The air cleaner system must be properly maintained. A plugged or restricted air cleaner system will reduce air pressure and volume at the compressor air inlet. The air pressure drop will lower turbocharger performance and can cause oil pullover during idle. Oil pullover is a compressor end oil seal leak without seal part failure.
3. The lube oil system must be properly serviced. When dirt or foreign material is introduced into the turbocharger bearing system by lube oil, the center housing bearing bore surfaces will wear. Contaminants act as an abrasive cutting tool and eventually wear through the bearing surfaces. When bearing and bore wear become excessive, the shaft hub and wheels may rub on the housings. The rubbing will cause the assembly to turn more slowly than it should, and turbocharger and engine performance will rapidly deteriorate. Excessive noise or smoke and oil at either end of the turbocharger may be noted. Oil contamination must be corrected before a new turbocharger is installed. Do not assume that the oil filter will remove contaminants before they reach the turbocharger. Oil will completely bypass the oil filter if the filter is clogged, the bypass valve is open or the filter element is ruptured or improperly installed.
4. Do not allow sludge to build up in the turbocharger. Sludge accumulates in engine oil when oil oxidation or breakdown occur. Primary causes are engine overheating, excessive combustion products from piston blow-by, non-compatible oils, engine coolant leakage into the oil, incorrect grade or quality of oil and improper oil change intervals. When the turbocharger shaft spins, oil is thrown against the center housing inner walls. Any sludge particles in the oil will stick to the walls. Sludge deposits at the turbine end may become baked, or coked. The hard coke can flake off and wear the turbine end journal and bearing and bore, but usually the turbine seal will leak first. If turbine end oil leakage is noted, check the turbocharger oil drain tube and crankcase breathers. Remove any restrictions and check again for leaks.
5. The charge air cooler system must be properly maintained. The coolant must be the proper mixture and level. If the coolant becomes dirty or otherwise contaminated, it must be flushed and replaced with the proper mixture.

DIAGNOSIS OF TURBOCHARGER

CAUTION: Operation of the turbocharger without ail normally installed inlet ducts and filters connected may permit foreign objects to enter the turbocharger, causing personal injury and vehicle damage.

Important

- To gain familiarity and skills for inspecting a turbocharger, examine a new turbocharger as outlined. Compare inspection results between the new and used turbocharger.

A turbocharger does not change the basic operating characteristics of an engine. It cannot correct or overcome malfunctions in the engine fuel system, timing, air cleaner or other systems. If a turbocharged engine system malfunctions and the turbocharger has been determined operational, proceed with engine diagnosis.

Always inspect the turbocharger before removing it from the engine.

NOISE AND AIR LEAK CHECK

With the engine running, check the turbocharger for uneven noise and vibration, which indicates a shaft wheel assembly malfunction. If suspicious conditions are noted, shut down the engine immediately to protect the turbocharger and engine from further damage.

Examine the turbocharger as explained under “Turbocharger Inspection” in this section. If any damage is evident, the turbocharger must be removed and cleaned or replaced as necessary.

If the turbocharger is assumed to be functional, proceed with a check of the air system. Refer to Figure 3.

Exhaust gas leakage between engine block and inlet to turbocharger will also create a noise level change and reduced turbocharger performance. Check the exhaust system. Refer to Figure 3.

TURBOCHARGER INSPECTION

Inspect (Figures 4, 5 and 6)

With the engine shut off and the turbo stopped turning completely, make a visual inspection of the turbocharger and components.

- Check for loose duct connections from the air cleaner to the turbo.
- Check the crossover duct from the turbocharger to the engine intake system. A loose duct can cause low power, and noise.
- Check the wheels of the turbo for impact damage from foreign objects, entering from engine or ducting.
- Check for evidence of wheel contact against the housing walls.
- Check the shaft for free rotation. Stiffness could indicate the presence of sludged oil, or coking from overheating. Push inward lightly on one of the shaft wheels while you turn it by hand and feel for any rubbing or binding. Do the same on the other side. The wheels should turn freely without contacting housing, backplate or shroud.
- Check the exhaust manifold for loose connections and cracks.
- Check oil drain line for restriction. Any restriction can cause severe oil loss through the turbo seals. There may also be traces of burned oil on the turbine housing exterior.
- Check the oil supply line to ensure it is clean and unobstructed. Restricted oil flow can result in severe damage to the turbocharger.

TURBOCHARGER
TROUBLESHOOTING

PROBLEM									
Engine lacks power	Black exhaust smoke	Excessive engine oil consumption	Blue exhaust smoke	Turbocharger noisey	Cyclic sound from turbocharger	Oil leak from compressor seal	Oil leak from turbine seal	CAUSE	REMEDY
▲				▲				Clogged air filter element	Replace element
	▲	▲	▲	▲	▲	▲		Obstructed air intake duct to turbo compressor	Remove obstruction or replace damaged parts as required
▲	▲			▲				Obstructed air outlet duct from compressor to intake manifold	Remove obstruction or replace damaged parts as required
▲	▲			▲				Obstructed intake manifold	Refer to engine mechanical section & remove obstruction
				▲				Air leak in duct from air cleaner to compressor	Correct leak by replacing seals or tightening fasteners as required
▲	▲	▲	▲	▲				Air leak in duct from compressor to intake manifold	Correct leak by replacing seals or tightening fasteners as required
▲	▲	▲	▲	▲				Air leak at intake manifold to engine joint	Refer to engine mechanical section & replace gaskets or tighten fasteners as required
▲	▲	▲	▲	▲		▲		Obstruction in exhaust manifold	Refer to engine mechanical section & remove obstruction
▲	▲					▲		Obstruction in exhaust system	Remove obstruction or replace faulty components as required
▲	▲					▲		Gas leak in exhaust manifold to engine joint	Refer to engine mechanical section & replace gaskets or tighten fasteners as required
▲	▲			▲		▲		Gas leak in turbine inlet to exhaust manifold joint	Replace gasket or tighten fasteners as required
				▲				Gas leak in ducting after the turbine outlet	Refer to engine mechanical section & repair leak
		▲	▲			▲	▲	Obstructed turbocharger oil drain line	Remove obstruction or replace line as required
		▲	▲			▲	▲	Obstructed engine crankcase ventilation	Refer to engine mechanical section, clear obstruction
		▲	▲			▲	▲	Turbocharger center housing sludged or coked	Change engine oil & oil filter, overhaul or replace turbo as required
▲	▲							Engine camshaft timing incorrect	Refer to engine mechanical section
▲	▲	▲	▲			▲	▲	Worn engine piston rings or liners (blowby)	Refer to engine mechanical section
▲	▲	▲	▲			▲	▲	Internal engine problem (valves, pistons)	Refer to engine mechanical section
▲	▲	▲	▲	▲	▲	▲	▲	Dirt caked on compressor wheel and/or diffuse vanes	Clean using a Non-Caustic cleaner & Soft Brush, Find & correct source of unfiltered air & change engine oil & oil filter
▲	▲	▲	▲	▲	▲	▲	▲	Damaged turbocharger	Replace turbocharger as required

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Figure 3 - Turbocharger Troubleshooting

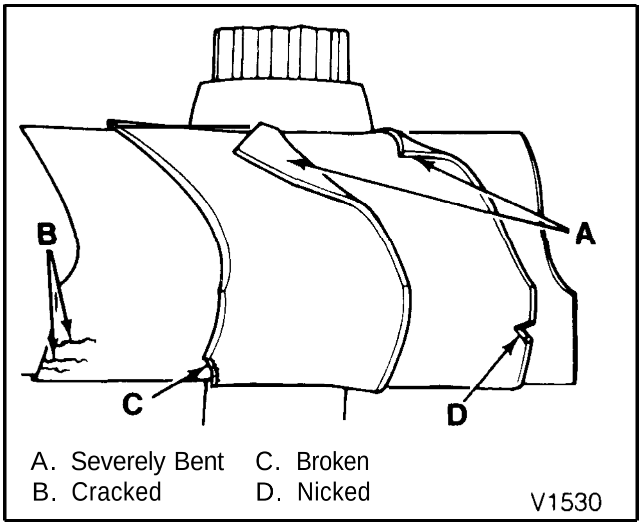


Figure 4 - Blade Damage From Foreign Material

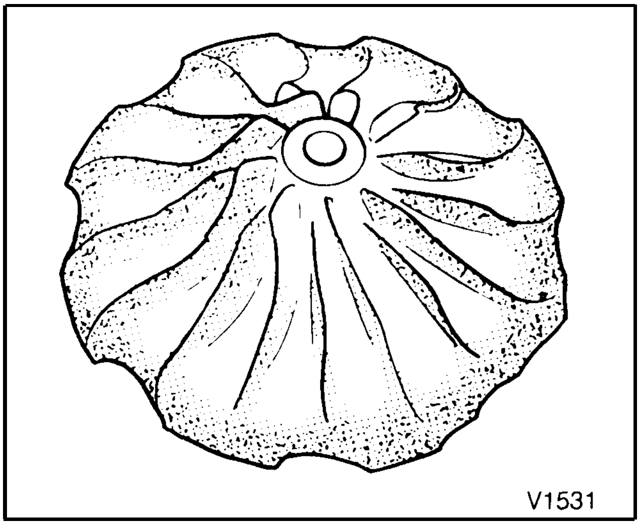


Figure 5 - Extreme Sand Erosion

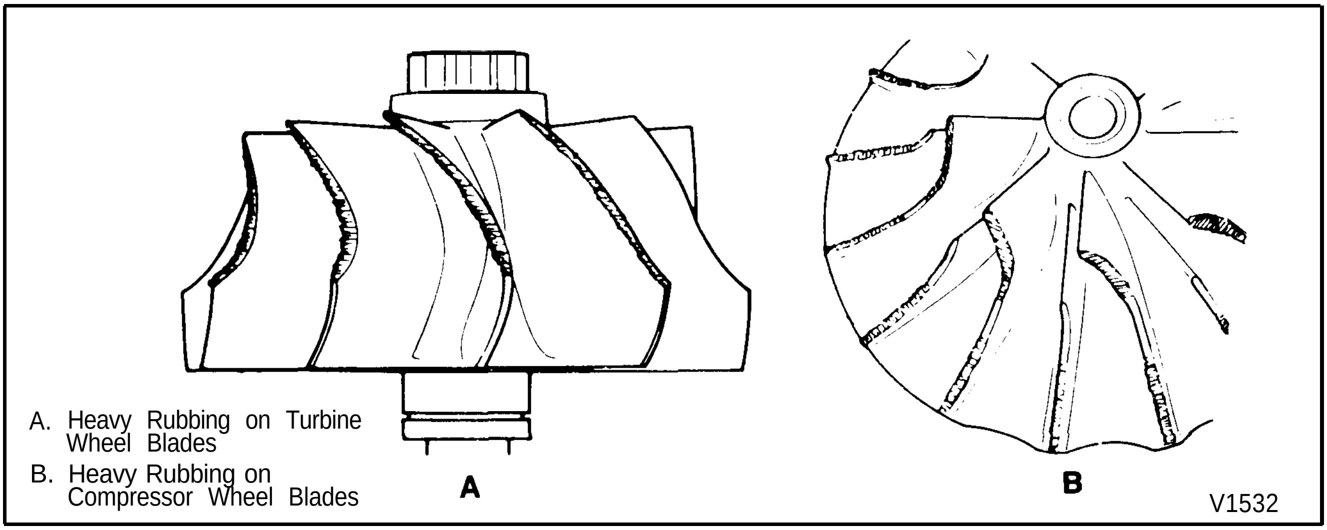


Figure 6 - Wheel Rub

ON-VEHICLE SERVICE

TURBOCHARGER

Remove or Disconnect (Figures 1, 7, 8, 9, 10 and 11)

- Drain coolant from radiator as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.

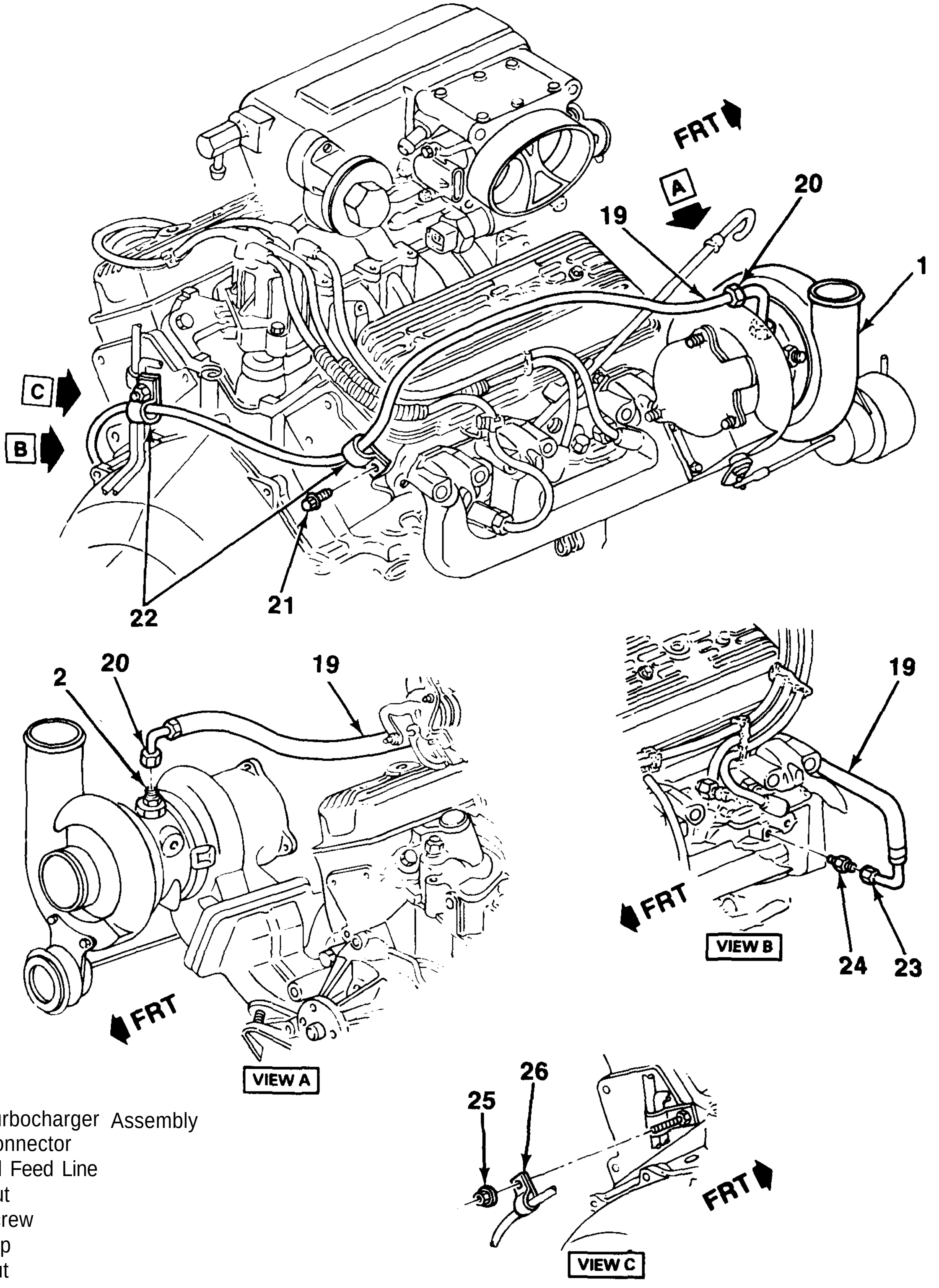
1. Air intake duct.
2. Turbocharger air intake duct.
3. Battery as described in BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.
4. Battery tray and vacuum tank. Refer to BATTERY (SEC. 6D1) in this manual.
5. Turbocharger oil feed line (19), by removing nut (20) from connector (2) on turbocharger assembly (1).
6. Electrical connector at solenoid (5).

- Loosen turbocharger coolant return line clamp nut (30).

7. Turbocharger coolant return line assembly (31) from connector (10) on turbocharger assembly (1).

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

8. Wheel and tire assembly. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.
9. Screws from right-hand wheelhouse panel.
10. Right-hand wheelhouse panel.
11. Turbocharger outlet pipe. Refer to EXHAUST (SEC. 6F) in this manual.
12. Bolts (41) from turbocharger oil return pipe (32).
13. Turbocharger oil return pipe (32) and gasket (40) from turbocharger assembly (1).
14. Turbocharger mounting nuts (49).
15. Bolt (43), gaskets (42) and turbocharger coolant feed line assembly (44) from turbocharger assembly (1).
16. Turbocharger assembly (1).



1. Turbocharger Assembly
2. Connector
19. Oil Feed Line
20. Nut
21. Screw
22. Clip
23. Nut
24. Connector
25. Nut
26. Clip

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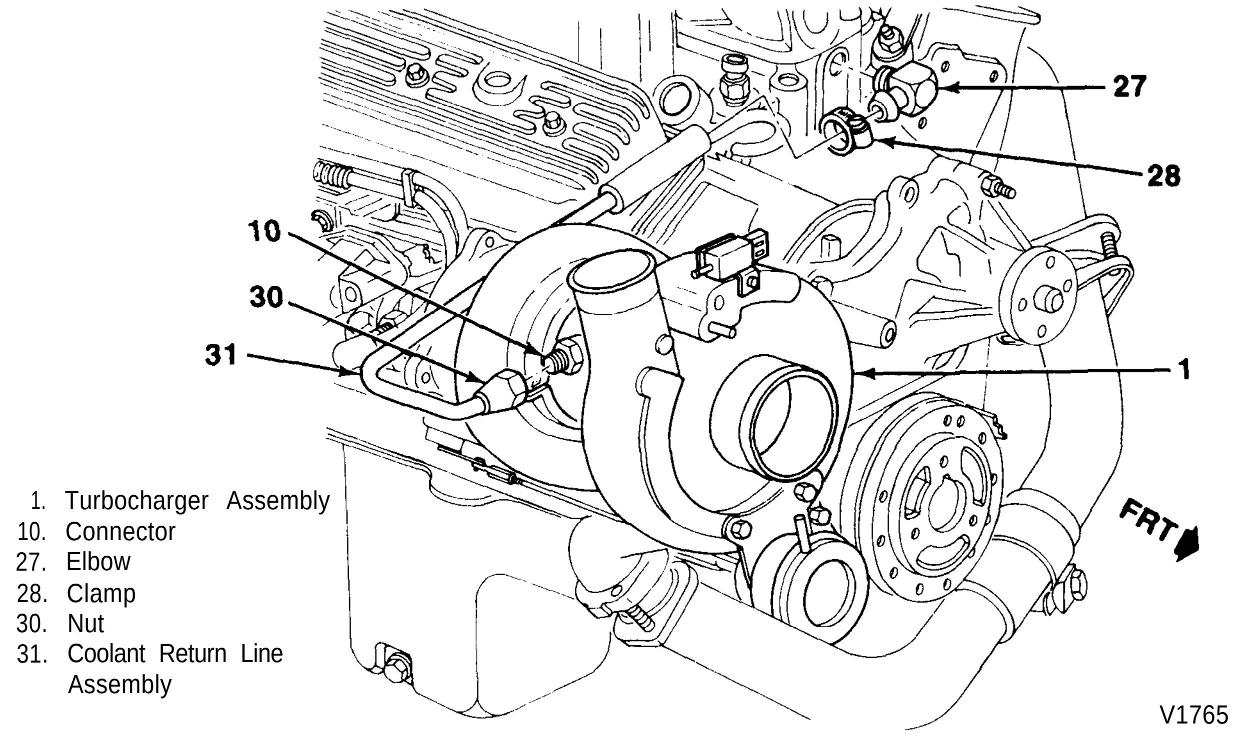
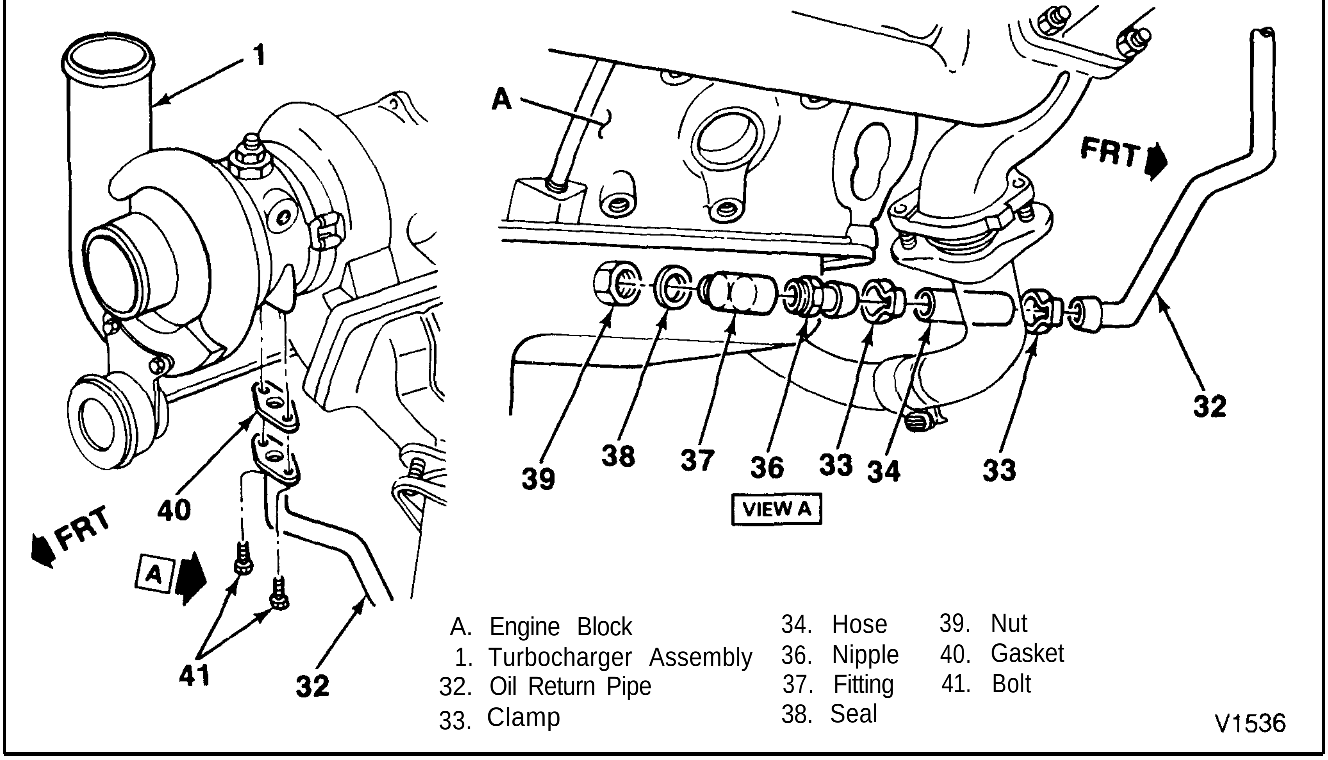
Figure 7 - Oil Feed Line Assembly



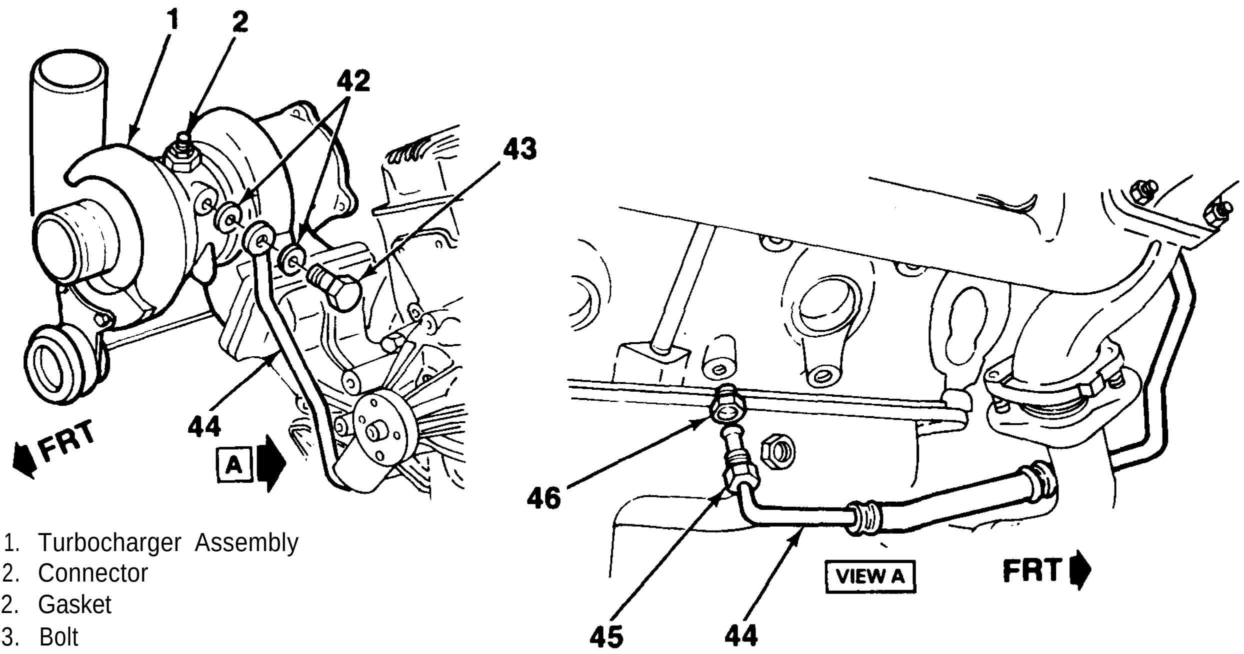
1. Turbocharger Assembly
10. Connector
27. Elbow
28. Clamp
30. Nut
31. Coolant Return Line Assembly

Figure 8 - Coolant Return Line Assembly



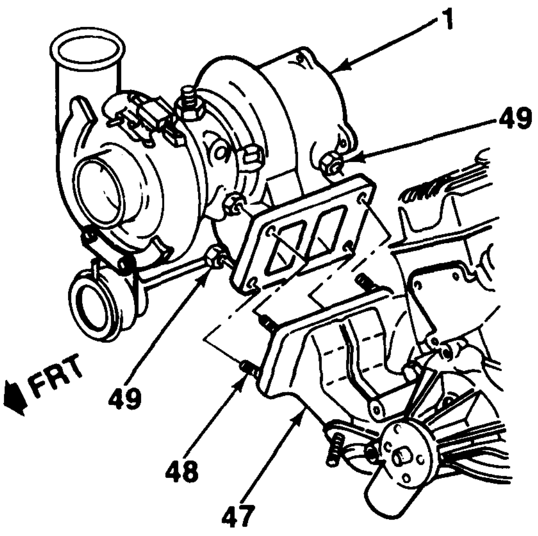
A. Engine Block
1. Turbocharger Assembly
32. Oil Return Pipe
33. Clamp
34. Hose
36. Nipple
37. Fitting
38. Seal
39. Nut
40. Gasket
41. Bolt

Figure 9 - Oil Return Line Assembly



1. Turbocharger Assembly
2. Connector
42. Gasket
43. Bolt
44. Coolant Feed Line Assembly
45. Nut
46. Connector

Figure 10 - Coolant Feed Line Assembly



1. Turbocharger Assembly
47. Manifold
48. Stud
49. Nut

Figure 11 - Removing Turbocharger Assembly

Install or Connect (Figures 1, 7, 8, 9, 10 and 11)

NOTICE: For steps 2, 3, 4, 5 and 6 see "Notice" on page 6J-1 of this section.

1. Turbocharger assembly (1) to vehicle.
2. Turbocharger coolant feed line assembly (44) by attaching bolt (43) and gaskets (42).

   Tighten

   - Coolant feed line bolt (43) to 35 N•m (26 ft. lbs.).
3. Turbocharger mounting nuts (49).

   Tighten

   - Nuts (49) to 45 N•m (33 ft. lbs.).
4. Turbocharger oil feed line (19).

   Tighten

   - Oil feed line nut (20) to 17 N•m (13 ft. lbs.).
5. Turbocharger oil return pipe (32), gasket (40) and bolts (41).

   Tighten

   - Oil return line bolts (41) to 4 N•m (35 in. lbs.)
6. Turbocharger coolant return line assembly (31).

   Tighten

   - Coolant return line nut (30) to 22 N•m (16 ft. lbs.).

- Coolant return line clamp (28) to 1.8 N•m (16 in. lbs.).

7. Turbocharger outlet pipe to turbocharger. Refer to EXHAUST (SEC. 6F) in this manual.
8. Right-hand wheelhouse panel.
9. Screws to right-hand wheelhouse panel.
10. Wheel and tire assembly. Refer to TIRES AND WHEELS (SEC. 3E) in this manual.

- Lower vehicle.

11. Electrical connector to solenoid (5).
12. Battery tray and vacuum tank. Refer to BATTERY (SEC. 6D1) in this manual.
13. Battery as described in BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.
14. Air intake duct.
15. Turbocharger air intake duct.

- Fill the radiator as described in ENGINE COOLING (SEC. 6B1) in the 1992 Service Manual Sonoma and Jimmy Models.

CHARGE AIR COOLER

Remove or Disconnect (Figure 12)

- Drain the charge air cooler radiator as explained under “Draining and Filling the Charge Air Cooler Radiator.”

1. Clamps and hoses from the charge air cooler (50).
2. Bolts (55) attaching the charge air cooler (50) to the mounting bracket.
3. Charge air cooler (50).

Install or Connect (Figure 12)

1. Charge air cooler (50) to mounting bracket.
2. Bolts (55) attaching charge air cooler (50) to the mounting bracket.
3. Clamps and hoses to the charge air cooler (50).

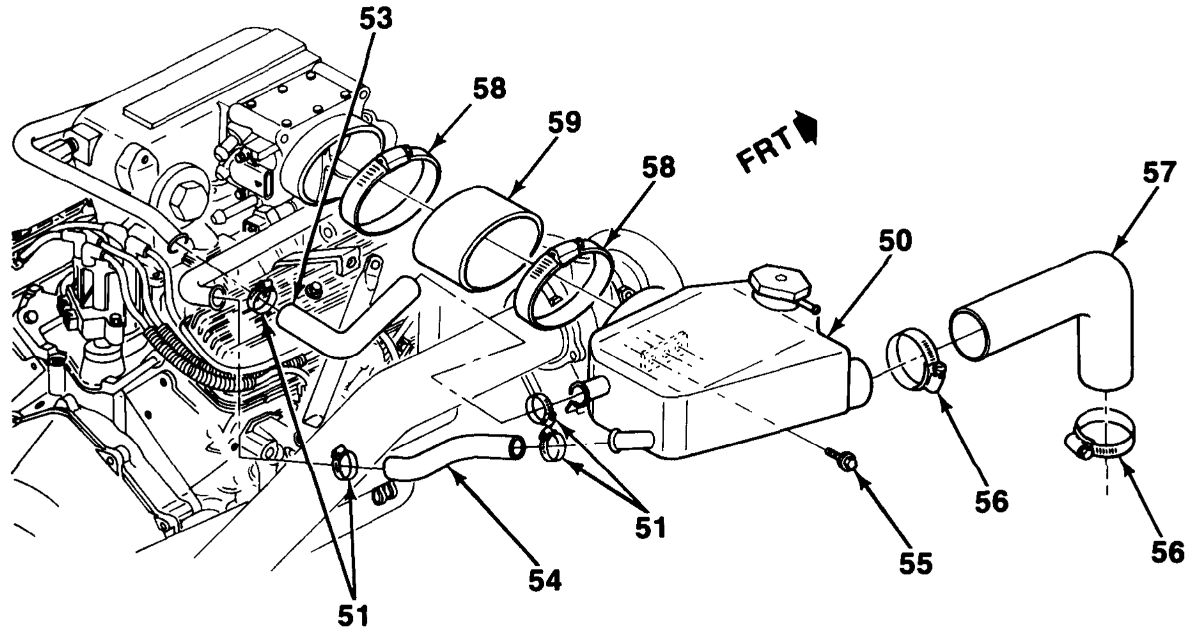
- Fill the charge air cooler radiator through the charge air cooler as explained under “Draining and Filling the Charge Air Cooler Radiator.”

CHARGE AIR COOLER RADIATOR

Remove or Disconnect (Figure 13)

- Drain the charge air cooler radiator as explained under “Draining and Filling the Charge Air Cooler Radiator.”
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Air deflector shield from studs on bottom of bracket (63).
2. Electrical connectors (65 and 66).
3. Clamps and hoses from the charge air cooler radiator (64) and charge air cooler pump (67).



50. Charge Air Cooler
51. Clamp
53. Hose
54. Hose
55. Bolt
56. Clamp
57. Hose
58. Clamp
59. Hose

Figure 12 - Charge Air Cooler

4. Bolts (60) and washers (61) from bracket (63).
5. Charge air cooler radiator (64) and bracket (63) from truck.
6. Charge air cooler radiator (64) from bracket (63) by removing 4 bolts (62).

Install or Connect (Figure 13)

1. Charge air cooler radiator (64) to bracket (63) by installing 4 bolts (62).
2. Charge air cooler radiator (64) and bracket (63) to truck.
3. Bolts (60) and washers (61) to bracket (63).
4. Hoses and clamps to charge air cooler radiator (64) and charge air cooler pump (67).
5. Electrical connectors (65 and 66).
6. Air deflector shield to studs on bottom of bracket (63).

- Fill the charge air cooler radiator with a 56/44 mixture of antifreeze and distilled water as explained under “Draining and Filling the Charge Air Cooler Radiator.”
- Bleed the system as explained under “Bleeding the Charge Air Cooling System.”
- Lower vehicle.

CHARGE AIR COOLER PUMP

Remove or Disconnect (Figure 13)

1. Charge air cooler radiator as explained previously in this section.
2. Bolts attaching charge air cooler pump (67) to charge air cooler radiator bracket (63).
3. Charge air cooler pump (67) from charge air cooler radiator bracket (63).

Install or Connect (Figure 13)

1. Charge air cooler pump (67) to charge air cooler radiator bracket (63).
2. Bolts attaching charge air cooler pump (67) to charge air cooler radiator bracket (63).
3. Charge air cooler radiator as explained previously in this section.

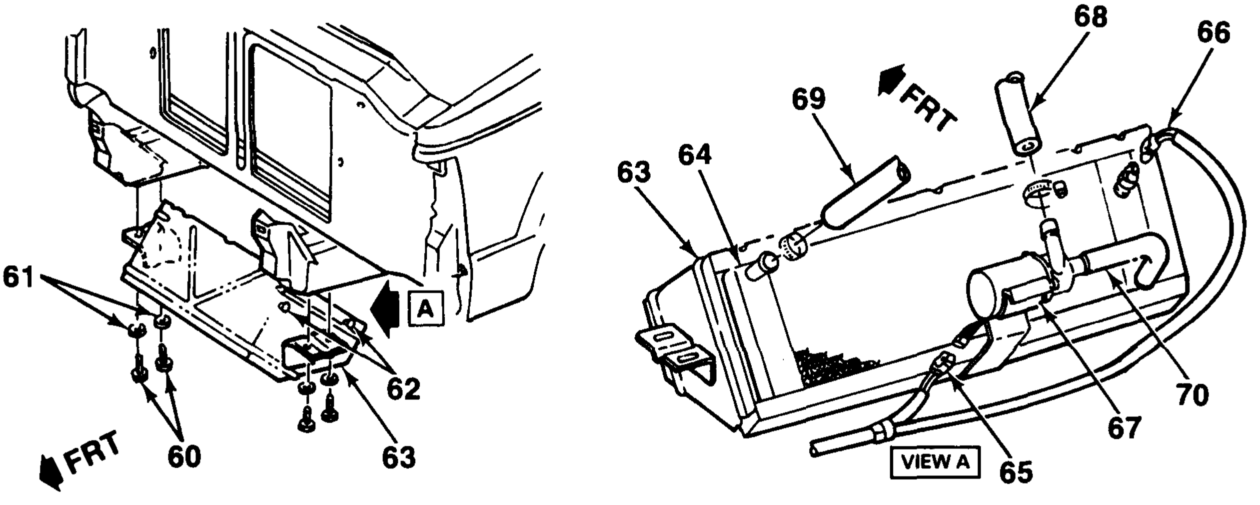
DRAINING AND FILLING THE CHARGE AIR COOLER RADIATOR

Draining

1. Remove charge air cooler pressure cap.
2. Place a drain pan under the left side of the charge air cooler radiator.
3. Open petcock on the lower left side of the charge air cooler radiator.
4. Allow coolant to drain completely.

Filling

1. Premix coolant with a 56/44 mixture of antifreeze and distilled water.
2. Close petcock.



60. Bolt
61. Washer
62. Bolt
63. Bracket
64. Charge Air Cooler Radiator
65. Electrical Connector
66. Electrical Connector
67. Charge Air Cooler Pump
68. Inlet Hose
69. Outlet Hose
70. Hose

Figure 13 - Charge Air Cooler Radiator

3. Fill the charge air cooler radiator through the charge air cooler.
4. Bleed the charge air cooler as explained later in this section.

BLEEDING THE CHARGE AIR COOLING SYSTEM

1. Open petcock on the charge air cooler radiator.
2. Fill the charge air cooler with a 56/44 mixture of anti-freeze and distilled water.
3. When coolant flows out of the drain hole, close the petcock.
4. Add coolant mixture to charge air cooler until full.
5. Remove charge air cooler pump relay, located near coil assembly.
6. Turn ignition key to "ON."
7. Position a jumper wire between the A and B terminals to run charge air cooler pump.
8. Add coolant mixture to the system while the pump is funning, until system is full.
9. Install charge air cooler pressure cap.

CHARGE AIR COOLER RADIATOR PRESSURE TEST

Tool Required:

J 24466-01 Cooling System Tester

1. With the system at a cool temperature, remove the charge air cooler cap and connect the gage.

NOTICE: Do not apply more than 89 kPa (13 psi) of pressure or damage to the radiator may result.

2. Apply normal system operating pressure of 56 to 68 kPa (8 to 10 psi).
3. Watch the gage needle for a decrease in pressure, indicating a leak, and examine the radiator and other cooling system parts for escaping coolant.
   - Repair hose and hose connections as required.
   - Replace radiator if a leak is found.
4. Repeat pressure test after repairs or replacement.

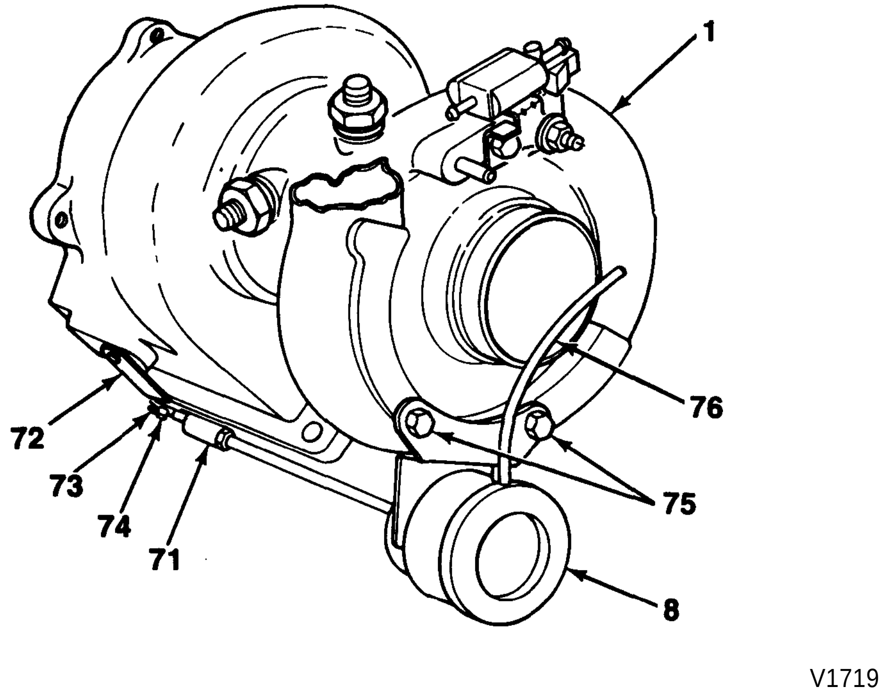
WASTEGATE ACTUATOR ADJUSTMENT CHECK

Remove or Disconnect (Figures 14 and 15)

1. Passenger side wheelhouse panel.
2. Rod end (71) from lever (72).
3. Retaining wire (73) and the rod end (71) from pin (74).
   - Move lever (72) to closed position.
   - Align hole in rod end (71) over pin (74).

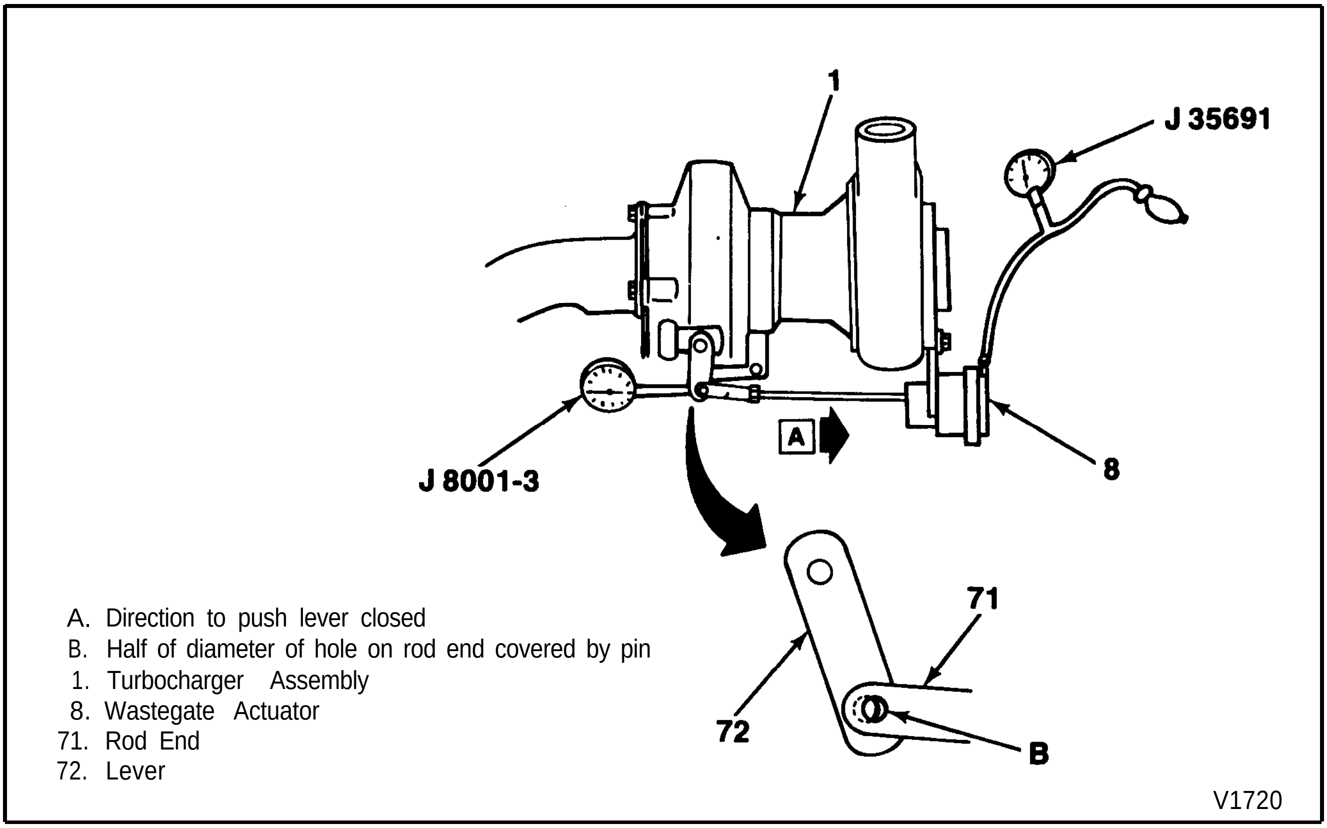
Inspect (Figures 14 and 15)

- Rod end hole to position of pin (74). If hole in rod end (71) appears one-half hole diameter too short for pin (74) to fit in hole, initial setting is correct. If setting is not correct, adjust to one-halt hole diameter short of pin (74) as explained under "Wastegate Actuator Adjustment."



1. Turbocharger Assembly
8. Wastegate Actuator
71. Rod End
72. Lever
73. Retaining Wire
74. Pin
75. Bolt
76. Hose

Figure 14 - Wastegate Actuator Assembly



A. Direction to push lever closed
B. Half of diameter of hole on rod end covered by pin
1. Turbocharger Assembly
8. Wastegate Actuator
71. Rod End
72. Lever

Figure 15 - Wastegate Actuator Adjustment

Install or Connect (Figure 14)

1. Rod end (71) to pin (74) and attach retaining wire (73) to pin (74).
2. Passenger side wheelhouse panel.

WASTEGATE ACTUATOR ADJUSTMENT

Important

- Do not attempt to adjust the wastegate actuator outside the range of the specifications in this procedure. Improper adjustment can severely limit performance or cause overboost, resulting in fuel shut off.

Remove or Disconnect (Figures 14 and 15)

Tools Required:

J 35691 Turbocharger Pressure Gage
J 8001-3 Dial Indicator, Part of J 8001
Dial Indicator Set

1. Passenger side wheelhouse panel.
2. Retaining wire (73) from pin (74).
3. Boost control hose (76) from wastegate actuator (6).

Install or Connect

1. J 35691 to hose connection on wastegate actuator (8), making sure dial reads zero.
2. J 8001-3 on end of lever (72), making sure dial reads zero.

Measure

- Apply 31 to 34.5 kPa (4.5 to 5 psi) air pressure with J 35691 and check J 8001-3.

Adjust

- If J 8001-3 reads greater than 0.5 mm to 1.5 mm (0.02 to 0.06 inch), readjust rod by shortening it a half-turn at rod end (71). If J 8001-3 reads less than 0.5 mm to 1.5 mm (0.02 to 0.06 inch), readjust rod by lengthening it a half-turn at rod end (71).

Measure

- Recheck travel at 31 to 34.5 kPa (4.5 to 5 psi) air pressure.

Adjust

- Repeat adjustment until specifications above are met. If specifications can not be met, replace wastegate actuator.
- If adjustment causes wastegate to open at all, replace wastegate actuator.
- Remove tools J 8001-3 and J 35691.

Install or Connect (Figure 14)

1. Boost control hose (76) to wastegate actuator (8).
2. Retaining wire (73) to pin (74).
3. Passenger side wheelhouse panel.

WASTEGATE ACTUATOR REPLACEMENT

Remove or Disconnect (Figure 14)

1. Passenger side wheelhouse panel.
2. Retaining wire (73) from pin (74).
3. Rod end (71) from pin (74).
4. Hose (76) from wastegate actuator (8).
5. Bolts (75).
6. Wastegate actuator (8).

Install or Connect (Figure 14)

1. Wastegate actuator (6) to turbocharger assembly (1).
2. Bolts (75).
3. Hose (76) to wastegate actuator (8).
4. Rod end (71) to pin (74).
5. Retaining wire (73) to pin (74).
6. Passenger side wheelhouse panel.

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Turbocharger-to-Manifold Mounting Nuts	45	33	-
Coolant Return Line Clamp	1.8	-	16
Coolant Feed Line Bolt	35	26	-
Turbocharger Oil Return Line Bolt	4.0	-	35

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FITTING TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.
Turbocharger Coolant Feed Line Connector	22	16
Turbocharger Oil Feed Line Nut	17	13
Turbocharger Coolant Return Line Connector	22	16

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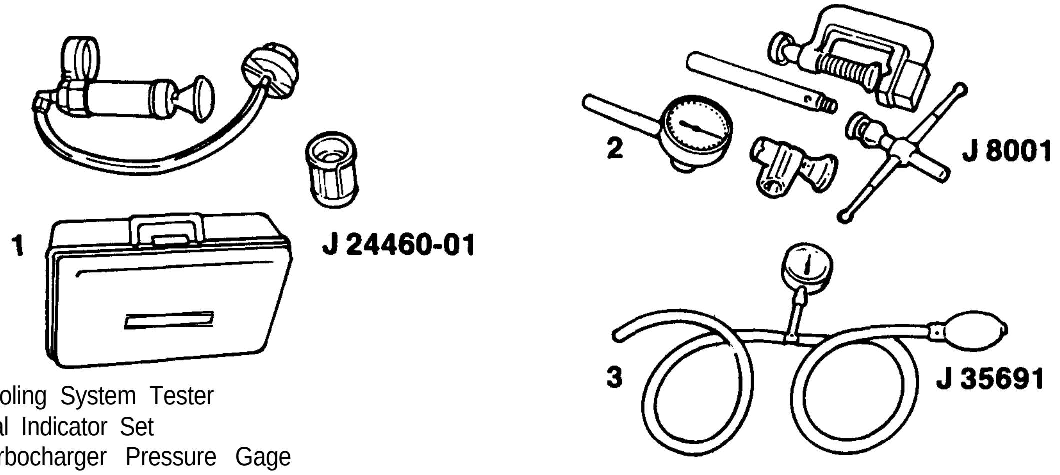
SPECIAL TOOLS



1. Cooling System Tester
2. Dial Indicator Set
3. Turbocharger Pressure Gage

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SECTION 7A1

4L60 AUTOMATIC TRANSMISSION

NOTICE: When fasteners are removed, a/ways reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

DIAGNOSIS

ROAD TEST PROCEDURE

For shift speed chart refer to figure 1.

1992 HYDRA-MATIC 4L60 SHIFT SPEED CHART

MODEL	1-2 MIN THROTTLE	2-3 MIN THROTTLE	3-4 MIN THROTTLE	1-2 W.O.T.	4-3 COAST DOWN	3-2 COAST DOWN	2-1 COAST DOWN
2LHM	12-14	21-26	48-53	25-29.5	35-47	13-21	8-10

NOTES:
1. ALL SPEEDS INDICATED ARE IN MILES PER HOUR. CONVERSION TO km/h = MPH x 1.609.
2. SHIFT POINTS WILL VARY SLIGHTLY DUE TO ENGINE LOADS AND VEHICLE OPTIONS.
3. SPEEDS LISTED WITH + EXCEED 65 MPH.

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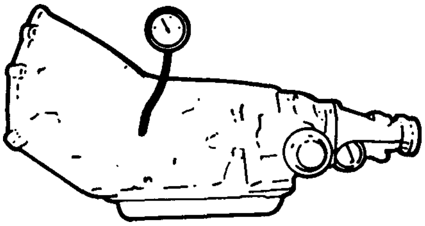
Figure 1 - Shift Speed Chart

PRELIMINARY CHECK PROCEDURE

PRELIMINARY CHECK PROCEDURE

- **CHECK TRANSMISSION FLUID LEVEL**
- **CHECK AND ADJUST T.V. CABLE**
- **CHECK OUTSIDE MANUAL LINKAGE AND CORRECT**
- **CHECK ENGINE TUNE**
- **INSTALL PRESSURE GAGE**
- **CONNECT TACHOMETER TO ENGINE**
- **CHECK PRESSURE AS FOLLOWS:**



(A) ATTACH PRESSURE GAUGE

Minimum T.V. Line Pressure Check

Set the T.V. cable to specification; and with the brakes applied, take the line pressure readings in the ranges and at the engine r.p.m. indicated in the chart below.

Full T.V. Line Pressure Check

Full T.V. line pressure readings are obtained by tying or holding the T.V. cable to the full extent of its travel; and with the brakes applied, take the line pressure readings in the ranges and at the engine r.p.m. indicated in the chart below.

***NOTICE** Total running time for this combination not to exceed 2 minutes.

CAUTION Brakes must be applied at all times.

1992 HYDRA-MATIC 4L60 TRANSMISSION PRESSURES

RANGE	MODEL	NORMAL PRESSURE AT MINIMUM T.V.		NORMAL PRESSURE AT FULL T.V.	
		kPa	PSI	kPa	PSI
PARK NEUTRAL OVERDRIVE & MANUAL 3RD @ 1000 RPM	2LHM	518- 587	75- 85	1332- 1766	193- 256
REVERSE @ 1000 RPM	2LHM	665- 754	96- 109	1710- 2268	248- 329
MANUAL 2ND & MANUAL LO @ 1000 RPM	2LHM	1293- 1465	188- 212	1293- 1465	188- 212

Line pressure is basically controlled by pump output and the pressure regulator valve. In addition, line pressure is boosted in Reverse, Second and Lo by the reverse boost valve.

Also, in the Neutral, Drive, Intermediate and Reverse positions of the selector lever, the line pressure should increase with throttle opening because of the T.V. system. The pressure is controlled by the T.V. cable, the throttle lever and bracket assembly and the T.V. link, as well as the control valve assembly.

The main line pressure tap plug is located on the left side of the transmission above the outside manual lever.

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Figure 2 - Preliminary Check Procedure

ELECTRICAL WIRING DIAGRAM

For electrical wiring diagram refer to figure 3.

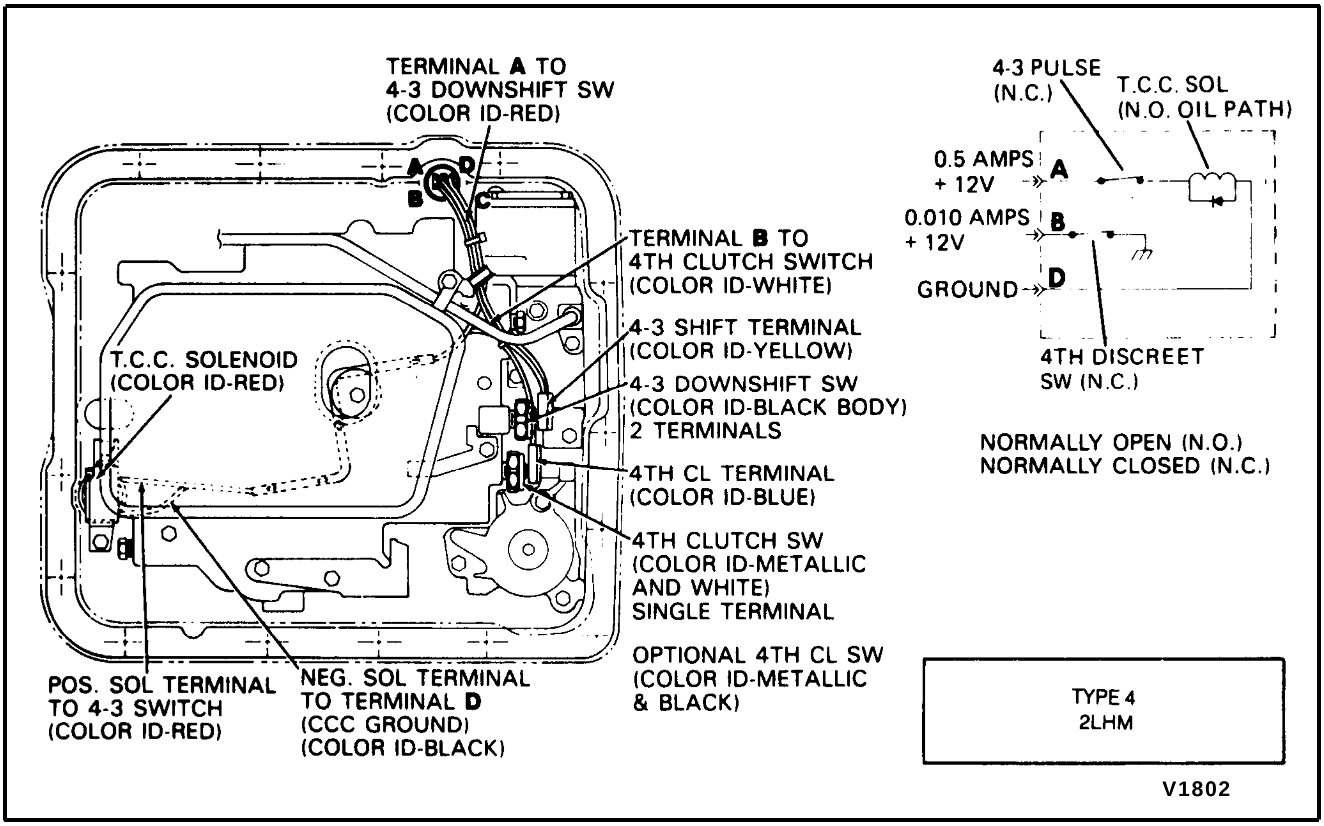


Figure 3 - Wiring Diagram - Type 4

ON-VEHICLE SERVICE

FLYWHEEL AND TORQUE CONVERTER VIBRATION TEST

SYCLONE AND TYPHOON

For on-vehicle service procedures, refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models. The front propeller shaft must be removed before the service procedure can be performed. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.

TV CABLE

SYCLONE AND TYPHOON

For on-vehicle service procedures, refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models without removing the air cleaner or the flat washer.

GOVERNOR

SYCLONE AND TYPHOON

For on-vehicle service procedures, refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in the 1992 Service Manual Sonoma and Jimmy Models after removing the front propeller shaft (refer to PROPELLER SHAFT [SEC. 4A] in this manual).

2-4 SERVO

SYCLONE AND TYPHOON

For 2nd apply piston and housing dimensions refer to figure 4.

OIL FILLER TUBE REPLACEMENT

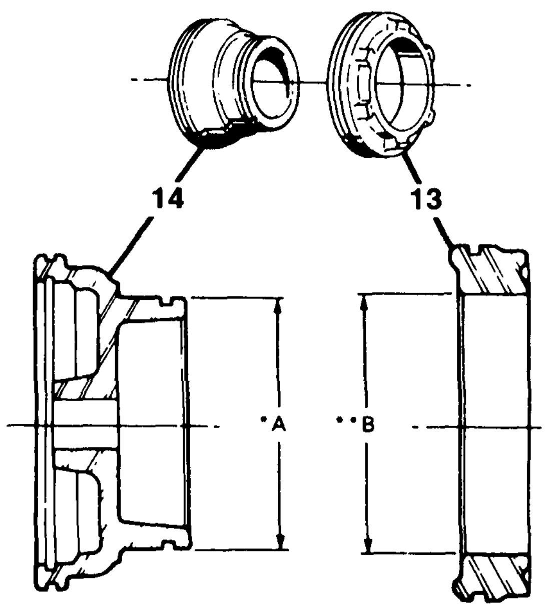
SYCLONE AND TYPHOON

↔ Remove or Disconnect (Figure 5)

1. Negative (-) battery cable.
2. Indicator (1).
3. Bolt (2) from the tube bracket (4) removing clip (3).
   - Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
4. Oil filler tube (5) from the transmission (35).
   - Pull oil filler tube (5) up from the transmission (35).

2ND APPLY PISTON & HOUSING APPLICATION

MODEL	PISTON DIMENSION *A	HOUSING DIMENSION **B
2LHM	57.85 mm (2.28″)	58.74 mm (2.31″)



13. Inner Servo Piston Housing
14. 2nd Apply Piston

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Figure 4 - 2nd Apply Piston and Housing Dimensions

5. Oil filler tube seal (6) from the oil filler tube (5).

Clean

- Metal parts using solvent. Do not allow solvent to enter the transmission (35). Air dry.

Install or Connect (Figure 5)

1. New oil filler tube seal (6) into the transmission (35).
2. Oil filler tube (5) into the oil filler tube seal (6).
3. Tube bracket bolt (2) through clip (3) and into bracket (4).

Tighten

- Bolt (2) to 47 N•m (35 ft. lbs.).

- Lower the vehicle.

4. Indicator (1).
5. Negative (-) battery cable.

SHIFT CONTROLS AND LINKAGE

SHIFT CONTROL CABLE

Remove or Disconnect (Figure 6)

1. Negative (-) battery cable.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Note routing of shift control cable (10).
2. Clip (7) and cotter pin (8), disconnecting shift control cable (10) from transmission (35).
- Lower vehicle.
3. Console assembly. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
4. Nuts (9) at floor panel.
5. Shift control cable (10) at floorshift control (17).
    - Remove clip (33) from floorshift control (17).
    - Remove retainer (34) and lift out shift control cable (10).
- Pull shift control cable (10) through hole in floor panel.

Install or Connect (Figure 6)

- Position shift control cable (10) through floor panel.

NOTICE: See "Notice" on page 7A1-1 of this section.

1. Nuts (9) at floor panel.

Tighten

- Nuts (9) to 4.5 N•m (40 in. lbs.).

2. Shift control cable (10).
    - Position shift control cable (10) into bracket at floorshift control (17) and install retainer (34) to secure.
    - Install clip (33).
3. Console assembly. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
- Place control lever in "NEUTRAL."
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Direct shift control cable (10) under fuel lines (49), vehicle speed sensor harness (46), and brace (61), if necessary, and through the cable retainer guide (59).
4. Clip (7) and cotter pin (8) connecting shift control cable (10) to transmission (35).

Adjust

1. Loosen cable attachment at shift lever.
2. Rotate shift lever clockwise to park detent and then back to "NEUTRAL."

Tighten

- Cable attachment to 20 N•m (15 ft. lbs.).

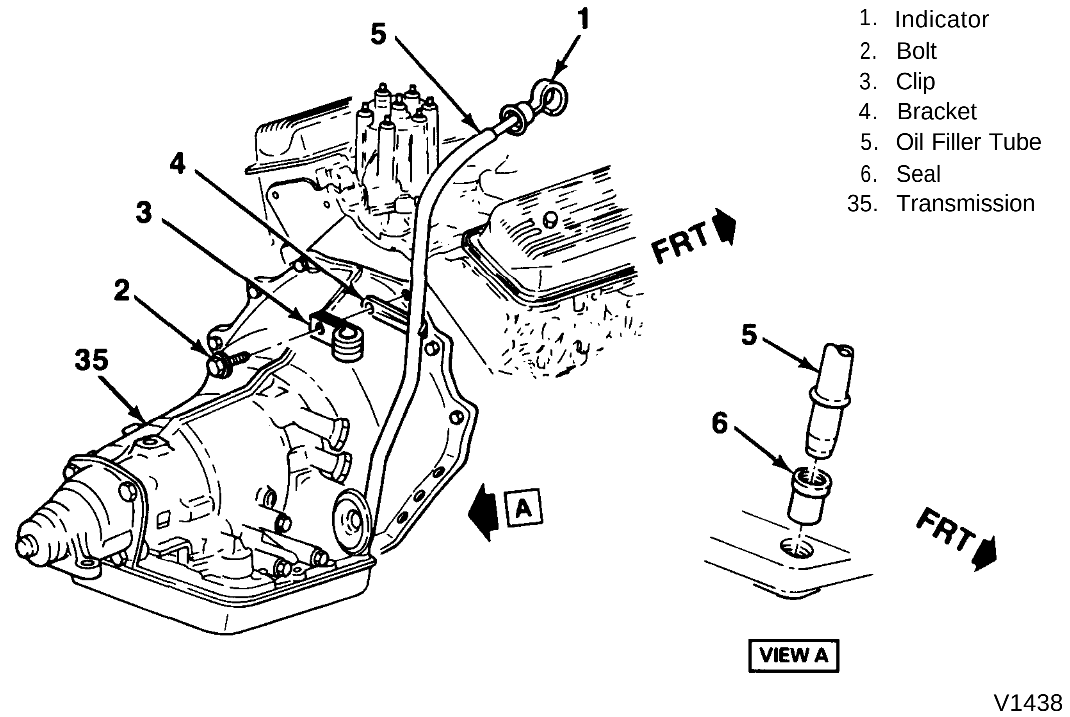


Figure 5 - Oil Filler Tube Replacement (Syclone and Typhoon)

Important

- Lever must be held out of "PARK" when tightening nut.

3. Lower vehicle.
4. Check shift control cable (10) adjustment by rotating control lever through the detents.
5. Connect negative (-) battery cable.

FLOORSHIFT CONTROL

Remove or Disconnect (Figure 7)

1. Negative (-) battery cable.
2. Shift knob and console assembly. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
3. Neutral start/backup lamp switch as explained later in this section.
4. Shift control cable as explained previously in this section.
5. Park/lock cable as explained later in this section.
6. Floorshift control (17) and screws (16).

Install or Connect (Figure 7)

NOTICE: See "Notice" on page 7A1-1 of this section.

1. Floorshift control (17) and screws (16).

Tighten

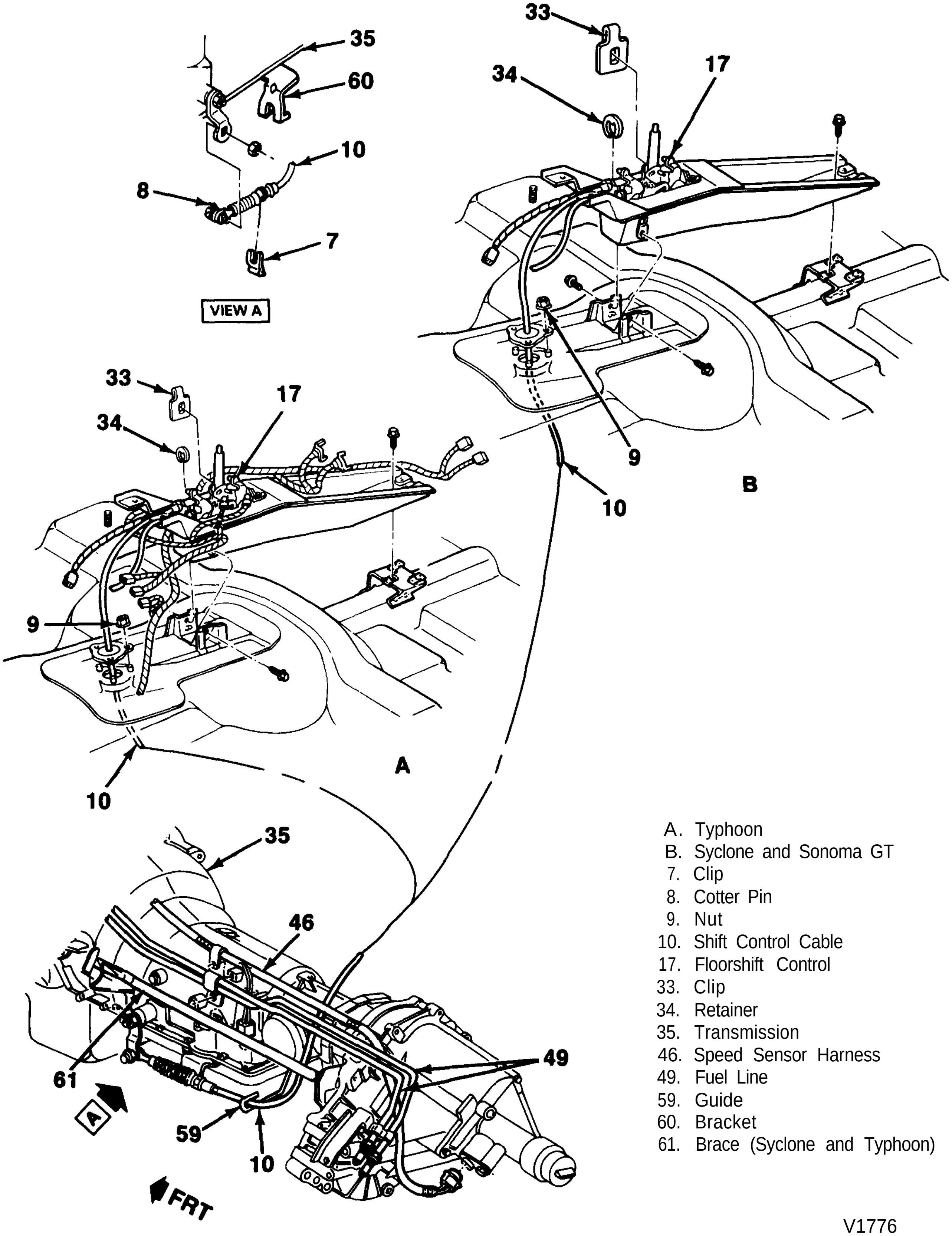
- Floorshift control screws (16) to 10 N•m (69 in. lbs.).

2. Park/lock cable as explained later in this section.
3. Shift control cable as explained previously in this section.
4. Neutral start/backup lamp switch as explained later in this section.
5. Console assembly and shift knob. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
6. Negative (-) battery cable.

PARK/LOCK CONTROL CABLE

Remove or Disconnect (Figure 6)

1. Negative (-) battery cable.
   - Put transmission in "PARK."
   - Turn ignition key to "RUN" position.
   - Do not attempt to proceed to next step with key in any other position.
2. Console. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
3. Parking brake handle as described in HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.
4. Steering column lower filler panel by removing screws.
5. ALDL connector by removing screws.



A.	Typhoon
B.	Syclone and Sonoma GT
7.	Clip
8.	Cotter Pin
9.	Nut
10.	Shift Control Cable
17.	Floorshift Control
33.	Clip
34.	Retainer
35.	Transmission
46.	Speed Sensor Harness
49.	Fuel Line
59.	Guide
60.	Bracket
61.	Brace (Syclone and Typhoon)

Figure 6 - Shift Control Cable Attachments

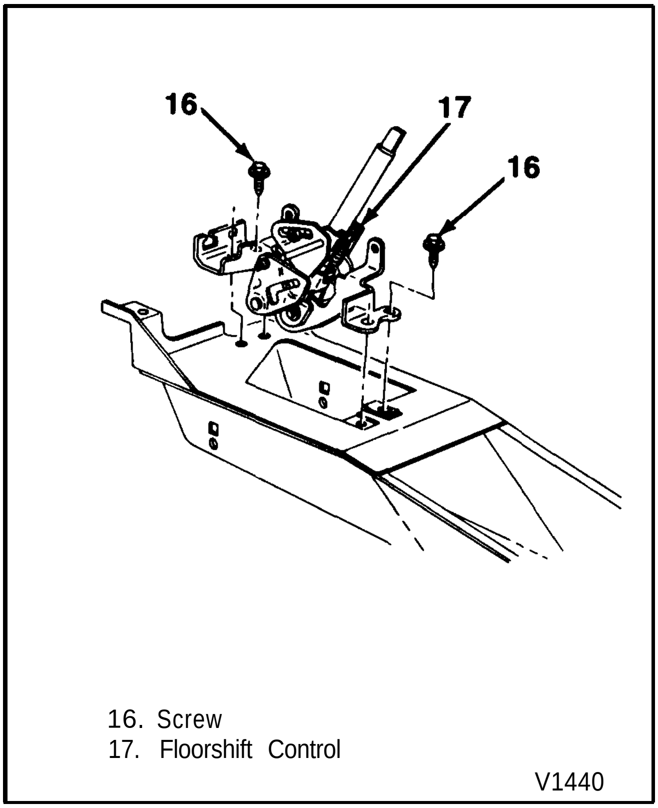


Figure 7 - Floorshift Control

6. Fog lamp relay as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.
- Lower steering column by removing nuts.
7. Park/lock cable (19) from steering column switch (22) by slipping a screwdriver blade into the slot provided in the steering column switch (22) and depressing the cable latch.
- Pull cable connector lock button (24) at the shifter base to the "UP" position.
6. Park/lock cable (19) from park/lock lever (20) by removing clip (16).
- Depress cable connector latches (31) and lift cable connector (23) out of shifter base.
9. Sill plate by removing screws.
10. Left-hand kick panel by removing screws.
11. Left-hand sound insulator panel by removing screws.
12. Floor heater outlet by removing screws.
- Pull back carpet to expose park/lock cable (19).
13. Park/lock cable (19) from vehicle.

Install or Connect (Figure 8)

NOTICE: For steps 3, 4, 5, 6, 8 and 9 see "Notice" on page 7A1-1 of this section.

- Snap cable connector (23) into shifter base.

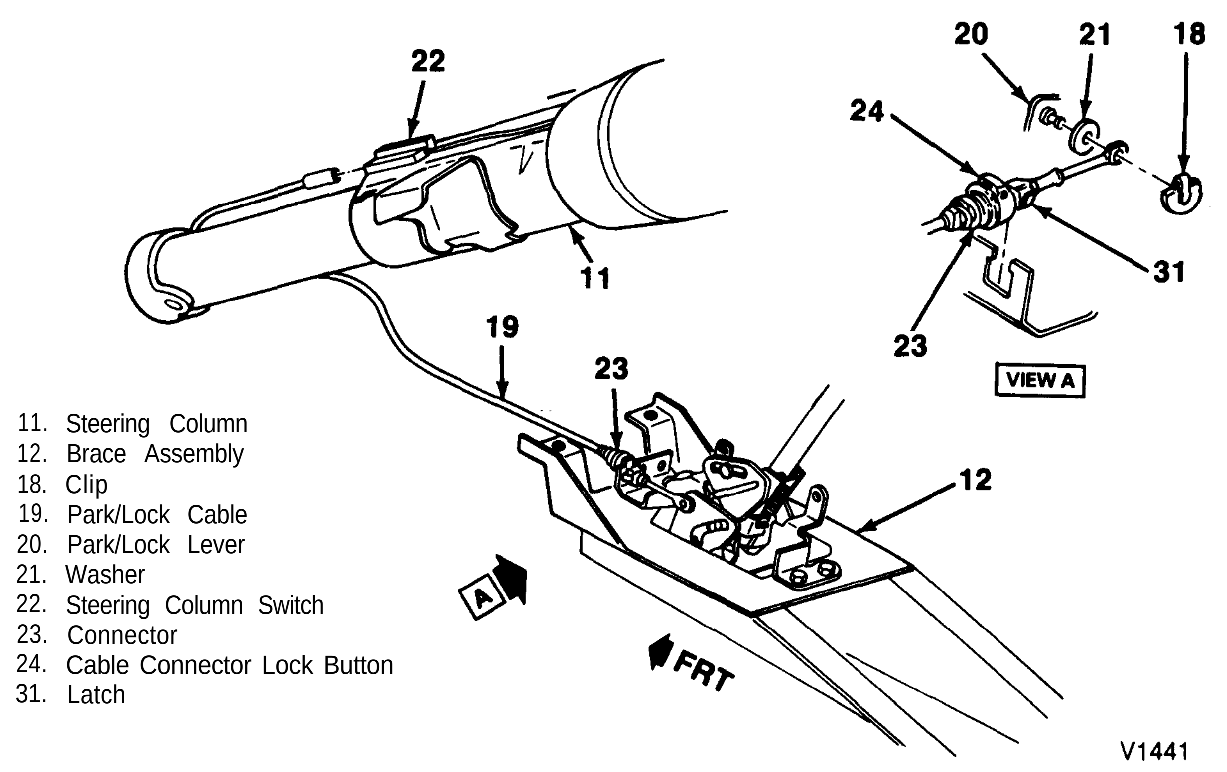
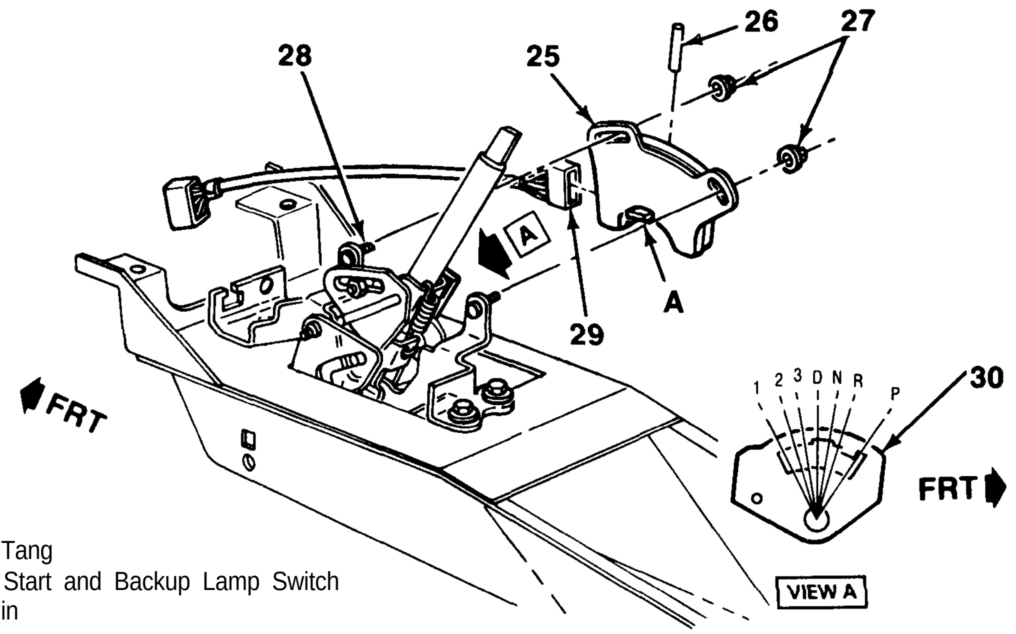


Figure 8 - Park/Lock Control Cable



A. Carrier Tang
25. Neutral Start and Backup Lamp Switch
26. Gage Pin
27. Nut
28. Mounting Stud
29. Electrical Connector
30. Detent Plate

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Figure 9 - Neutral Start and Backup Lamp Switch

1. Park/lock cable (19) to park/lock lever (20) by installing clip (16).
- Push cable connector lock button (24) at the shifter base to the “DOWN” position.
2. Park/lock cable (19) to steering column switch (22) by snapping in.
- Reposition carpet.
3. Floor heater outlet by installing screws.
4. Left-hand sound insulator panel by installing screws.
5. Left-hand kick panel by installing screws.
6. Sill plate by installing screws.
- Raise steering column and install nuts.
7. Fog lamp relay as described in LIGHTING SYSTEMS (SEC. 8B) in the 1992 Service Manual Sonoma and Jimmy Models.
8. ALDL connector by installing screws.
9. Steering column lower filler panel by installing screws.
10. Parking brake handle as described in HYDRAULIC BRAKES (SEC. 5A) in the 1992 Service Manual Sonoma and Jimmy Models.
11. Console. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
12. Negative (-) battery cable.

NEUTRAL START AND BACKUP LAMP SWITCH

Remove or Disconnect (Figure 9)

1. Negative (-) battery cable.
2. Console. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
3. Nuts (27).
- Disconnect electrical connector (29).
4. Neutral start and backup lamp switch (25).
5. Gage pin (26).

Using New Switch

Install or Connect (Figure 9)

- Place shift control lever in “NEUTRAL.”
1. Carrier tang on neutral start and backup lamp switch (25) in slot on shifter.
   - Connect electrical connector (29).

NOTICE: See “Notice” on page 7A1-1 of this section.

2. Nuts (27).

Tighten

- Nuts (27) to 3.4 N•m (30 in. lbs.).

Important

- If holes do not align with shift control, verify shift control lever is in “NEUTRAL.” Do not rotate switch. Switch is pinned in “NEUTRAL.”
- If switch has been rotated and the pin is broken, switch can be adjusted by using the “Using Old Switch” procedure.

- Move shift control lever out of "NEUTRAL" to shear plastic pin.

3. Gage pin (26).
4. Console. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
5. Negative (-) battery cable.

Important

- After switch installation, verify that engine will only start in "PARK" or "NEUTRAL." If engine will start in any other position, readjust neutral start and backup lamp switch (25) using "Using Old Switch" procedure.

Using Old Switch

Install or Connect (Figure 9)

- Place shift control lever in "NEUTRAL."

1. Carrier tang on neutral start and backup lamp switch (25) with tang slot on shift control.
    - Connect electrical connector (29).
2. Nuts (27) to shift control, loosely.

- Rotate neutral start and backup lamp switch (25) to align service adjustment hole with carrier tang hole.

NOTICE: See "Notice" on page 7A1-7 of this section.

3. Gage pin (26) 2.34 mm (0.09 in.) in service adjustment hole and rotate neutral start and backup lamp switch (25) until gage pin (26) drops in to a depth of 15 mm (0.59 in.).

Tighten

- Nuts (27) to 3.4 N•m (30 in. lbs.).

4. Console. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
5. Negative (-) battery cable.

Important

- After neutral start and backup lamp switch adjustment, verify that engine will only start in "PARK" or "NEUTRAL." If engine will start in any other position, readjust neutral start and backup lamp switch (25).

TRANSMISSION REPLACEMENT

SYCLONE AND TYPHOON

Remove or Disconnect (Figures 10 and 11)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Transfer case. Refer to TRANSFER CASE (SEC. 7D) in this manual.
2. Converter cover (36) by removing converter cover screws (37) and converter cover bolts (32) (figure 10).
3. Shift control cable as explained previously in this section.
4. Fuel lines (49) and speed sensor harness (46) by removing bolt (44) and clip.
5. TV cable as explained previously in this section.
6. Oil cooler lines (48) by removing nuts (47).
7. Vent hose (45) by removing straps (43) and pulling vent hose (45) through clip (50).
8. Oil filler tube as explained previously in this section.
9. Bracket (41) by removing nuts (40) and studs (38) from transmission (35).
10. Transmission (35) by removing bolts (39).

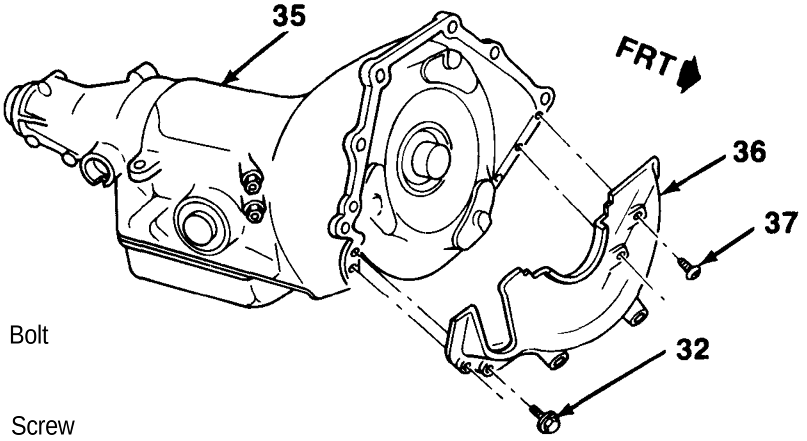
Install or Connect (Figures 10 and 11)

NOTICE: For steps 1, 2, 5, 7 and 9 see "Notice" on page 7A1-1 of this section.

1. Transmission (35) by installing bolts (39).

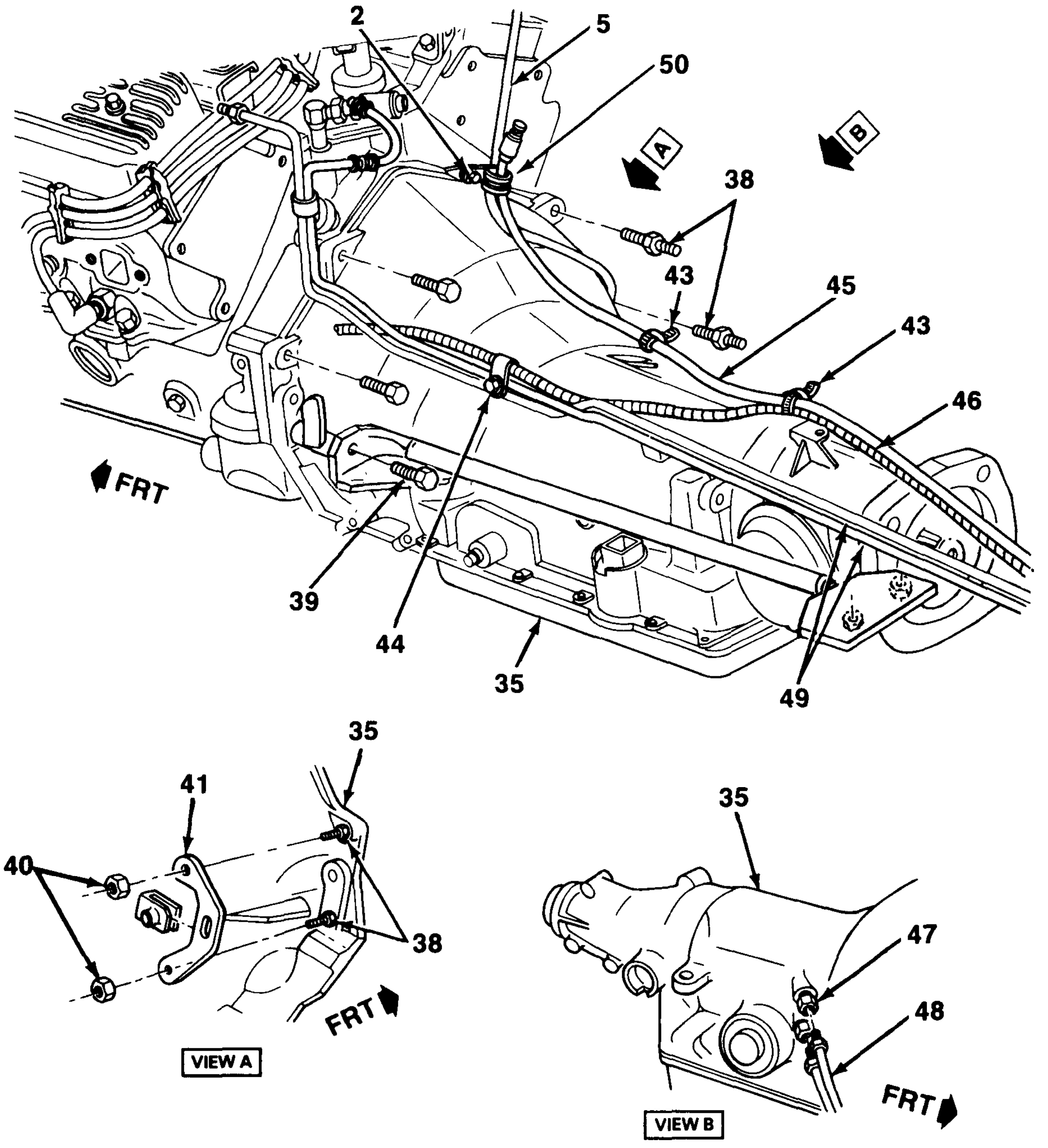
Tighten

- Bolts (39) to 47 N•m (35 ft. lbs.).



32. Converter Cover Bolt
35. Transmission
36. Converter Cover
37. Converter Cover Screw

Figure 10 - converter Cover (Syclone and Typhoon)



2. Bolt	43. Strap
5. Oil Filler Tube	44. Bolt
35. Transmission	45. Vent Hose
38. Stud	46. Speed Sensor Harness
39. Bolt	47. Nut
40. Nut	48. Oil Cooler Line
41. Bracket	49. Fuel Line
	50. Clip

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Figure 11 - Transmission and Components (Syclone and Typhoon)

2. Bracket (41).
   - Install studs (38) through transmission (35) to engine.

   Tighten
     - Studs (38) to 47 N•m (35 ft. lbs.).
   - Install bracket (41) over studs (38) and install nuts (40) over bracket (41).

   Tighten
     - Nuts (40) to 30 N•m (22 ft. lbs.).
3. Oil filler tube as explained previously in this section.
4. Vent hose (45).
   - Pull vent hose (45) through clip (50).
   - Install straps (43).
5. Oil cooler lines (48) to transmission (35) by installing nuts (47).

   Tighten
   - Nuts (47) to 22 N•m (16 ft. lbs.).
6. TV cable as explained earlier in this section.
7. Fuel lines (49) and speed sensor harness (46) by installing bolt (44) through clip to transmission (35).
   - Be sure speed sensor harness (46) is routed through rear strap (43) with vent hose (45).

   Tighten
   - Bolt (44) to 6.5 N•m (58 in. lbs.).
8. Shift control cable as explained earlier in this section.
9. Converter cover (36) by installing converter cover bolts (32) and converter cover screws (37).

   Tighten
   - Converter cover bolts (32) and converter cover screws (37) to 47 N•m (35 ft. lbs.).
10. Transfer case. Refer to TRANSFER CASE (SEC. 7D) in this manual.

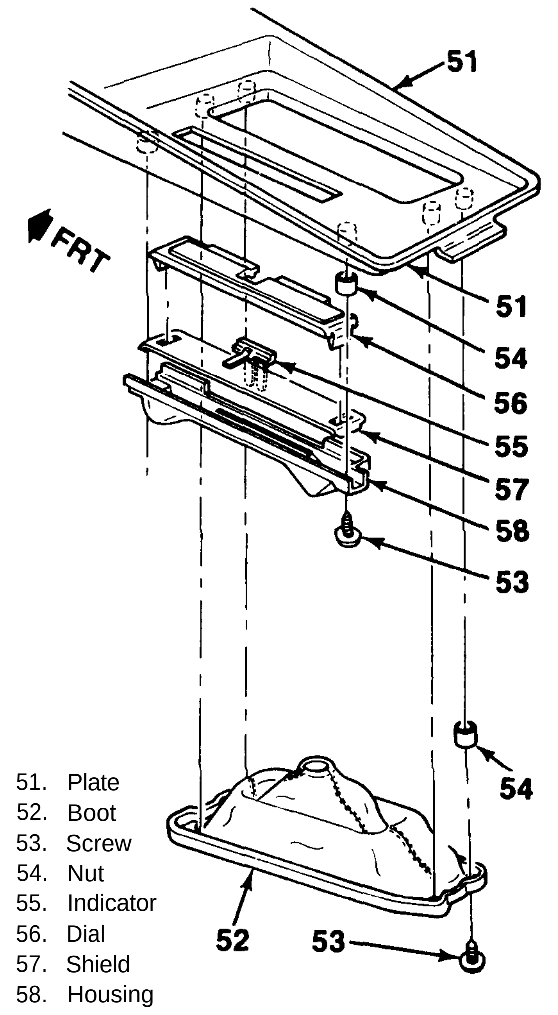
- Lower vehicle.

ACCUMULATOR ASSEMBLY

MODEL	1-2 ACCUMULATOR SPRING COLOR	3-4 ACCUMULATOR SPRING COLOR
2LHM	PLAIN OR WHITE	PLAIN OR WHITE

V1806

Figure 12 - Accumulator Spring Chart



51. Plate
52. Boot
53. Screw
54. Nut
55. Indicator
56. Dial
57. Shield
58. Housing

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Figure 13 - Shift Indicator and Boot Replacement

SHIFT INDICATOR AND BOOT REPLACEMENT

Remove or Disconnect (Figure 13)

1. Plate assembly. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.
2. Boot (52) by removing screws (53) and nuts (54) from plate (51).
3. Screws (53) connecting indicator assembly to plate (51).
4. Dial (56) using a flat-bladed tool.
5. Indicator (55) from shield (57).

Install or Connect (Figure 13)

NOTICE: For steps 3 and 4 see "Notice" on page 7A1-1 of this section.

1. Indicator (55) to shield (57).
2. Dial (56) by snapping onto shield (57) and housing (58).

3. Screws (53) connecting indicator assembly to plate (51).

Tighten

- Screws (53) to 2 N•m (18 in. lbs.).

4. Boot (52), positioning nuts (54) and holes, and installing screws (53).

Tighten

- Screws (53) to 2 N•m (18 in. lbs.).

5. Plate assembly. Refer to INTERIOR TRIM (SEC. 10A4) in this manual.

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Shift Control Cable-to-Floor Panel Nut	4.5		40
Cable Attachment at Shift Lever	20	15	
Floor Shift Control-to-Brace Assembly Screw	10		89
Neutral Start and Backup Lamp Switch-to-Floorshift Control Nut	3.4		30
Transmission-to-Engine Bolt	47	35	
Transmission-to-Engine Stud	47	35	
Bracket-to-Transmission Stud Nut	30	22	
Oil Cooler Line-to-Transmission Nut	22	16	
Converter Cover-to-Transmission Bolt	47	35	
Fuel Line Bracket-to-Transmission Bolt	6.5		58
Indicator-to-Plate Assembly Screw	2		18
Boot-to-Plate Assembly Screw	2		18
Oil Filler Tube Bracket-to-Transmission Bolt	47	35	

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SECTION 7D

TRANSFER CASE

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The BORG WARNER-4472 transfer case is a two-piece aluminum case, chain driven, viscous clutch type transfer case. This produces a system in which all wheel drive is engaged all the time. Torque is transmitted through a planetary gear set which distributes torque at a ratio of 1/3 front 2/3 rear. All wheel drive is automatic and has no external controls.

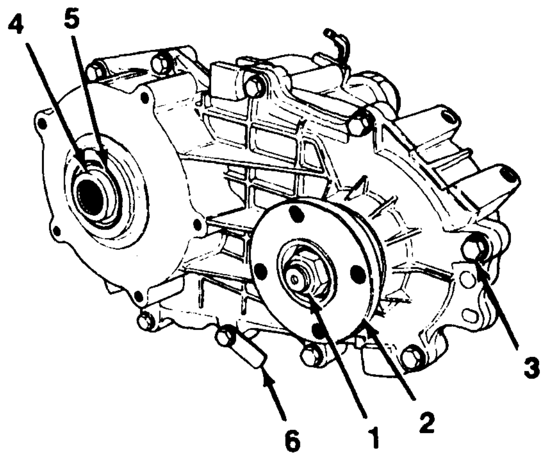
The viscous clutch used in the BW-4472 is a torque distribution device and is nonserviceable. The internal construction of the viscous clutch consists of alternating plates that are connected to the front and rear outputs of the transfer case. The viscous clutch is filled with a high viscosity fluid which flows through slots in the plates. The resistance to sheer causes the plates to transmit torque.

OPERATION

Torque is transmitted through the input shaft to the planet carrier assembly. The viscous clutch provides the connection between the gear ring and the sun gear shaft. Torque flow continues through the gear ring to the rear output shaft. -Torque also flows from the planet carrier assembly to the sun gear shaft which is splined to the drive gear. The drive gear is connected to the driven sprocket by the drive chain. Torque continues through the driven sprocket to the front output shaft flange (figure 1).

IDENTIFICATION

The identificaton tag is an aluminum tag attached under one of the self tapping case bolts. The tag provides the Borg Warner part number, the General Motors part number, serial number and the build date. The information on the tag is necessary when servicing this transfer case. If the tag is removed or becomes dislodged during service operations, every attempt should be made to keep the identification tag with the unit (figure 1).



1. Front Output Flange Nut
2. Front Output Flange
3. Front Cover Bolts
4. Input Shaft
5. Input Shaft Oil Seal
6. Identification Tag

F8405

Figure 1 - BW-4472 Front View

DIAGNOSIS OF TRANSFER CASE

PROBLEM	POSSIBLE CAUSE	CORRECTION
Fluid (ATF) Leaking From Vent Hose	Transfer case overfilled.	Drain fluid to proper level.
Fluid Leaking At Front Or Rear Output Shaft Seals	1. Vent hose plugged or kinked. 2. Output shaft seals damaged or improperly installed.	1. Repair. 2. Replace leaking output shaft seal.
Fluid Leak At Case Halves, Extension Housing, Or Transfer Case Adapter	1. Loose case half bolts. 2. Loose extension housing bolts. 3. Loose adapter-to-transfer case bolts.	1. Remove front cover, reapply Loctite™ 518 sealant (or equivalent) and reinstall front cover. 2. Retorque bolts - 47 N•m (35 ft. lbs.). 3. Retorque bolts - 45 N•m (33 ft. lbs.).
Fill Plug Or Drain Plug Leaking	No thread sealant on leaking plug.	Remove plug, clean threads, apply sealant tape (or equivalent). Reinstall plug.
Transfer Case Noisy	1. Internal bearing or chain problem. 2. Low fluid level.	1. Repair or replace transfer case as required. 2. Fill with Dexron®-IIE (ATF) to proper level.
Driveline Vibration	1. Worn or damaged engine or transmission mounts. 2. Front or rear propeller shaft bent or out of balance. 3. Front propeller shaft CV-Joint worn or damaged.	1. Repair or replace worn or damaged mount. 2. Rebalance or replace faulty propeller shaft. 3. Replace front propeller shaft.

ON-VEHICLE SERVICE

FLUID CHANGE

Remove or Disconnect (Figure 2)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Place a drain pan under the drain plug (15).

1. Drain plug (15).
   - Allow the fluid to drain.
2. Fill plug (18).

Install or Connect (Figure 2)

NOTICE: For steps 1 and 3, see "Notice" on page 7D-1 of this section.

- Apply Loctite™ 518 Sealant (or equivalent) to drain and fill plugs (15 and 18) before installation.

1. Drain plug (15).

Tighten

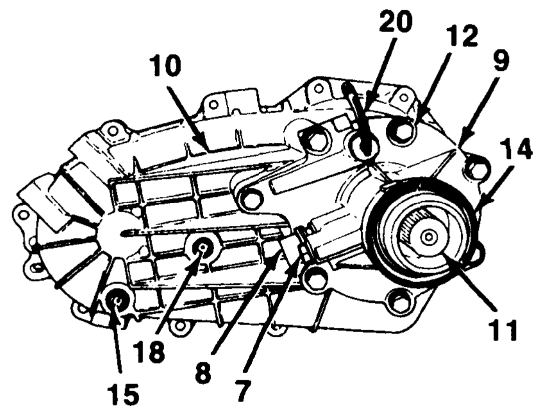
   - Drain plug (15) to 9 N•m (80 in. tbs.).

2. Fluid as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.
   - Fill the transfer case until the fluid level is at the bottom of the filler plug hole.
3. Fill plug (18).

Tighten

   - Fill plug (18) to 9 N•m (80 in. Ibs.).

- Lower the vehicle.



7. Speed Sensor Bolt
8. Speed Sensor
9. Extension Housing
10. Rear Case Half
11. Output Shaft Assembly
12. Extension Housing Bolt
14. Rear Output Shaft Oil Seal
15. Drain Plug
18. Fill Plug
20. Vent Tube

V1415

Figure 2 - BW-4472 Rear View

VENT HOSE REPLACEMENT

When replacing the vent hose, be sure to route it as shown in figure 3. The installed hose must be free of kink.

OUTPUT SHAFT OIL SEAL REPLACEMENT

FRONT OUTPUT SHAFT OIL SEAL

Remove or Disconnect (Figures 4 and 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Front propeller shaft. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.
2. Front output flange nut (1) and steel flat washer (21).
3. Rubber sealing washer (22).
4. Front output flange (2).

NOTICE: Use care when removing the front output shaft oil seal. Damage to the seal bore could result.

5. Front output shaft oil seal (23).
   - Pry out with a screwdriver.

Install or Connect (Figures 4 and 5)

Tool Required:
J 37668-A Seal Installer

1. Front output shaft oil seal (23).
   - Lubricate the seal lips with ATF or petroleum jelly.
   - Install the front output shaft oil seal (23) using J 37668-A (figure 5).
2. Front output flange (2).
3. Rubber sealing washer (22).
4. Steel flat washer (21).

NOTICE: See "Notice" on page 7D-1 of this section.

5. Front output flange nut (1).

8. Speed Sensor
9. Extension Housing
13. Breather Assembly
16. Vent Hose
19. Clip
20. Vent Tube
44. Fuel Line
45. Bracket
47. Bolt
55. Clip
56. Bolt
57. Speed Sensor Connector
58. Brace
59. Strap

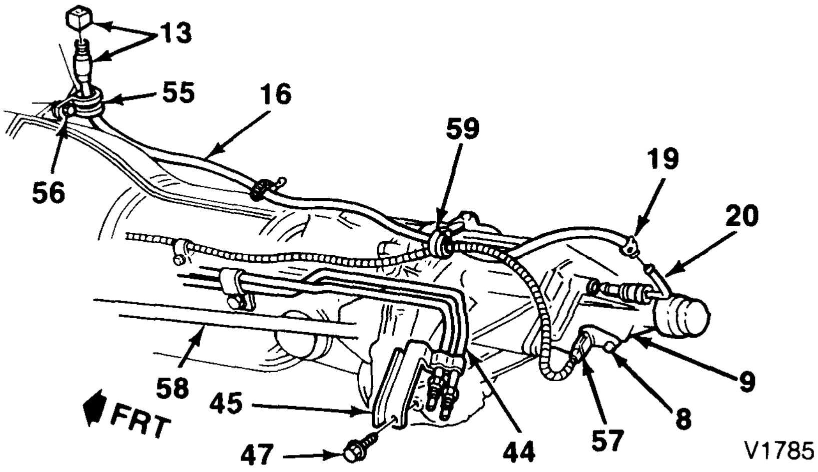
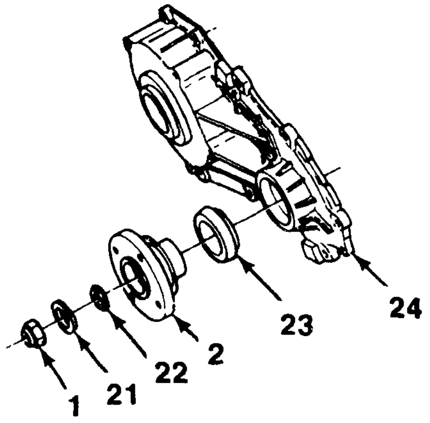


Figure 3 - Vent Hose Replacement



1. Front Output Flange Nut
2. Front Output Flange
21. Steel Flat Washer
22. Rubber Sealing Washer
23. Front Output Shaft Oil Seal
24. Front Cover

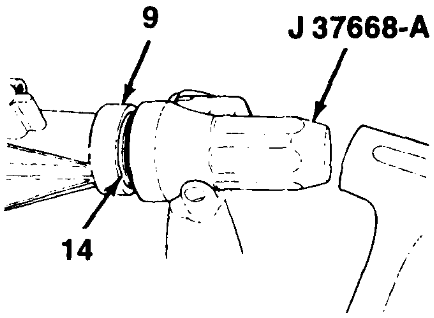
Figure 4 - Front Output Shaft Oil Seal

Tighten

- Front output flange nut (1) to 108 N•m (80 ft. lbs.).

6. Front propeller shaft. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.

- Check transfer case fluid level and add as necessary.
- Lower the vehicle.



9. Extension Housing
14. Rear Output Shaft Oil Seal

Figure 5 - Output Shaft Oil Seal Installation

REAR OUTPUT SHAFT OIL SEAL

Remove or Disconnect (Figure 5)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

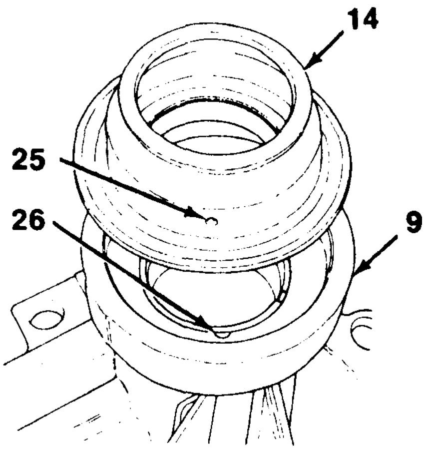
1. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.

NOTICE: Use care when removing the rear output shaft oil seal. Damage to the seal bore could result.

2. Rear output shaft oil seal (14).
   - Pry out with a screwdriver.

Install or Connect (Figures 5 and 6)

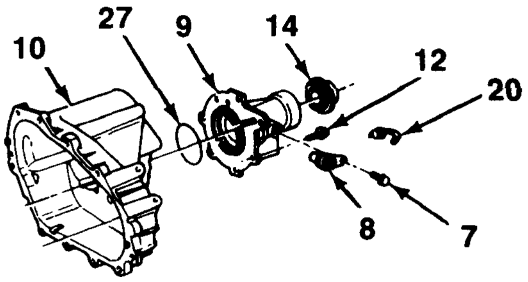
Tool Required:
J 37668-A Seal Installer



9. Extension Housing
14. Rear Output Shaft Oil Seal
25. Water Drain
26. Drain Groove

F8404

Figure 6 - Rear Output Shaft Oil Seal Alignment



7. Speed Sensor Bolt
8. Speed Sensor
9. Extension Housing
10. Rear Case Half
12. Extension Housing Bolt
14. Rear Output Shaft Oil Seal
20. Vent Tube
27. Output Shaft Bearing Snap Ring

V1417

Figure 7 - Extension Housing Replacement

1. Rear output shaft oil seal (14).
   - Align the water drain hole in the rear output shaft oil seal (14) with the drain groove in the extension housing (9).
   - Lubricate the seal lips with ATF or petroleum jelly.
   - Install the seal using J 37668-A (figure 5).
2. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.

- Check transfer case fluid level and add as necessary.
- Lower vehicle.

EXTENSION HOUSING REPLACEMENT

Remove or Disconnect (Figures 3 and 7)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

1. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.
2. Speed sensor (8) and speed sensor connector (57).
3. Vent tube (20).
4. Extension housing bolts (12).
5. Extension housing (9).

NOTICE: Use care when removing the rear output shaft oil seal. Damage to the seal bore could result.

6. Rear output shaft oil seal (14).
   - Pry out with screwdriver.

Clean

- Gasket surfaces with suitable solvent.

Install or Connect (Figures 3, 6 and 7)

Tool Required:
J 37668-A Seal Installer

Inspect

- Gasket surfaces making sure they are clean and free of grease and oil.

- Apply a 3 mm (1/8-inch) bead of Silicone Rubber Sealant (Loctite™ 598, GM part number 9985675), or equivalent, to the rear case half extension housing sealing surface.

1. Rear extension housing (9) to rear case half (10).

NOTICE: See "Notice" on page 7D-1 of this section.

2. Extension housing bolts (12).

Tighten

- Extension housing bolts (12) to 47 N•m (35 ft. lbs.).

3. Vent tube (20).
4. Speed sensor (8) and speed sensor connector (57).
5. Rear output shaft oil seal (14).
   - Align the water drain hole in the output shaft oil seal with the drain groove in the extension housing (9).
   - Lubricate seal lips with ATF or petroleum jelly.
   - Install rear output shaft oil seal (14) using J 37668-A.
6. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.

- Fill the transfer case with the proper fluid as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.
- Lower the vehicle.

TRANSFER CASE BRACE AND BRACKET REPLACEMENT

Remove or Disconnect (Figure 8)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Support the transmission (28) with a suitable jack.

1. Nuts (38) and washers (39) from transfer case mount (36).
2. Nuts (66), washers (65) and bolts (64) from transmission support (17).
3. Transmission support (17) from frame.
4. Transfer case brace-to-bracket bolts (60).
5. Transfer case brace-to-transmission bolt (61).
6. Transfer case brace (58).
7. Bracket-to-transfer case nuts (62).
8. Bracket (63) from transfer case (34).

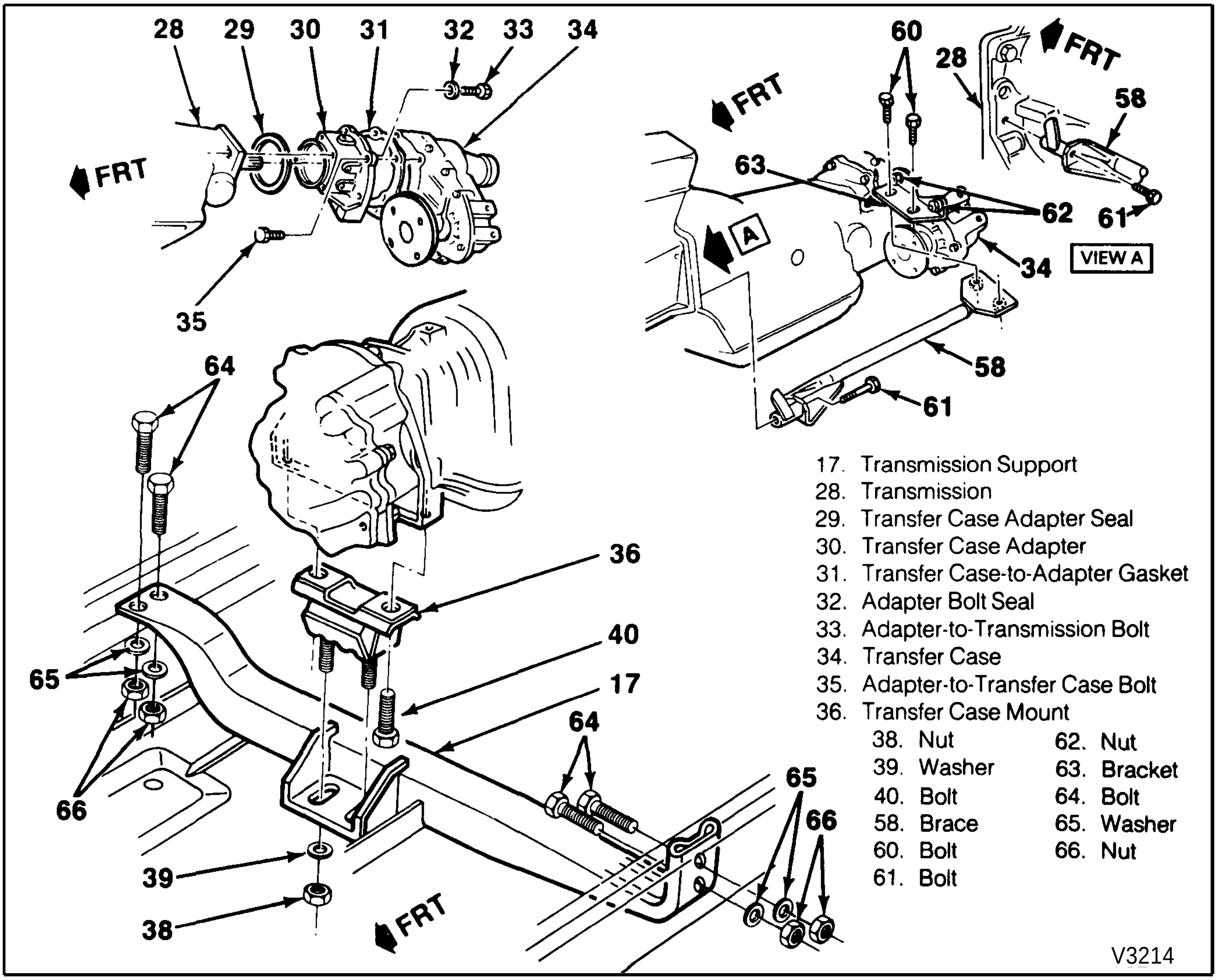


Figure 8 - Transfer Case Installation

Install or Connect (Figure 8)

NOTICE: See "Notice" on page 7D-1 of this section for steps 4, 5, 7 and 8.

1. Bracket (63) to transfer case (34).
2. Nuts.
3. Transfer case brace (58) to transmission (28).
4. Transfer case brace-to-transmission bolt (61).
5. Transfer case brace-to-bracket bolts (60).

Tighten

- Transfer case brace-to-transmission bolt (81) and transfer case brace-to-bracket bolts (80) to 47 N•m (35 ft. lbs.).

6. Transmission support (17) to frame.
7. Bolts (64), washers (65) and nuts (66) to transmission support (17) and frame.
8. Washers (39) and nuts (38) attaching transmission support (17) to transfer case mount (36).

Tighten

- Bolts (64) to 47 N•m (35 ft. lbs.).
- Nuts (38) to 35 N•m (26 ft. lbs.).

- Remove the jack from the transmission.
- Lower vehicle.

TRANSFER CASE REPLACEMENT

Remove or Disconnect (Figures 3, 8 and 9)

1. Negative (-) battery cable.
- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.
- Drain fluid from transfer case (34).
2. Front propeller shaft. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.
3. Transfer case brace and bracket as explained previously in this section.
4. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.
5. Transfer case mount (36) and bolts (40).
6. Fuel line (44) by removing bolt (47) and bracket (45).
7. Speed sensor connector (57).
- Support the transfer case (34) with a suitable jack.
8. Vent hose (16) from transfer case (34).
9. Adapter-to-transfer case bolts (35).
10. Transfer case (34).
11. Transfer case-to-adapter gasket (31).

Install or Connect (Figures 3, 8 and 9)

NOTICE: For steps 3, 6, and 7 see "Notice" on page 7D-1 of this section.

Inspect

- Gasket surfaces making sure that they are clean and free of grease and oil.

1. Transfer-case-to-adapter gasket (31).
   - Use gasket sealer to hold gasket in place.
- Support the transfer case (34) with a suitable jack.
2. Transfer case (34) to transfer case adapter (30).
3. Adapter-to-transfer case bolts (35).
- Remove the jack from the transfer case (34).

Tighten

- Bolts (35) to 45 N•m (33 ft. lbs.).

4. Vent hose (16).
5. Speed sensor connector (57).
6. Fuel line (44) by feeding through bracket (45) and attaching bolt (47).

Tighten

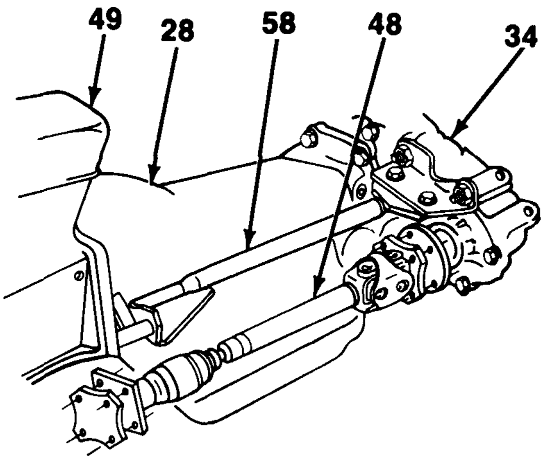
- Bolt (47) to 35 N•m (26 ft. lbs.).

7. Transfer case mount (36) and bolts (40).

Tighten

- Bolts (40) to 45 N•m (33 ft. lbs.).

8. Transfer case brace and bracket as explained previously in this section.
9. Front propeller shaft. Refer to PROPELLER SHAFT (SEC. 4A) in this manual.



28. Transmission
34. Transfer Case
48. Front Propeller Shaft
49. Engine
58. Transfer Case Brace

Figure 9 - Transfer Case Installation

10. Rear propeller shaft as described in PROPELLER SHAFT (SEC. 4A) in the 1992 Service Manual Sonoma and Jimmy Models.
    - Fill the transfer case with the proper fluid as described in MAINTENANCE AND LUBRICATION (SEC. 0B) in the 1992 Service Manual Sonoma and Jimmy Models.
    - Lower the vehicle.
11. Negative (-) battery cable.

TRANSFER CASE ADAPTER REPLACEMENT

Remove or Disconnect (Figures 8 and 9)

1. Transfer case as explained previously in this section.
2. Transfer case mount-to-adapter bolts (40).
   - Raise rear of transmission (28) slightly.
3. Adapter-to-transmission bolts (33) and adapter bolt seals (32).
4. Transfer case adapter (30).
5. Transfer case adapter seal (29).

Install or Connect (Figures 8 and 9)

NOTICE: For steps 3 and 4 see "Notice" on page 7D-1 of this section.

1. Transfer case adapter seal (29).
2. Transfer case adapter (30).
3. Adapter bolt seals (32) and adapter-to-transmission bolts (33).

   Tighten

   - Bolts (33) to 45 N•m (33 ft. lbs.).
   - Lower rear of transmission,
4. Transfer case mount-to-adapter bolts (40).

   Tighten

   - Bolts (40) to 45 N•m (33 ft. lbs.).
5. Transfer case as explained previously in this section.

TRANSFER CASE UNIT REPAIR

DISASSEMBLY OF THE TRANSFER CASE

EXTERNAL COMPONENTS

Clean

- The transfer case using solvent and a stiff brush.

Remove or Disconnect (Figures 10, 11 and 12)

1. Front output flange nut (1), steel flat washer (2) and the rubber sealing washer (3) from the front output shaft (4).
2. Front output flange (5) from the front output shaft (4).
3. Speed sensor bolt (6) and speed sensor (7) from the extension housing (8).
4. Front cover bolts (9) from the rear case half (10).
5. Front cover (11) by prying on the tabs provided (figure 12).

INTERNAL COMPONENTS

Remove or Disconnect (Figures 11, and 13 through 15)

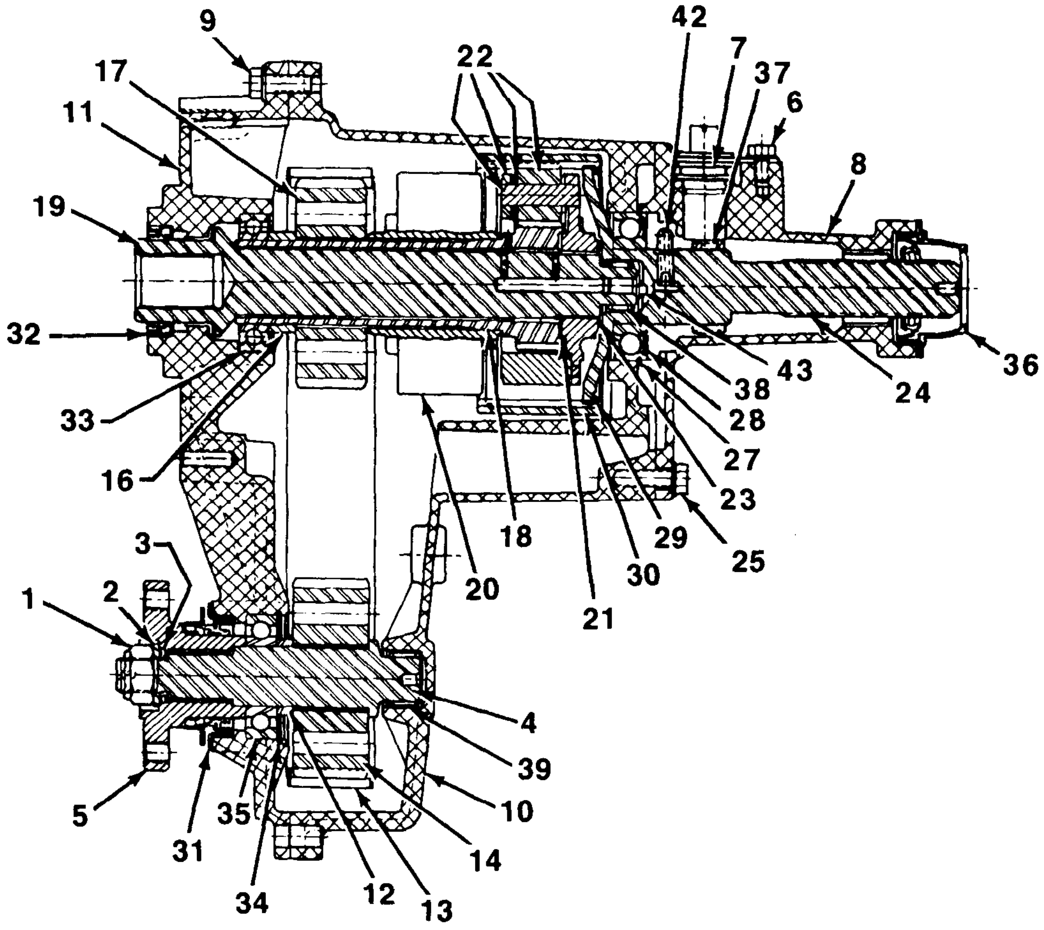
1. Front output shaft spacer (12) from the front output shaft (4).
2. Front output shaft (4) drive chain (13) and the driven sprocket (14) from the rear case half (10).
3. Magnet (15) from the rear case half (10).
4. Input shaft (19) from the sun gear shaft (18) (figure 14).
5. Sun gear shaft (18), sun gear shaft bearing (33) drive sprocket spacer (16), drive sprocket (17), viscous clutch (20) and the sun gear shaft thrust washer (21) as an assembly from the planet carrier assembly (22).
6. Planet carrier assembly (22) and the planet carrier assembly thrust washer (23) from the output shaft assembly (24).
7. Extension housing bolts (25) from the extension housing (8).
8. Vent tube (26) from the extension housing (8).
9. Extension housing (8) from the rear case half (10).
   - Turn the rear case half (10) over and support the output shaft assembly (24) from the inside of the rear case half (10).
10. Output shaft bearing snap ring (27) from the output shaft bearing (28) (figure 15).
11. Gear ring snap ring (29) from the gear ring (30).
12. Output shaft assembly (24) from the gear ring (30).

BEARINGS AND SEALS

Remove or Disconnect (Figures 11 and 15 through 17)

Tools Required:
J 22912-01 Bearing Remover
J 23907 Puller
J 2619-01 Slide Hammer
J 29369-1 Output Shaft Bearing Remover

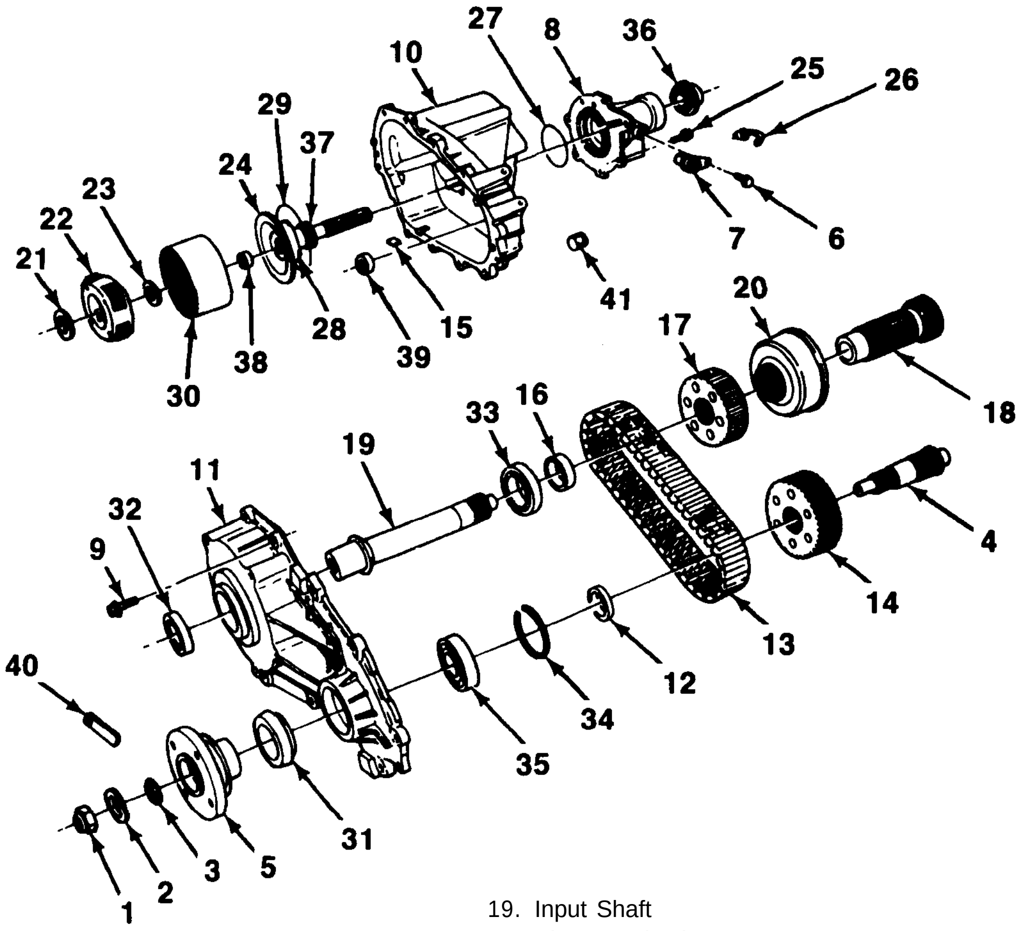
1. Front output shaft oil seal (31) from the front cover (11).
2. Input shaft oil seal (32) from the front cover (11).



1. Front Output Flange Nut
2. Steel Flat Washer
3. Rubber Sealing Washer
4. Front Output Shaft
5. Front Output Flange
6. Speed Sensor Bolt
7. Speed Sensor
8. Extension Housing
9. Front Cover Bolts
10. Rear Case Half
11. Front Cover
12. Front Output Shaft Spacer
13. Drive Chain
14. Driven Sprocket
16. Drive Sprocket Spacer
17. Drive Sprocket
18. Sun Gear Shaft
19. Input Shaft
20. Viscous Clutch
21. Sun Gear Shaft Thrust Washer
22. Planet Carrier Assembly
23. Planet Carrier Assembly Thrust Washer
24. Output Shaft Assembly
25. Extension Housing Bolts
27. Output Shaft Bearing Snap Ring
28. Output Shaft Bearing
29. Gear Ring Snap Ring
30. Gear Ring
31. Front Output Shaft Oil Seal
32. Input Shaft Oil Seal
33. Sun Gear Shaft Bearing
34. Output Shaft Bearing Snap Ring
35. Output Shaft Bearing
36. Output Shaft Oil Seal
37. Speedometer Tone Wheel
38. Input Shaft Pilot Bearing
39. Output Shaft Rear Bearing
42. Oil Scoop
43. Lubrication Tube

V3215

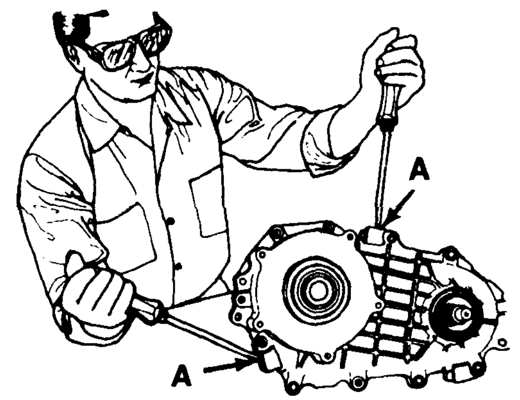
Figure 10 - Transfer Case Cross Section



1. Front Output Flange Nut
2. Steel Flat Washer
3. Rubber Sealing Washer
4. Front Output Shaft
5. Front Output Flange
6. Speed Sensor Bolt
7. Speed Sensor
8. Extension Housing
9. Front Cover Bolts
10. Rear Case Half
11. Front Cover
12. Front Output Shaft Spacer
13. Drive Chain
14. Driven Sprocket
15. Magnet
16. Drive Sprocket Spacer
17. Drive Sprocket
18. Sun Gear Shaft
19. Input Shaft
20. Viscous Clutch
21. Sun Gear Shaft Thrust Washer
22. Planet Carrier Assembly
23. Planet Carrier Assembly Thrust Washer
24. Output Shaft Assembly
25. Extension Housing Bolts
26. Vent Tube
27. Output Shaft Bearing Snap Ring
28. Output Shaft Bearing
29. Gear Ring Snap Ring
30. Gear Ring
31. Front Output Shaft Oil Seal
32. Input Shaft Oil Seal
33. Sun Gear Shaft Bearing
34. Output Shaft Bearing Snap Ring
35. Output Shaft Bearing
36. Output Shaft Oil Seal
37. Speedometer Tone Wheel
38. Input Shaft Pilot Bearing
39. Output Shaft Rear Bearing
40. Identification Tag
41. Drain/Fill Plug

V1418

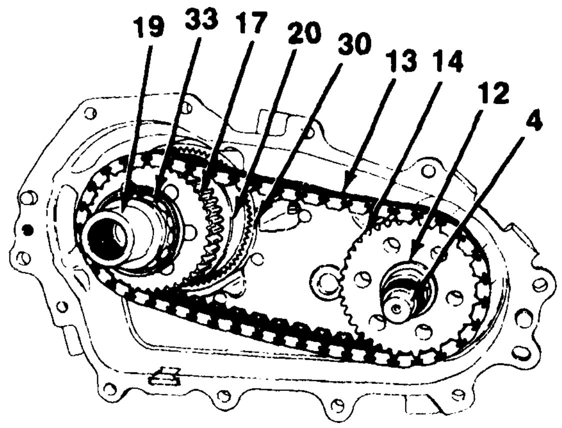
Figure 11 - BW-4472 Transfer Case



A. Tab Locations

V1419

Figure 12 - Tab Locations

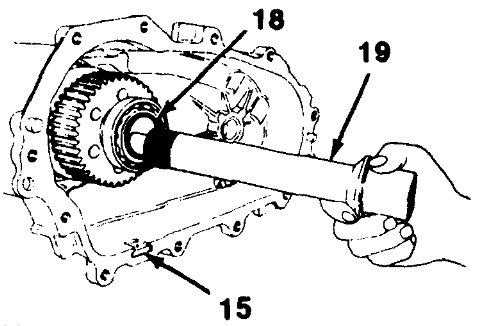


4. Front Output Shaft
12. Front Output Shaft Spacer
13. Drive Chain
14. Driven Sprocket
17. Drive Sprocket
19. Input Shaft
20. Viscous Clutch
30. Gear fling
33. Sun Gear Shaft Bearing

F7566

Figure 13 - Inside The Rear Case Half

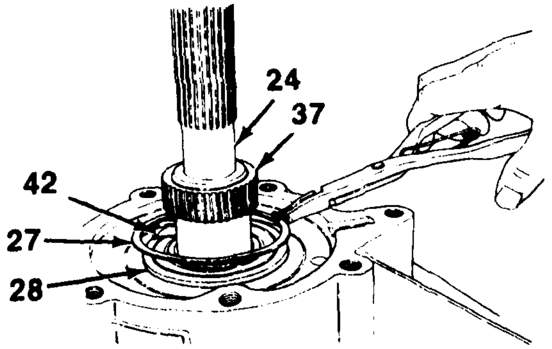
3. Output shaft bearing snap ring (34) from the front cover (11).
4. Output shaft bearing (35) from the front cover (11).
5. Output shaft oil seal (36) from the extension housing (8).
   - Using J 22912-01, press the sun gear shaft bearing (33) from the sun gear shaft (18).
6. Drive sprocket spacer (16), drive sprocket (17) and the viscous clutch (20) from the sun gear shaft (18).
7. Input shaft pilot bearing (38) from the output shaft assembly (24) using J 23907 (figure 16).



15. Magnet
18. Sun Gear Shaft
19. Input Shaft

F7567

Figure 14 - Removing the Input Shaft



24. Output Shaft Assembly
27. Output Shaft Bearing Snap Ring
28. Output Shaft Bearing
37. Speedometer Tone Wheel
42. Oil Scoop

F7568

Figure 15 - Removing the Output Shaft Rear Bearing

8. Output shaft rear bearing (39) from the rear case half (10) using J 2619-01 and J 29369-1 (figure 17).

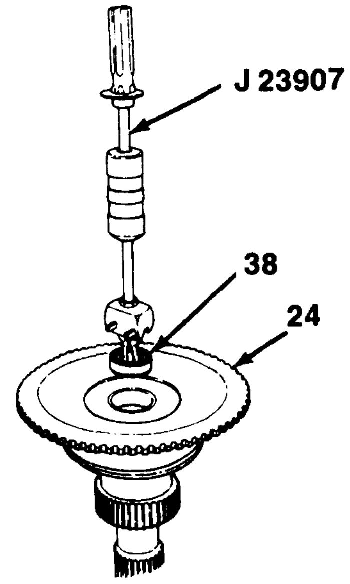
CLEANING AND INSPECTION

Clean

1. Bearings.
2. Shafts.
3. Sprockets.
4. Chain.
5. Oil feed ports and channels.
   - Apply compressed air to each oil feed port and channel in order to remove any obstructions or cleaning solvent residue.

Inspect (Figure 11)

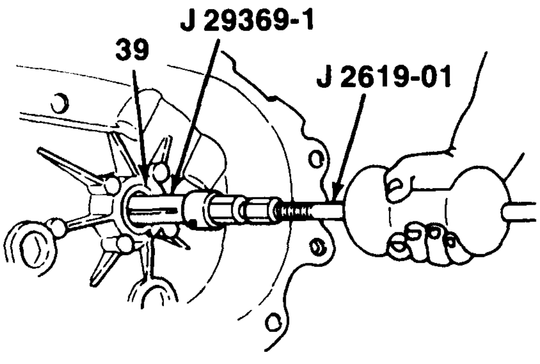
1. Bearings and thrust washers for wear, spalling, brinelling, or corrosion.
2. Gear teeth for excessive wear or damage, spalling, cracks or corrosion.



24. Output Shaft Assembly
38. Input Shaft Pilot Bearing

V1420

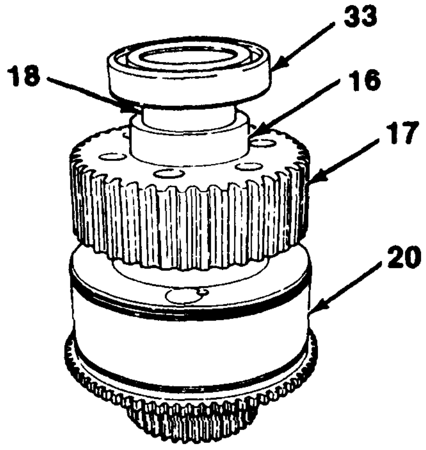
Figure 16 - Removing the Input Pilot Shaft Bearing



39. Output Shaft Rear Bearing

V3216

Figure 17 - Removing the Output Shaft Rear Bearing



16. Drive Sprocket Spacer
17. Drive Sprocket
18. Sun Gear Shaft
20. Viscous Clutch
33. Sun Gear Shaft Bearing

F7603

Figure 10 - Installing the Sun Gear Shaft Components

3. Gear splines for excessive wear, spalling, cracks, twist or corrosion.
4. Shaft splines for excessive wear, spalling, cracks, distortion or corrosion.
5. Case half for damaged or warped mating surfaces, cracks, porosity, or damaged thread holes.
6. Oil scoop on the output shaft assembly (24) for cracks, wear or damage.
7. Speedometer tone wheel (37) for wear, spalling, cracks, twist and corrosion.
8. Speed sensor (7) and the breather assembly O-ring seals for cuts, tears, cracks or damage.

ASSEMBLY OF THE TRANSFER CASE

Tools Required:
J 7079-2 Driver Handle
J 38212 Needle Bearing Installer

During assembly of the transfer case, lube all necessary parts with Dexron®-IIE Automatic Transmission Fluid, or equivalent.

Assemble (Figures 16 through 30)

1. Viscous clutch (20), drive sprocket (17), drive sprocket spacer (16), and the sun gear shaft bearing (33) into the sun gear shaft (16) (figure 16).
2. Input shaft pilot bearing (36) into the output shaft assembly (24) using J 7079-2 and J 38212 (figure 19).
3. Output shaft assembly (24) to the gear ring (30).
4. Gear ring snap ring (29) to the gear ring (30) (figure 20).
5. Output shaft bearing (35) to the front cover (11).

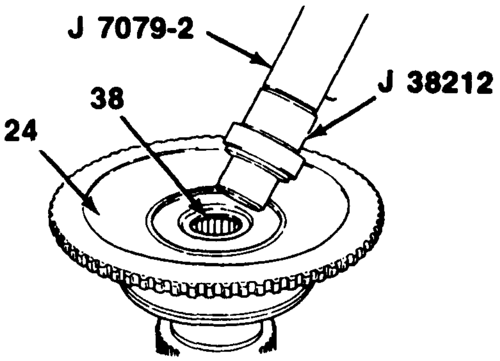


Figure 19 - Installing the Input Shaft Pilot Bearing

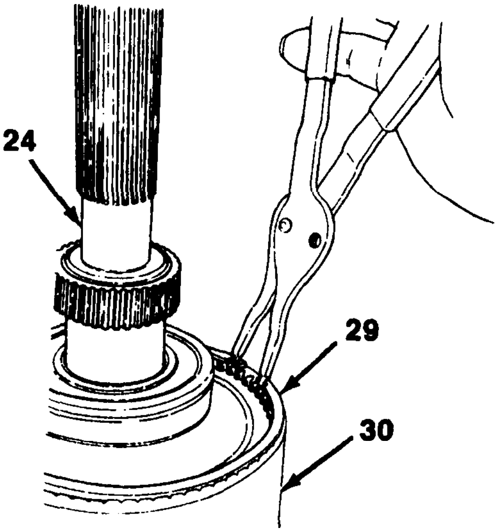


Figure 20 - Installing the Gear Ring Snap Ring

6. Output shaft bearing snap ring (34) to the front cover (11) (figure 21).
7. Output shaft rear bearing (39) to the rear case half (10) using J 7079-2 and J 38212 (figure 22).

Install or Connect (Figures 11 and 18 through 30)

NOTICE: For steps 3, 4, 16 and 20 see "Notice" on page 7D-1 of this section.

Tools Required:
J 37668-A Seal installer
J 38216 Seal installer

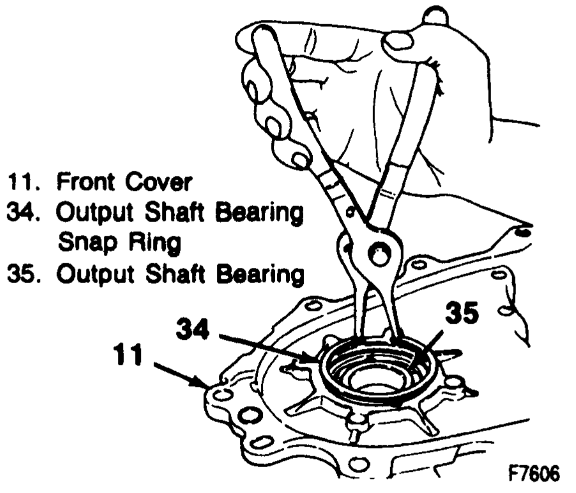


Figure 21 -installing the Output Shaft Bearing Snap Ring

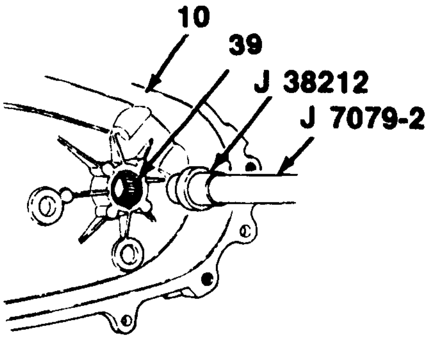


Figure 22 - Installing the Output Shaft Rear Bearing

1. Output shaft assembly (24) and gear ring (30) through the rear case half (10).
2. Output shaft bearing snap ring (27) to the output shaft bearing (28).
   - Apply a 3 mm (1/8-inch) bead of Silicone Rubber Sealant (Loctite™ 598, GM part number 9985675) or equivalent to the rear case half extension housing sealing surface.
3. Extension housing (8) and the extension housing bolts (25) to the rear case half (10).

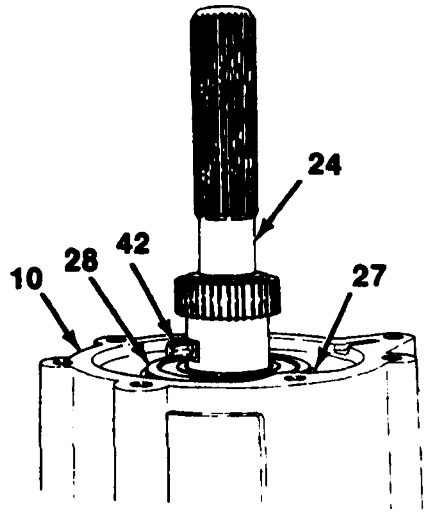
Tighten

- Extension housing bolts (25) to 47 N•m (35 ft. lbs.).

4. Speed sensor (7) and speed sensor bolt (6) into the extension housing (8).

Tighten

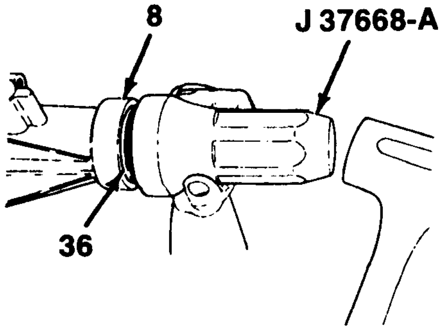
- Speed sensor bolt (6) to 1 N•m (10 in. lbs.).



10. Rear Case Half
24. Output Shaft Assembly
27. Output Shaft Bearing Snap Ring
28. Output Shaft Bearing
42. Oil Scoop

F7608

Figure 23 - Installing the Output Shaft Bearing Snap Ring



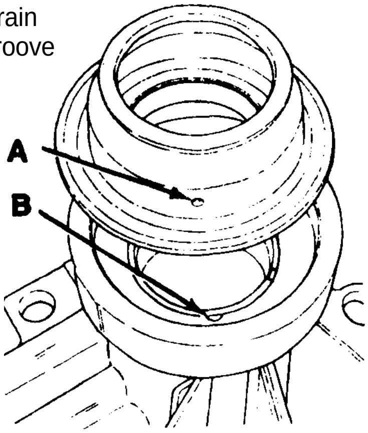
8. Extension Housing
36. Output Shaft Oil Seal

V1422

Figure 24 - Installing the Output Shaft Oil Seal

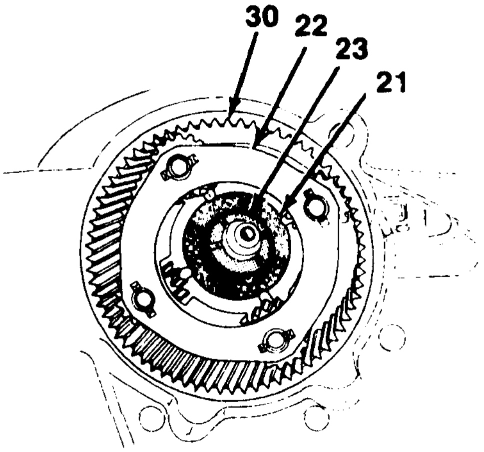
5. Output shaft oil seal (38) to the extension housing (8) using J 37668-A.
   - Align the water drain hole in the output shaft oil seal (38) with the drain groove in the extension housing (8).
6. Planet carrier assembly thrust washer (23) to the output shaft assembly (24) using a petroleum jelly and align with the input shaft pilot bearing (38).

A. Water Drain
B. Drain Groove



F7610

Figure 25 - Alignment of the Oil Seal

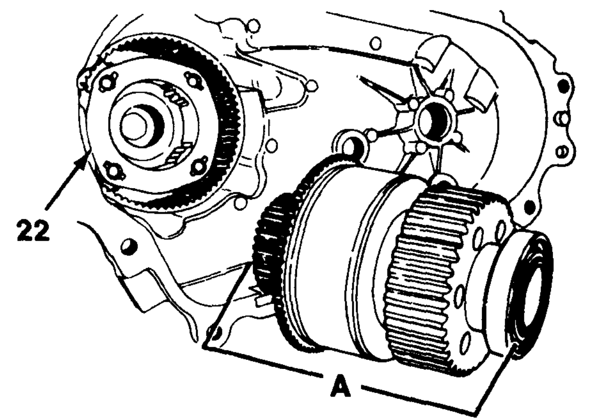


21. Sun Gear Shaft Thrust Washer
22. Planet Carrier Assembly
23. Planet Carrier Assembly Thrust Washer
30. Gear Ring

F7611

Figure 28 - Installing the Planet Carrier Assembly

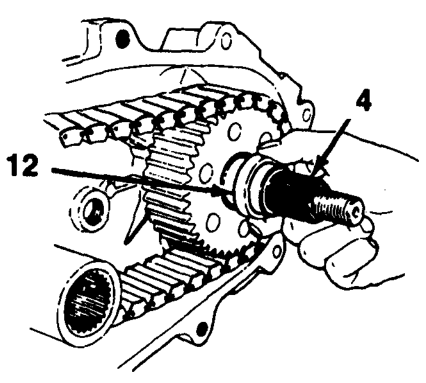
7. Planet carrier assembly (22) into the gear ring (30).
8. Sun gear shaft thrust washer (21) to the planet carrier assembly (22) using petroleum jelly (figure 28).
9. Sun gear shaft assembly into the planet carrier assembly planet gears and align the viscous clutch teeth (20) to the gear ring spline.
10. input shaft (19) into the input shaft pilot bearing (38) aligning the input shaft (19) with the sun gear shaft



A. Sun Gear Shaft Assembly
22. Planet Carrier Assembly

F7612

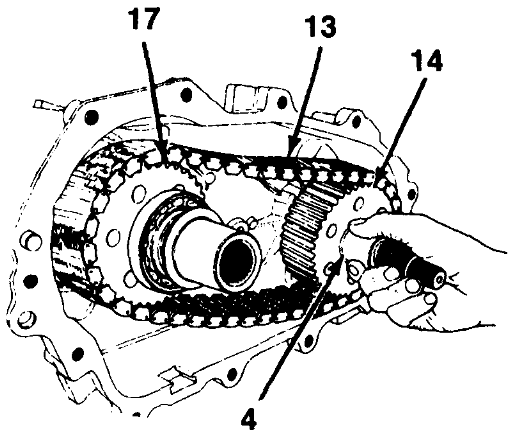
Figure 27 - Installing the Sun Gear Shaft Assembly



4. Front Output Shaft
12. Front Output Shaft Spacer

V1474

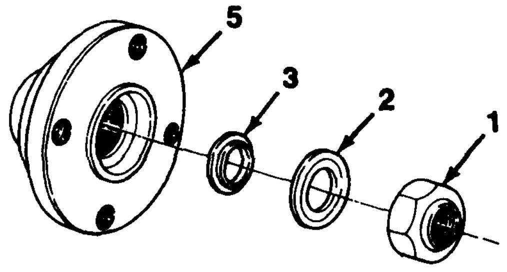
Figure 29 - Installing the Front Output Shaft Spacer



4. Front Output Shaft
13. Drive Chain
14. Driven Sprocket
17. Drive Sprocket

V1473

Figure 28 - Installing the Drive Chain Assembly



1. Front Output Flange Nut
2. Steel Flat Washer
3. Rubber Sealing Washer
5. Front Output Flange

F7637

Figure 30 - Installing the Output Flange Assembly

11. Driven sprocket (14) onto the front output shaft (4).
12. Drive chain (13) onto the driven sprocket (14).
13. Drive chain (13) over the drive sprocket (17) and the front output shaft (4) into the output shaft rear bearing (39).
14. Front output shaft spacer (12) onto the front output shaft (4) (figure 29).
15. Magnet (15) to the rear case half (10).
    - Apply a 3 mm (1/8-inch) bead of Silicone Rubber Sealant (Loctite™ 598, GM part number 9985675) or equivalent to the rear case half (10) front cover sealing surface.

16. Front cover (11) and front cover bolts (9) to the rear case half (10).

Tighten

- Front cover bolts (9) to 47 N•m (35 ft. lbs.).

17. Front output shaft oil seal (31) to the front cover (11) using J 37668-A.
18. Input shaft oil seal (32) using J 38216.
19. Front output flange (5) to the front output shaft (4).
20. Rubber sealing washer (3), steel flat washer (2) and a new front output flange nut (1).

Tighten

- Front output flange nut (1) to 108 N•m (80 ft. lbs.).

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	Ft. Lbs.	In. Lbs.
Drain and Fill Plugs	9	-	80
Front Output Flange Nut	108	80	-
Extension Housing Bolt	47	35	-
Transfer Case Brace-to-Transmission Bolt	47	35	-
Transfer Case Brace-to-Bracket Bolt	47	35	-
Transmission Support-to-Frame Bolt	47	35	-
Adapter-to-Transfer Case Bolt	45	33	-
Transfer Case Mount Nut	35	26	-
Transfer Case Mount-to-Adapter Bolt	45	33	-
Fuel Line-to-Transfer Case Bolt	35	26	-
Adapter-to-Transmission Bolt	45	33	-
Front Cover Bolt	47	35	-
Speed Sensor Bolt	1	-	10

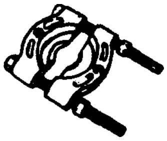
V1814

FLUID RECOMMENDATIONS

Lubricant . . . . .Dexron®-IIE 1.4 Liters, 52 Ounces (1.5 Quarts)

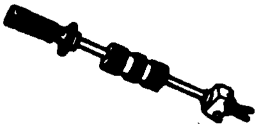
SPECIAL TOOLS

1.



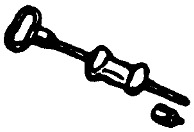
J 22912-01

2.



J 23907

3.



J 2619-01

4.

J 29369-1

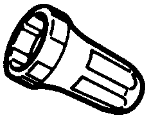
5.

J 7079-2

6.

J 38212

7.



J 37668-A

8.

J 38216

1. Bearing Remover
2. Puller
3. Slide Hammer
4. Output Shaft Searing Remover
5. Driver Handle
6. Needle Bearing Installer
7. Seal Installer
8. Seal Installer

V1423

SECTION 8A

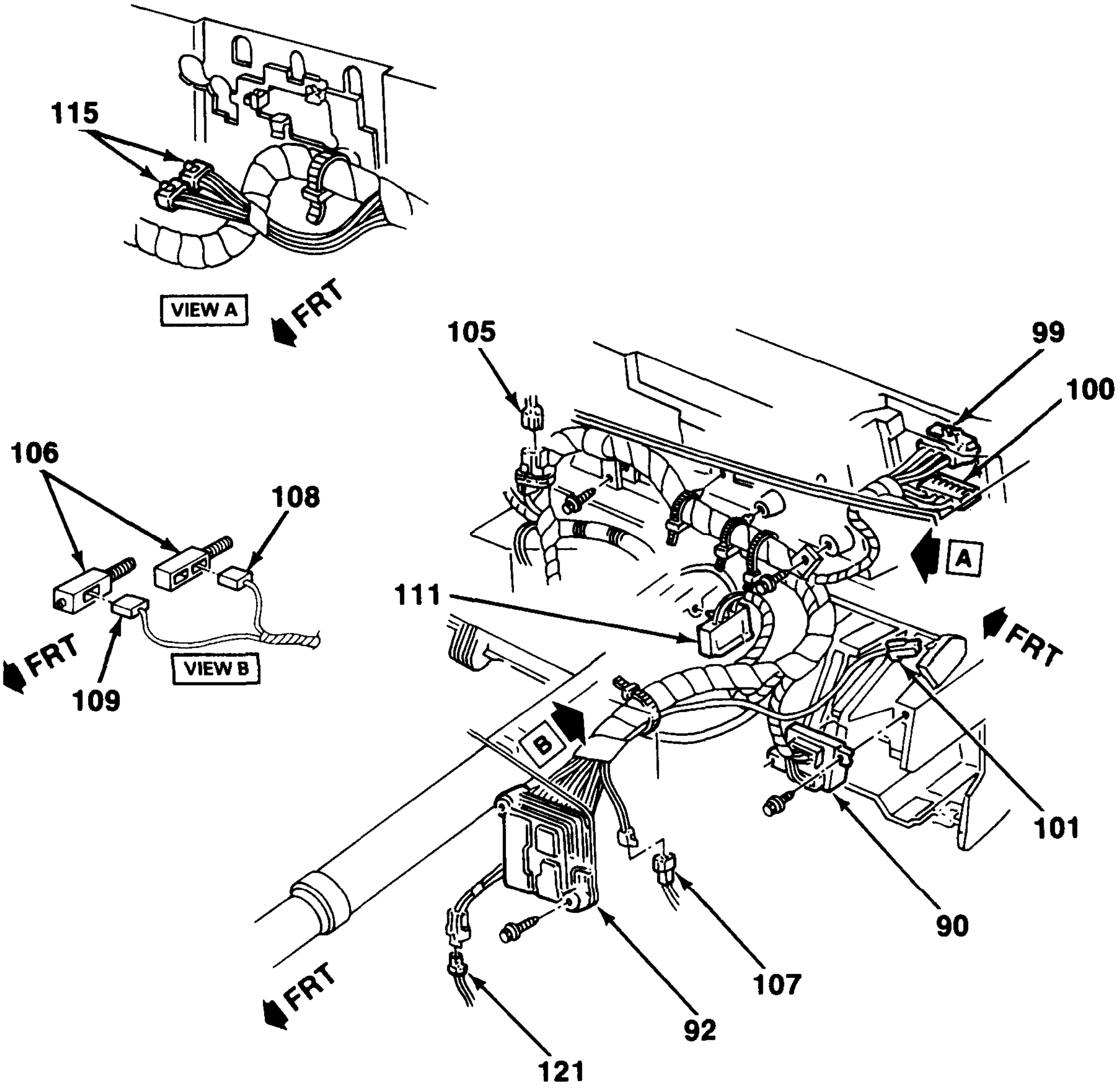
CAB ELECTRICAL

CONTENTS

CAB HARNESSES AND COMPONENTS

INSTRUMENT PANEL HARNESSES

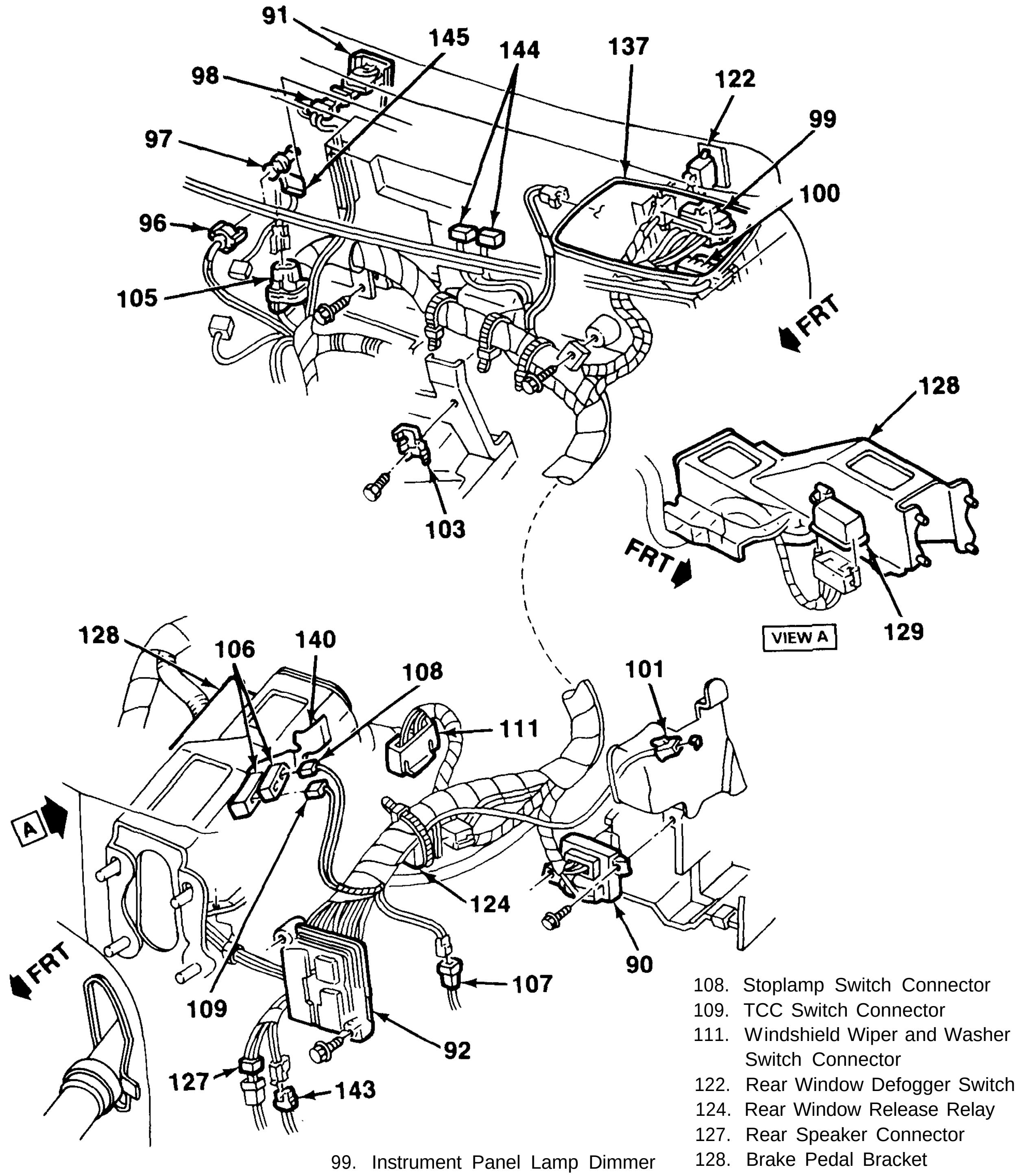
The instrument panel harnesses are routed from the fuse box, up over the steering column and then along the lower edge of the steering column. The harness is held by brackets which are fastened with capscrews (figures 1 through 5).



90. Convenience Center
92. Fuse Block
99. Instrument Panel Lamp Dimmer Switch Connector
100. Headlamp Switch Connector
101. Parking Brake Switch Connector
105. AC/Heater Harness Connector
106. Stoplamp Switch
107. Left Door Harness Connector (For Jam Switch)
108. Stoplamp Switch Connector
109. TCC Switch Connector
111. Windshield Wiper and Washer Switch Connector
115. Instrument Panel Harness Connectors (2 Each)
121. Dome Lamp and Safety Belt Retractor Switch Connector

V1743

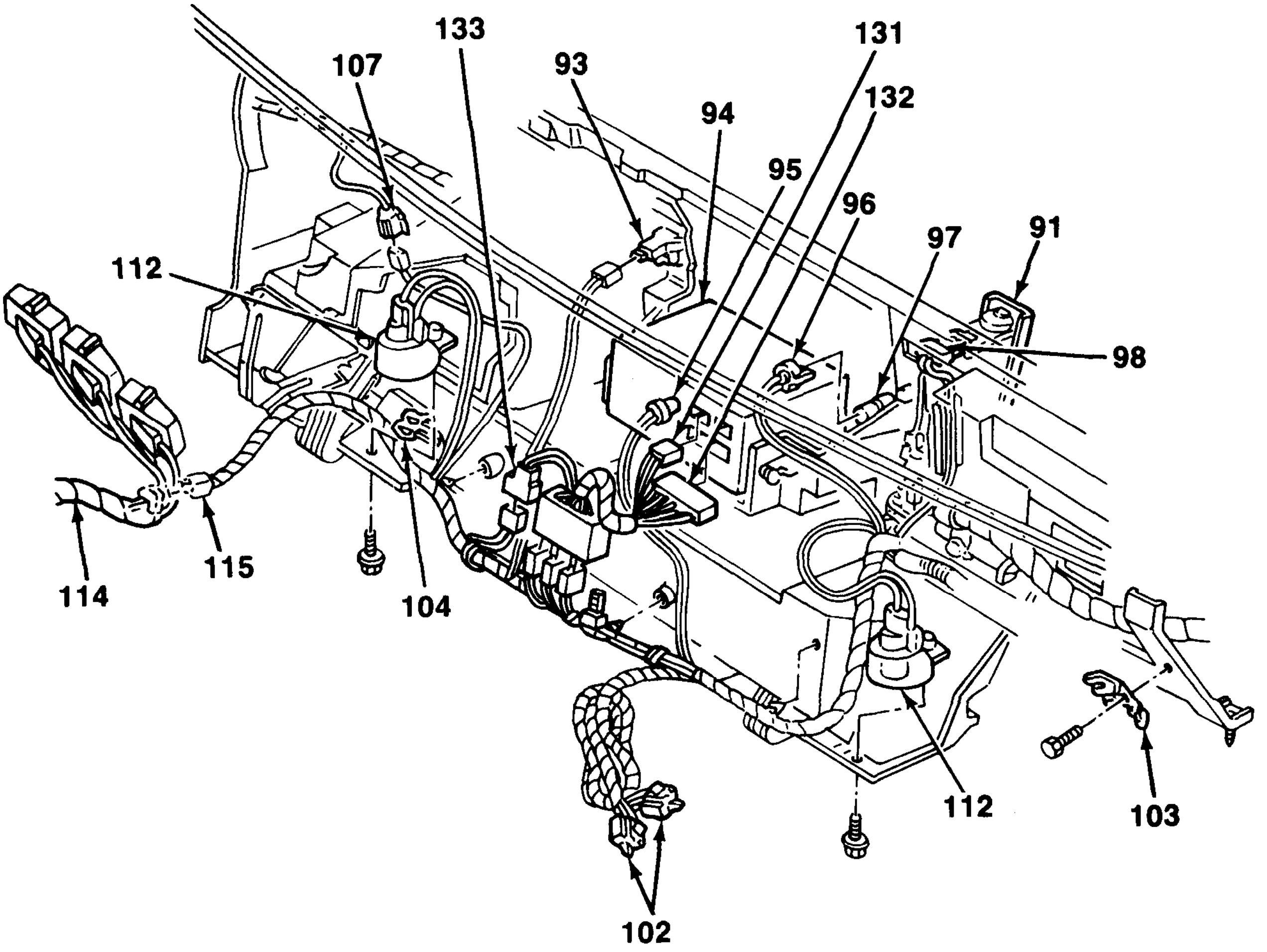
Figure 1 - Instrument Panel Harness-Left Side (Sonoma GT and Syclone)



90. Convenience Center
91. AC/Heater Control Panel
92. Fuse Block
96. Cigar Lighter Connector
97. Cigar Lighter
98. AC/Heater Control Panel Lamp Connector
99. Instrument Panel Lamp Dimmer Switch Connector
100. Headlamp Switch Connector
101. Parking Brake Switch Connector
103. Bus Bar Ground Terminal
105. AC/Heater Harness Connector
106. Stoplamp Switch
107. Left Door Harness Connector (For Jam Switch)
108. Stoplamp Switch Connector
109. TCC Switch Connector
111. Windshield Wiper and Washer Switch Connector
122. Rear Window Defogger Switch
124. Rear Window Release Relay
127. Rear Speaker Connector
128. Brake Pedal Bracket
129. Rear Window Defogger Relay
137. Left-Hand Front Speaker
140. Switch Mounting Bracket
143. Rear Window Defogger and Liftgate Harness
144. IP Cluster Connectors
145 Rear Window Release Switch Assembly

V1774

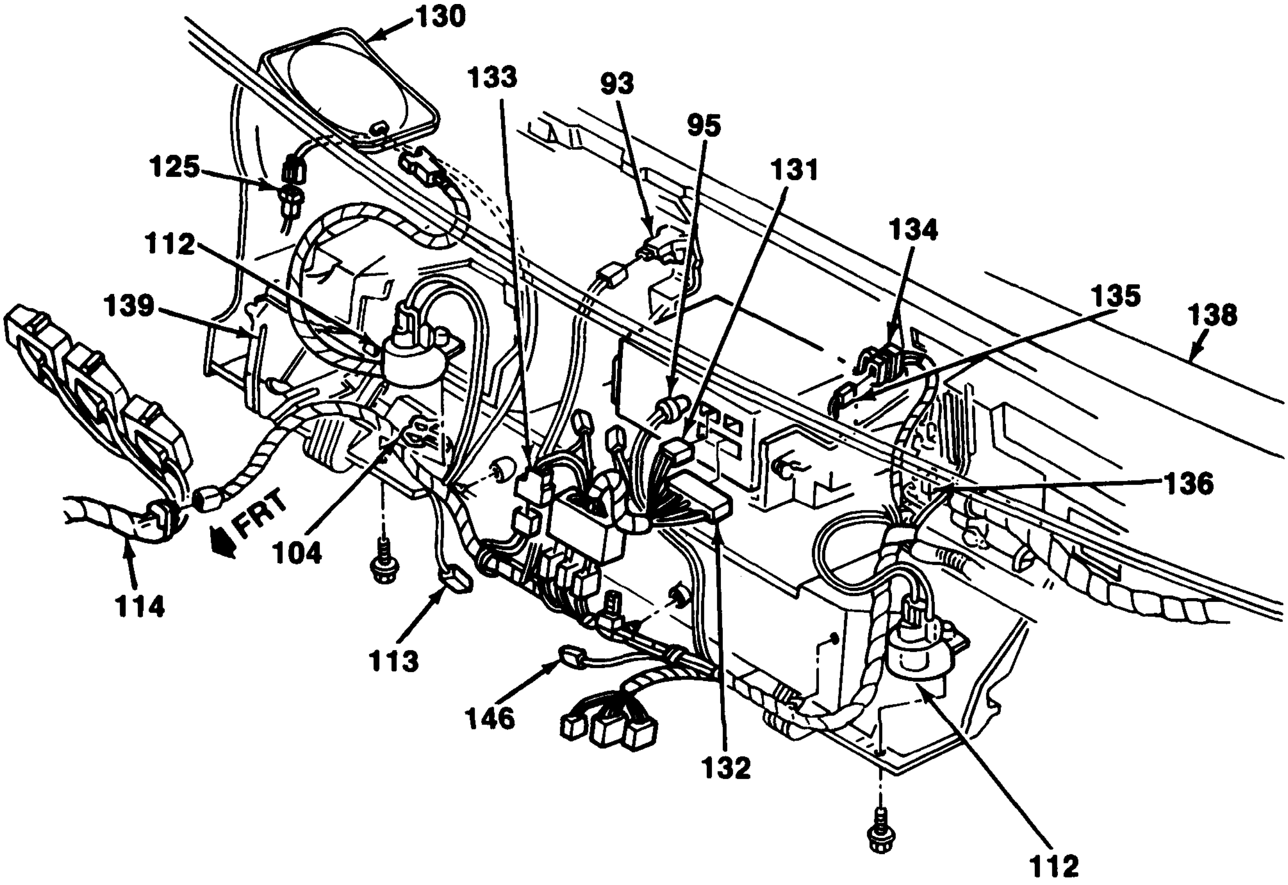
Figure 2 - Instrument Panel Harness-Left Side (Typhoon)



91. AC/Heater Control Panel
93. Compartment Lamp
94. Radio
95. Ash Tray Lamp
96. Cigar Lighter Connector
97. Cigar Lighter
98. AC/Heater Control Panel Lamp Connector
102. Console Harness Connector
103. Bus Bar Ground Terminal
104. DRAC Connector
107. Right Door Harness Connector (For Jam Switch)
112. Courtesy Lamp
114. Engine Harness
115. ECM/Engine Harness IP Connector
131. Rear Speaker Connector
132. Power and Front Speaker Connector
133. Clock Connector

V1862

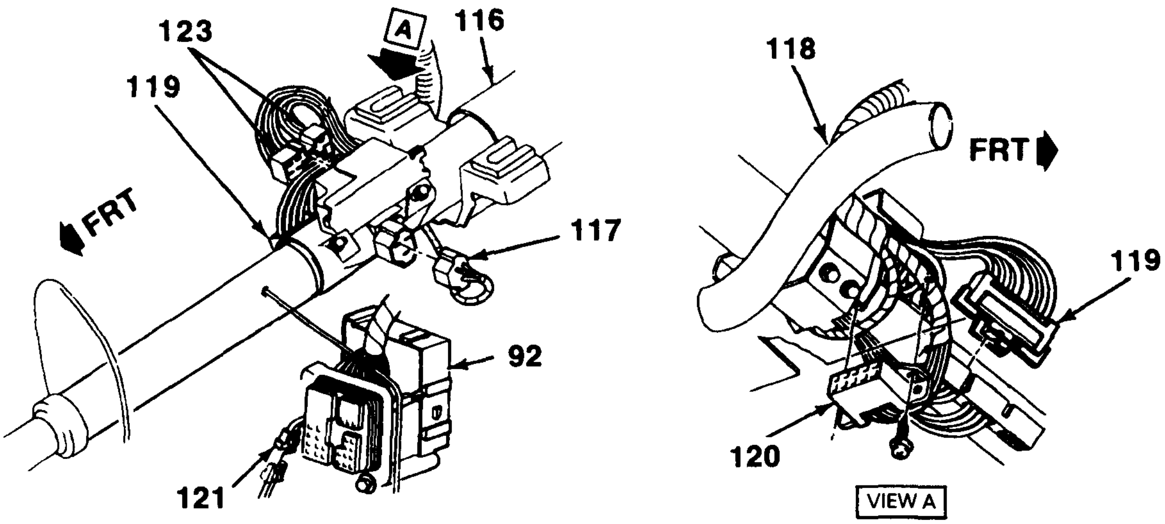
Figure 3 - Instrument Panel Harness-Right Side (Sonoma GT and Syclone)



93. Compartment Lamp
95. Ash Tray Lamp
104. DRAC Connector
112. Courtesy Lamp
113. Glove Box Lamp Connector
114. Engine Harness
125. Power Window/Door Jamb Switch/Outside Rearview Mirror Connector
130. Right-Hand Front Speaker
131. Rear Speaker Connector
132. Power and Front Speaker Connector
133. Clock Connector
134. Rear Window Release Connector
135. Rear Window Release Switch
136. AC/Heater Connector
138. Instrument Panel Cluster
139. Buffer Assembly and Bracket
146. Ash Tray Light Connector

V1775

Figure 4 - Instrument Panel Harness-Right Side (Typhoon)



92. Fuse Block	120. ALDL Connector
116. Steering Column	121. Safety Belt Retractor Switch Connector
117. Dimmer Switch Connector	123. Ignition Switch Connector
118. Lap Cooler Duct	
119. Turn Signal Switch Connector	

V3212

Figure 5 - Instrument Panel Harness-Steering Column

SECTION 8B

LIGHTING SYSTEMS

CONTENTS

DESCRIPTION

BACKUP LAMP SYSTEM

The backup lamp system consists of the backup switch and the backup lamp circuit. The backup switch is located on the floorshift control and is part of the neutral start switch.

The backup lamps are turned on when the transmission is shifted into reverse. The backup lamps are located in the rear lamp assemblies.

ON-VEHICLE SERVICE

BACKUP LAMP SWITCH REPLACEMENT

For on-vehicle service information, refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in this manual.

SECTION 8C

INSTRUMENT PANEL AND GAGES

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

VEHICLE SPEED SENSOR

The vehicle speed sensor (VSS) is a permanent magnet signal generator located on the transmission or transfer case output shaft housing. The vehicle speed sensor sends an analog signal proportional to the propeller shaft speed. This signal goes to the digital ratio adapter controller (figure 1).

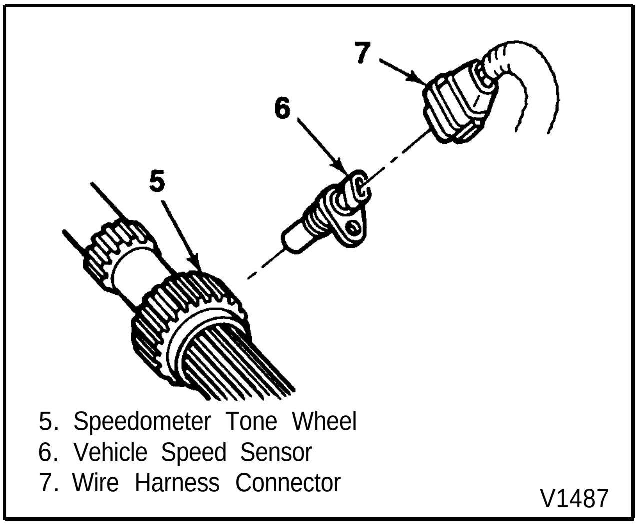


Figure 1 - Vehicle Speed Sensor (Syclone and Typhoon Shown)

DIGITAL RATIO ADAPTER CONTROLLER

The digital ratio adapter controller (DRAC) is a solid-state device that is used to change the signal from the speed sensor to a digital signal. The DRAC will change the signal from the speed sensor to a signal containing 4000 pulses per mile (PPM) for the electronic instrument cluster. The DRAC is matched to the final drive of each vehicle, so it must be replaced with the proper adapter to match the final drive of the vehicle. If the final drive is changed for any reason, the DRAC must also be changed to continue to produce an accurate speedometer/odometer reading. The incorrect adapter will also affect the antilock brakes (Sonoma GT only), engine control module (ECM) and the cruise control module.

TACHOMETER

The tachometer indicates engine speed in RPM (revolutions per minute) with the key in the “run” position. A wire to the “TACH” connector of the coil (C3l) module measures the ignition pulses of the module. An electronic circuit on the tachometer converts these pulses to RPM information.

TURBO BOOST GAGE SYCLONE AND TYPHOON

The boost gage displays intake manifold pressure. The gage receives a signal input from the manifold absolute pressure (MAP) sensor. The ECM also receives input from the MAP sensor, which is connected to the intake manifold. Turbo boost is controlled by a wastegate solenoid which is controlled by the ECM.

DIAGNOSIS OF TACHOMETER

PROBLEM	POSSIBLE CAUSE	CORRECTION
Tachometer Does Not Operate	1. Open circuit or faulty ignition coil. 2. Faulty tachometer.	1. Check WHT (121) wire to the ignition coil for continuity. If continuity exists, replace the ignition coil. 2. Disconnect the instrument cluster printed circuit connector and turn the ignition switch to “RUN.” Measure the voltage from WHT (121) wire to ground. If the voltage is greater than 10 volts, replace the instrument cluster.

V1519

DIAGNOSIS OF TURBO BOOST GAGE SYCLONE AND TYPHOON

PROBLEM	POSSIBLE CAUSE	CORRECTION
Turbo Boost Gage Does Not Work Properly	1. Open circuit or faulty turbo boost gage. 2. Faulty ECM, ECM wiring or MAP sensor.	1. Check for ECM code 33 or 34. If neither code is present, check LT GRN (432) wire at ECM to DK GRN 932 at the instrument cluster printed circuit for continuity. If continuity exists, replace the instrument cluster. 2. If either code 33 or 34 is present, refer to DRIVEABILITY AND EMISSIONS-FUEL INJECTION (PORT) (SEC. 6E3) in this manual for ECM diagnosis.

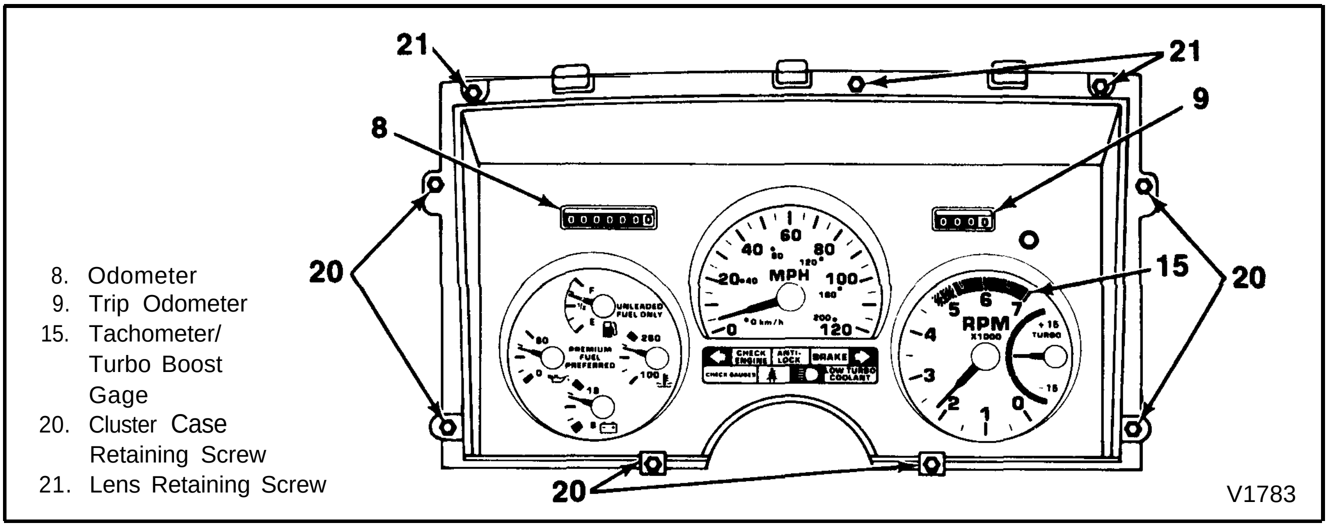
V1782

ON VEHICLE SERVICE

INSTRUMENT CLUSTER REPLACEMENT

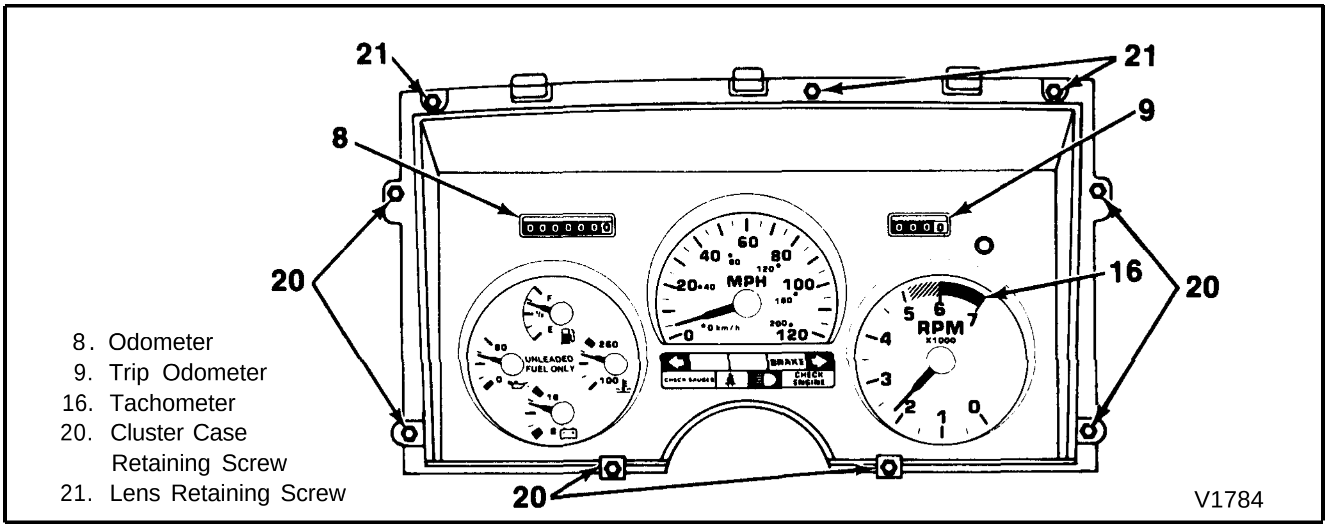
↔ Remove or Disconnect (Figures 2 through 5)

1. Negative (-) battery cable.
2. Screws (16) from fog lamp switch (17).
3. Screws (3) from lamp switch trim plate (4).
4. Lamp switch trim plate (4).
5. Lamp switch harness.
6. Screws (23) from power outside rearview mirror



8. Odometer
9. Trip Odometer
15. Tachometer/ Turbo Boost Gage
20. Cluster Case Retaining Screw
21. Lens Retaining Screw

Figure 2 - Instrument Cluster (Syclone and Typhoon)



8. Odometer
9. Trip Odometer
16. Tachometer
20. Cluster Case Retaining Screw
21. Lens Retaining Screw

Figure 3 - Instrument Cluster (Sonoma GT)

switch (22).

7. Screws (19) from A/C and heater control assembly (2).
8. A/C and heater control assembly (2).
9. A/C and heater control assembly harness.
10. Power outside rearview mirror switch harness.
11. Screws (13) from filler panel (14).
12. Filler panel (14).
13. Nuts (10) from instrument cluster housing (12).
14. Instrument cluster housing (12).
15. Nuts (10) from instrument cluster (11).
16. Instrument cluster (11).

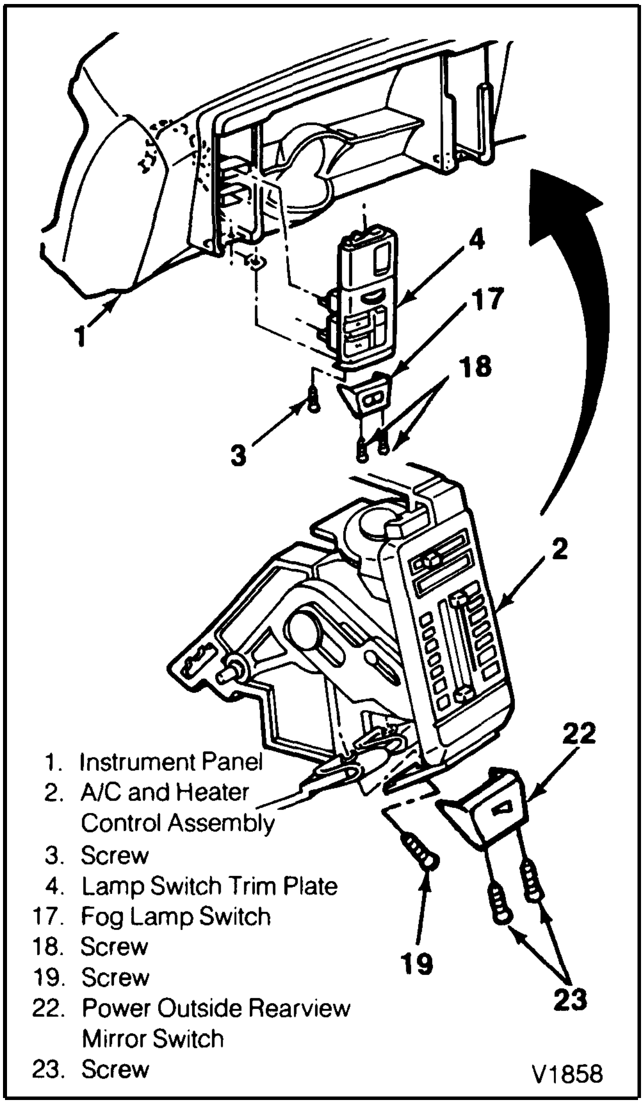
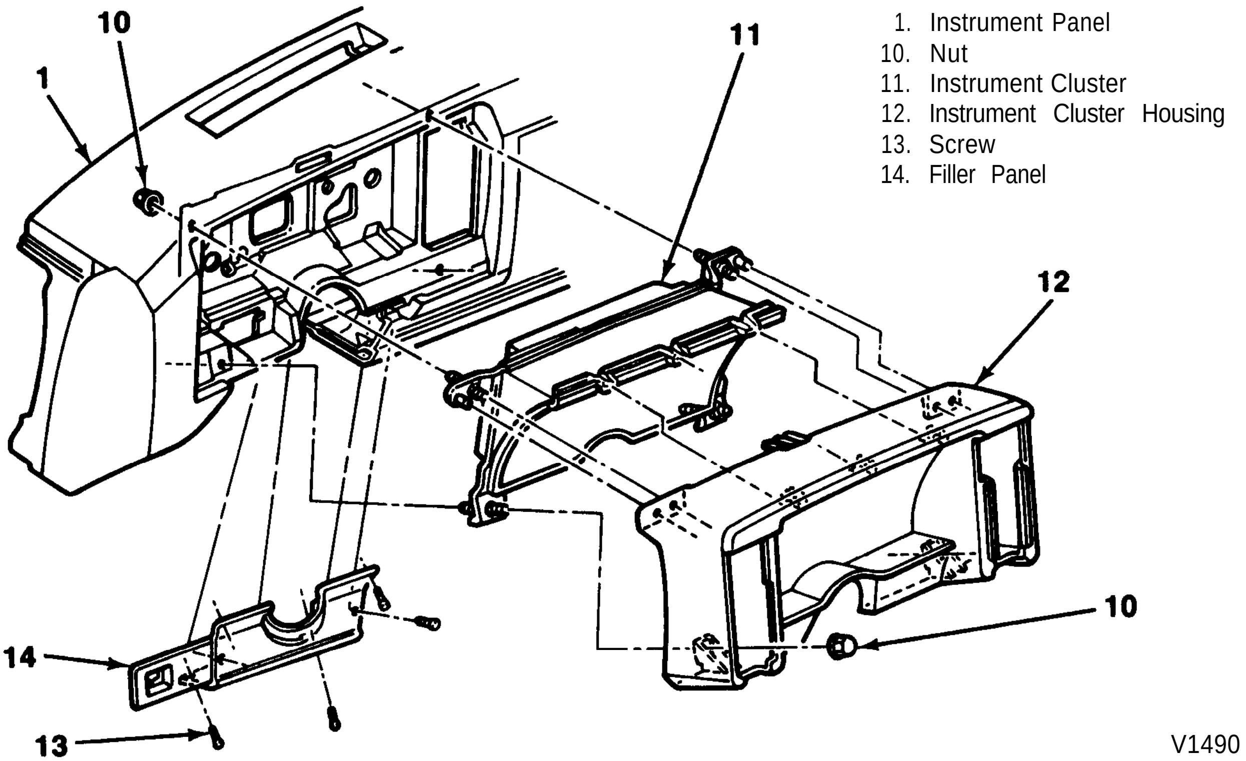


Figure 4 - Instrument Panel Controls

→← Install or Connect (Figures 2 through 5)

1. Instrument cluster (11).
2. Nuts (10) to instrument cluster (11).
3. Instrument cluster housing (12).
4. Nuts (10) to instrument cluster housing (12).
5. Filler panel (14).
6. Screws (13) to filler panel (14).
7. Power outside rearview mirror switch harness.
8. A/C and heater control assembly harness.
9. A/C and heater control assembly (2).
10. Screws (19) to A/C and heater control assembly (2).
11. Screws (23) to power outside rearview mirror switch (22).
12. Lamp switch harness.
13. Lamp switch trim plate (4).
14. Screws (3) to lamp switch trim plate (4).
15. Screws (18) to fog lamp switch (17).
16. Negative (-) battery cable.



1. Instrument Panel
10. Nut
11. Instrument Cluster
12. Instrument Cluster Housing
13. Screw
14. Filler Panel

Figure 5 - Instrument Panel Components

SECTION 9A

AUDIO SYSTEMS

CONTENTS

DESCRIPTION

For operational procedures of the Sonoma GT, Syclone and Typhoon radios, refer to the 1992 Sonoma GT Owner's Manual Supplement and the 1992 Syclone and Typhoon Owner's Manual Supplement.

ON-VEHICLE SERVICE

For service procedures refer to the 1992 Service Manual Sonoma and Jimmy Models. Sonoma GT, Syclone and Typhoon vehicles will be equipped with a special antenna jumper. Be sure that any time the antenna cable is replaced, the antenna jumper is reinstalled if removed.

SECTION 9B

CRUISE CONTROL

SYCLONE AND TYPHOON

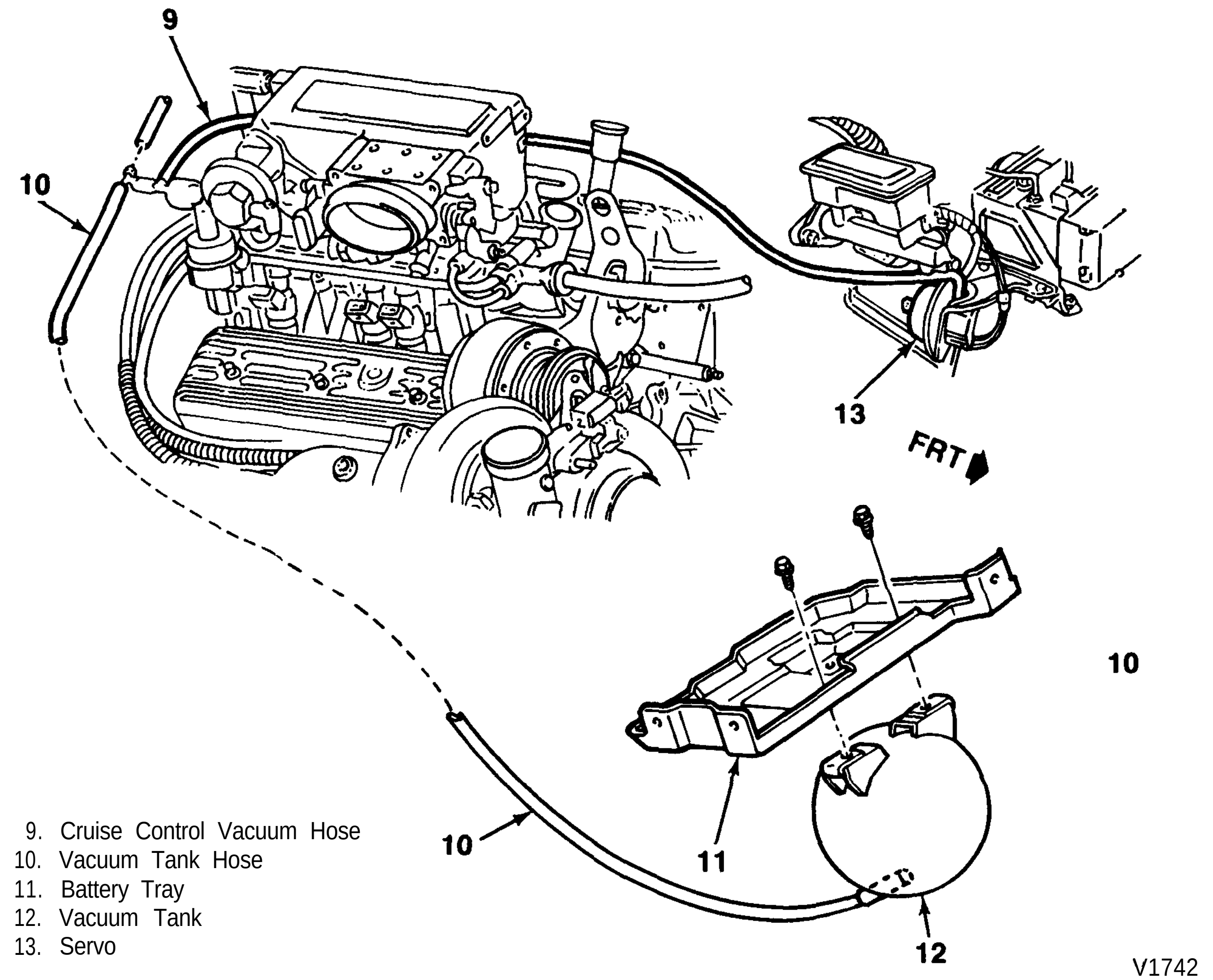
NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be ceiled out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

SERVO REPLACEMENT

Figure 1 shows the vacuum hose routing for the 1992 Syclone and Typhoon and should be used in conjunction with the appropriate figure in CRUISE CONTROL (SEC. 9B) in the 1992 Service Manual Sonoma and Jimmy Models.



9. Cruise Control Vacuum Hose
10. Vacuum Tank Hose
11. Battery Tray
12. Vacuum Tank
13. Servo

Figure 1 - Cruise Control Vacuum Hose Routing

SECTION 9K

REMOTE KEYLESS ENTRY

TYPHOON

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

CONTENTS

DESCRIPTION

The keyless entry system operates by means of remote control, to lock and unlock the doors and release the rear end gate glass. A receiver is installed in the console between the storage compartment and the rear of the console. The transmitter is hand held and attached to a key ring. The transmitter has three buttons that control the operation of the system. It emits a coded UHF radio signal, that is received by the keyless entry module, if the transmitter is within approximately 10 meters (33 feet) of the vehicle. The system has no effect on the normal operation of the locks or end gate release as long as the module is operational (not defective) and is connected to its harness. The transmitter is battery powered, water resistant, and supplied in pairs to each vehicle. The receiver is only capable of recognizing two transmitters per vehicle. Replacement transmitters may be obtained but must be matched to the receiver.

REMOTE CONTROL OPERATION

TO UNLOCK DOORS

When the "UNLOCK" button is pressed on the transmitter, the signal is received by the keyless entry module and unlocks the driver door only (figure 1).

When the "UNLOCK" button is pressed a second time, within 1 to 5 seconds of the first, the remaining door will unlock.

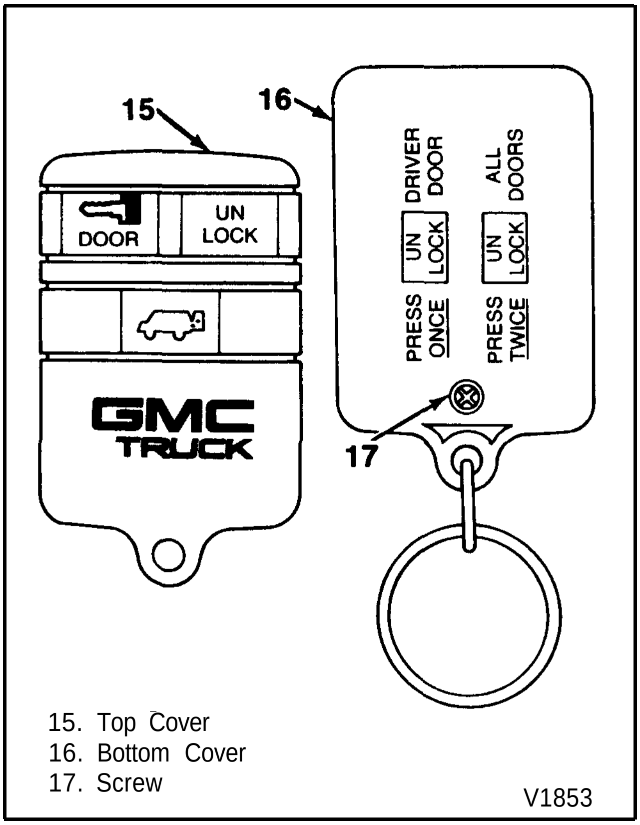


Figure 1 - Keyless Entry System Transmitter (Typhoon)

When the “END GATE RELEASE” symbol is depressed, the rear glass is unlocked from the end gate.

TO LOCK DOORS

Press the “DOOR KEY” symbol to lock all the doors at once.

DIAGNOSIS OF THE KEYLESS ENTRY SYSTEM

Refer to the Sonoma GT/Syclone/Typhoon Models Electrical Diagrams and Diagnosis Manual, the last section in this manual.

ON-VEHICLE SERVICE

KEYLESS ENTRY RECEIVER

Remove or Disconnect (Figures 2 and 3)

1. Shifter button (1) with spring (2).
2. Snap ring (3).
3. Knob (4).
4. Bolts (32) from plate assembly (31) and console assembly (34).
5. Plate assembly (31).
6. Gear indicator light bulb sockets from bottom of plate assembly (31).
7. Bolts (29) from nuts (22).
8. Bolts (30) from console assembly (34) and brace assembly (20).
   - Reposition console assembly (34) for access.
9. Remote keyless entry bracket screws (43).
10. Remote keyless entry receiver (38) and bracket (44) from console bin (41).
11. Remote keyless entry connectors (37).
12. Remote keyless entry receiver (38) from bracket (44) by removing screws (42).

Install or Connect (Figures 2 and 3)

NOTICE: For steps 6, 7 and 10 see “Notice” on page 9K-1 of this section.

1. Remote keyless entry receiver (38) to bracket (44) by installing screws (42).
2. Remote keyless entry connectors (37).
3. Remote keyless entry receiver (38) and bracket (44) to console bin (41).
4. Remote keyless entry bracket screws (43).
5. Console assembly (34) to brace assembly (20).
6. Bolts (30) to console assembly (34) and brace assembly (20).

Tighten

- Bolts (30) to 6.5 N•m (58 in. lbs.).

7. Bolts (29) through console bin (41) and brace assembly (20) to nuts (22).

Tighten

- Bolts (29) to 1.9 N•m (17 in. lbs).

8. Gear indicator light bulb sockets to bottom of plate assembly (31).
9. Plate assembly (31).
10. Bolts (32) to plate assembly (31) and console assembly (34).

Tighten

- Bolts (32) to 1.8 N•m (16 in. lbs.).

11. Knob (4).
12. Snap ring (3).
13. Shifter button (1) with spring (2).
   - If programming the system is necessary, refer to “Coding the Transmitter” in this section.

TRANSMITTER BATTERY REPLACEMENT

Remove or Disconnect (Figure 1)

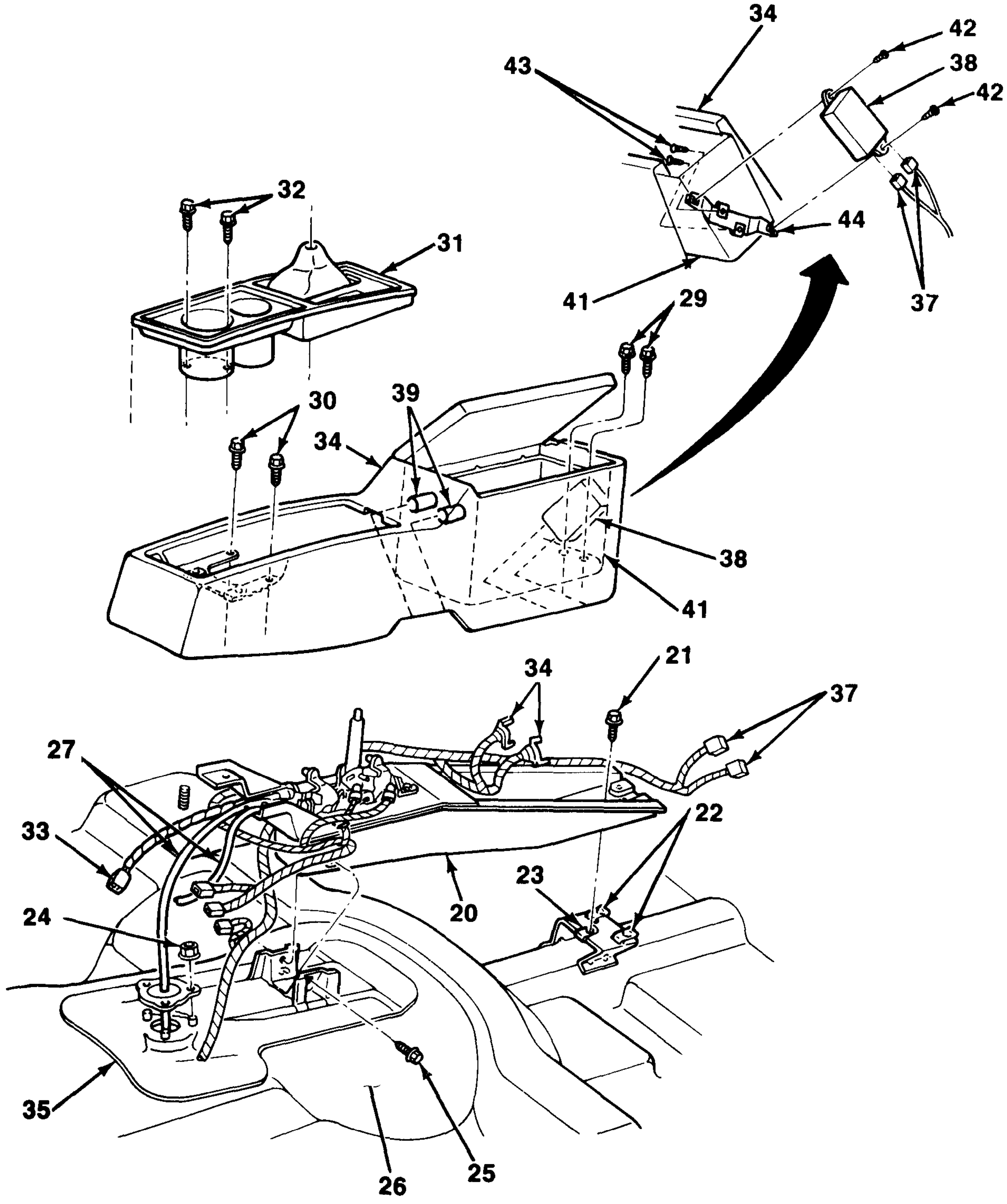
1. Screw (17) from bottom cover (18) and top cover (15).
2. Top cover (15).
3. Battery.

Install or Connect (Figure 1)

1. Battery.
2. Top cover (15).
3. Screw (17) through bottom cover (16) into top cover (15).
   - Test transmitter operation. Refer to “Remote Control Operation” in this section.

CODING THE TRANSMITTER

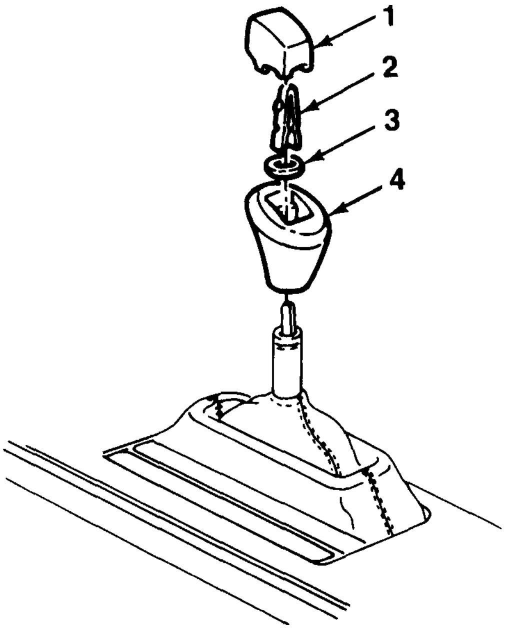
1. Turn ignition switch to “OFF.”



20. Brace Assembly
21. Bolt
22. Nut
23. Nut
24. Nut
25. Bolt
26. floor Pan
27. Cable
29. Bolt
30. Bolt
31. Plate Assembly
32. Bolt
33. Electrical Connector
34. Console Assembly
35. Floor Patch Assembly
36. Power Auxiliary Outlet Connector
37. Remote Keyless Entry Connector
38. Remote Keyless Entry Receiver
39. Power Auxiliary Outlet
41. Console Bin
42. Screw
43. Screw
44. Bracket

V3205

Figure 2 - Console Assembly



1. Shifter Button
2. Spring
3. Snap Ring
4. Knob

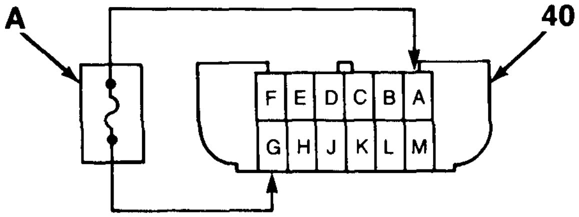
V1448

Figure 3 - Shifter

2. Jumper program connector terminal “A”. (BLK/ WHT) to terminal “G” (PPL) on assembly line diagnostic link (ALDL) connector (40). Door locks will lock and unlock in approximately two seconds (figure 4).

3. Press “UNLOCK” button on transmitter. Door lock will lock and unlock in approximately two seconds. The transmitter is now programmed.

4. Disconnect jumper from assembly line diagnostic link (ALDL) connector (40).



A. Fused Jumper
40. Assembly Line Diagnostic Link (ALDL) Connector

V1867

Figure 4 - Coding the Transmitter

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	In. Lbs.
Console Assembly-to-Brace Assembly Bolt	6.5	58
Console Bin-to-Brace Assembly Bolt.	1.9	17
Plate Assembly-to-Console Assembly Bolt	1.8	16

V1741

SECTION 9O

TONNEAU COVER

SONOMA GT AND SYCLONE

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener Is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

TONNEAU COVER REPLACEMENT

Remove or Disconnect (Figures 1 through 3)

1. Cover, partially.
    - Unsnap cover at rear rail first.
    - Unsnap sides from rear to front.
2. One corner of front rail.
    - Remove corner bolt (1).
    - Slide first snap out of front rail.
3. Cover at front rail by sliding rod in cover out of front rail.
4. Bows (2) front and rear.
    - Remove hair pin (3).
    - Lift out bow (2) from both sides.
5. Bolts (4) from large brackets (5) short brackets (6) and spacers (7) by loosening nuts (8).
6. Spacers (7).
7. Bolts (1) from corners of side rails.
8. Rear rail with corners from side rails.
9. Nuts (8) by sliding them out of side rails.
10. Side rails.
11. Four large brackets (5) by sliding them out of inside of vehicle.
12. Four short brackets (6) by sliding them out of inside of vehicle.
    - It may be necessary to loosen bolts (4) on large bracket (5) and short bracket (6) to slide them out of the side rails.

Install or Connect (Figures 1 through 3)

Clean

- All vehicle surfaces where the rails will come in contact.

- Loosen bolts (4) on all large brackets (5) and short brackets (6) 2½ turns. This will allow them to slide easily into inside of vehicle.

1. Two short brackets (6) (one each side) 15.2 cm (6 inches) from front, and two short brackets (6) (one each side) 20.3 cm (8 inches) from rear of vehicle bed.
2. Two large brackets (5) (one each side) marked "Front" 55.9 cm (22 inches) from front, and two large brackets (5) (one each side) marked "Rear" 55.9 cm (22 inches) from rear of the bed.

Disassemble

- All eight bolt (4), spacer (7) and nut (8) assemblies.

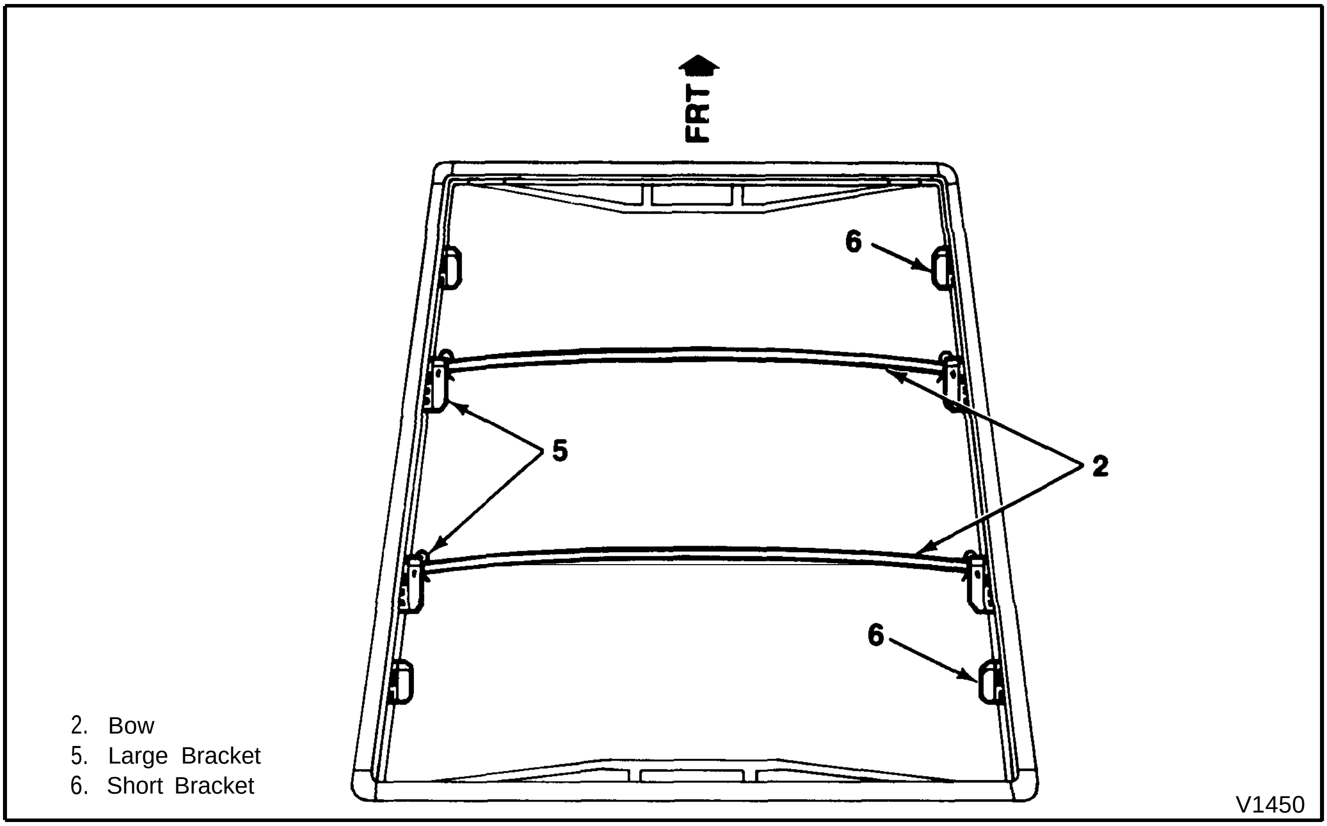


Figure 1 - Tonneau Frame and Brackets

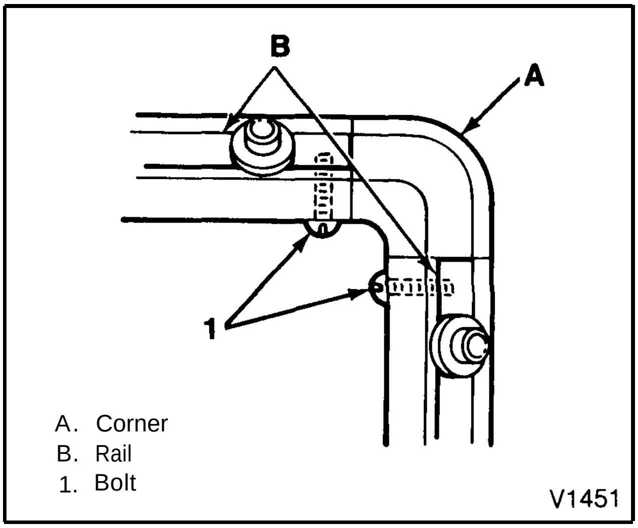
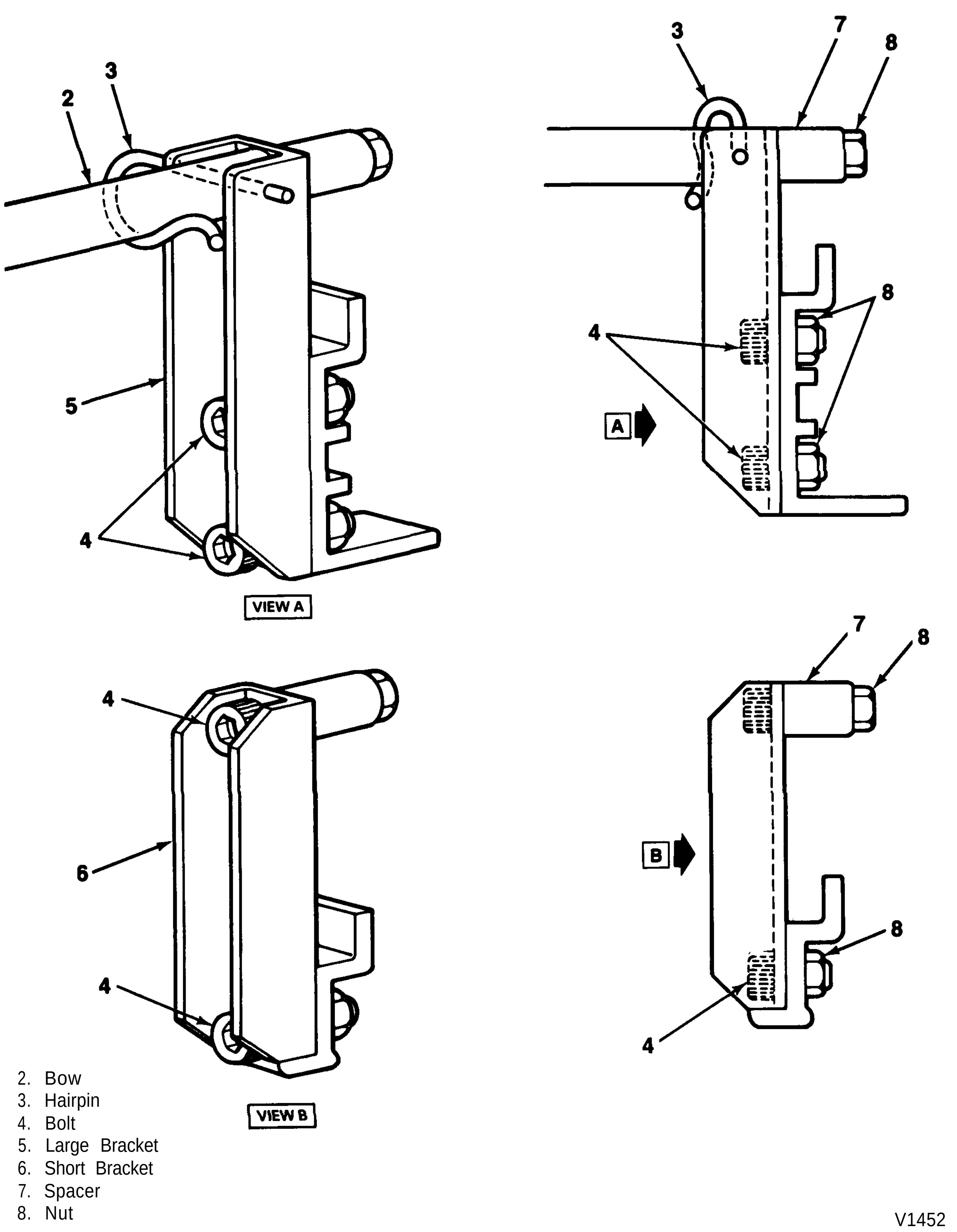


Figure 2 - Corners and Screws

3. Side rails on vehicle.
   - It may be necessary to replace the old adhesive with new double-sided foam tape.
4. Four nuts (8) through ends of each side rail. Slide in to fit behind previously-installed large and short brackets (5 and 6).
5. Bolts (1) through corners of end rails from the inside out, and loosely attach nuts.
6. Rear rail with corners into side rails.
   - It may be necessary to replace the old adhesive with new double-sided foam tape.
   - Position rear rail so that inside of rail is flush with inside of end gate.
   - Position side rail so that the distance from side rail to outside edge of truck is approximately equal to distance from rear rail to outside edge of end gate.
7. Spacers (7) taped side down, between each large and short bracket (5 and 6) and side rail.
   - It may be necessary to replace the old adhesive with new double-sided foam tape.
8. Bolts (4) through large and short brackets (5 and 6) and spacers (7) into nuts (8) and tighten.
9. Bows (2) front and rear.
   - Slide unnotched end of bow (2) over head of top bolt (4) of large bracket (5). Drop other end of bow (2) over head of bolt (4) on opposite large bracket (5).
   - Insert hairpin (3) through aligned holes, bent leg under bow.
10. Cover at front rail.
    - Unscrew bolt (1) in corner of front rail and remove.
    - Remove first snap.
    - Unroll cover and slide end with rod sewn in it through end of front rail.
    - Replace snap and corner that was removed, and tighten bolt (1).
    - Apply additional double-sided foam tape under corner, if necessary.
11. Front rail corners into side rails and tighten bolts (1).



2. Bow
3. Hairpin
4. Bolt
5. Large Bracket
6. Short Bracket
7. Spacer
8. Nut

Figure 3 - Brackets

12. Cover.
    - Stretch cover over bows (2) to rear of vehicle.
    - Snap 2 snaps on each corner.
    - Snap sides from front to rear starting at a corner, and snap the rear rail last, smoothing out all wrinkles or bulges on outside of cover.
    - The front and rear trusses are adjustable. If the cover becomes loose, look for a rail (especially the rear) that is bent towards the bed. Remove rail and loosen bolts holding the truss. The rail should now be straight. While supporting the ends, put slight pressure outward in the center of rail and tighten all bolts. Front and rear rails should have a slight outward bow of 3.2-6.4 mm (1/8-1/4 inch) without the cover attached. If front or rear rail is removed, be sure to remove snaps from the side rails.
    - The bow (2) should have at least a 25.4 mm (1-inch) bow in the center as measured from the ground to the bottom of bow (2); 38.1 mm (1½ inches) is ideal.

SECTION 10A

DOORS

SYCLONE AND TYPHOON

NOTICE: When fasteners are removed, a/ways reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener Is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

MOLDING

Remove or Disconnect (Figure 1)

- Raise and suitably support vehicle as described in GENERAL INFORMATION (SEC. 0A) in the 1992 Service Manual Sonoma and Jimmy Models.

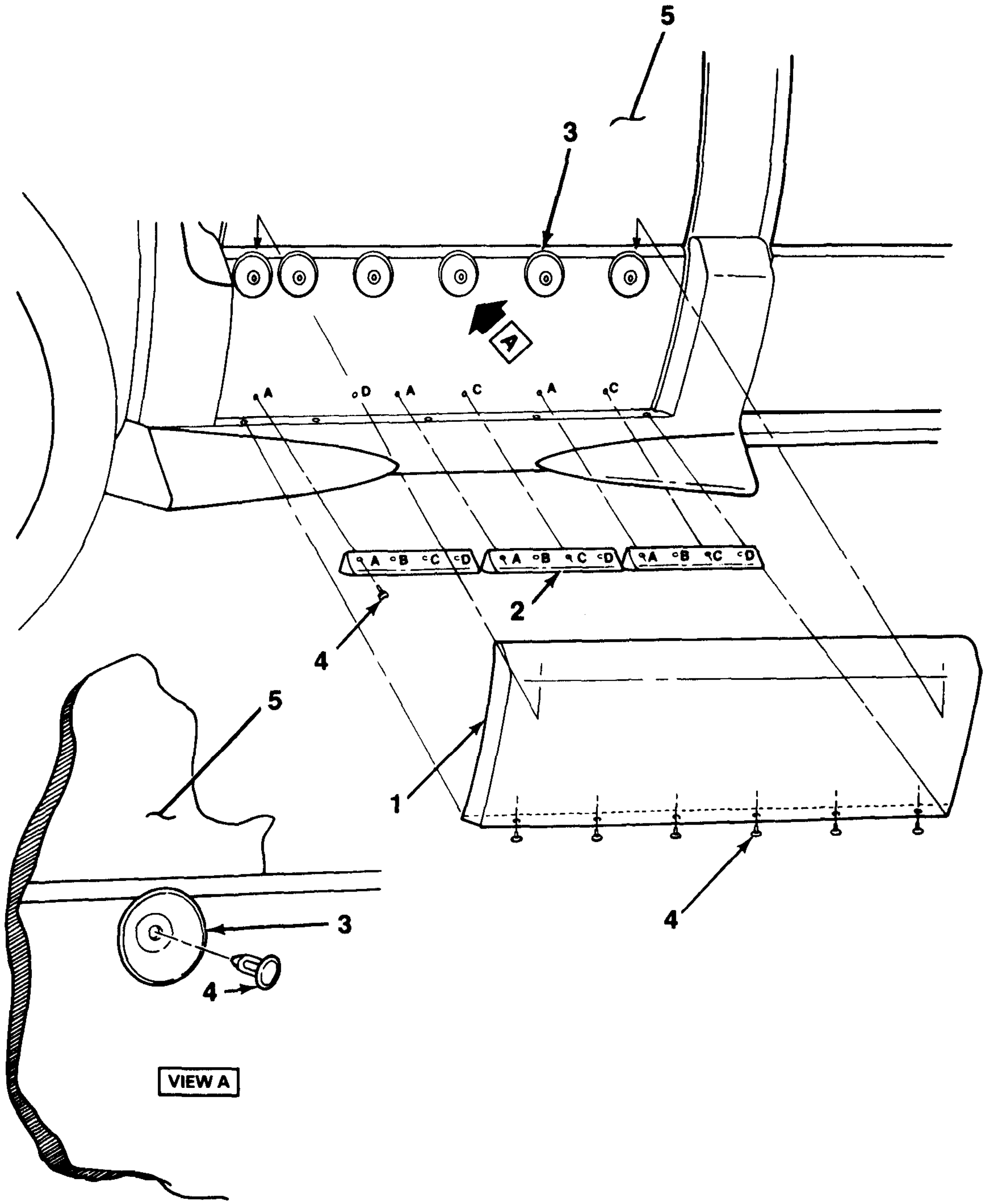
1. Rivets (4) from bottom of molding (1) using a drill and a 15/64-inch drill bit.
2. Molding (1) by pulling bottom of molding (1) away from door (5) and lifting top of molding (1) up.
3. Retainers (2) if necessary, by drilling out rivets (4) using a drill and a 15/64-inch drill bit.
4. Clips (3), if necessary.
    - Using a drill and a 15/64-inch drill bit, remove rivets (4).

Install or Connect (Figure 1)

NOTICE: For steps 1, 2 and 4 see "Notice" on page 10A1-1 of this section.

1. Clips (3) if removed, using rivets (4).
2. Retainers (2) if removed, using rivets (4).
    - For the left door, use holes A and D in the forward retainer (2) and holes A and C in the middle and rear retainers (2).
    - For the right door, use holes A and D in the forward retainer (2) and holes B and D in the middle and rear retainers (2).
3. Molding (1) by installing top of molding (1) to clips (3) and bottom of molding (1) to retainers (2).
4. Rivets (4) to bottom of molding (1).

- Lower vehicle.



1. Molding
2. Retainer
3. Clip
4. Rivet
5. Door

V1751

Figure 1 - Door Molding (Left Door Shown, Right Door Similar)

SECTION 10A2

SEATS

SYCLONE AND TYPHOON

CONTENTS

ON-VEHICLE SERVICE

LUMBAR COMPONENT AND SEATBACK COVER REPLACEMENT

Remove or Disconnect (Figure 1)

1. Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

Disassemble

- Seat, with the exception of seatback stop, as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

2. Lumbar hose (2).
   - Pull lumbar hose (2) off bulb/valve assembly (1) and pull out of seat cushion.

- Unzip zipper.
- Pull seat cover (6) up enough to expose rods (7).

3. Retainer rings (8).
4. Rods (7) out of seat cover (6).

- Pull up seat cover (6) by working it up slowly.

5. Lumbar hose (2) from bladder (5).
6. Bladder (5) out of pocket in seat cover (6).
7. Retainer rings (4) on the bottom of the inboard side of seat cushion.

Install or Connect (Figure 1)

1. Bladder (5) into pocket in seat cover (6).
2. Lumbar hose (2) to bladder (5).
3. Seat cover (6) down over seatback, if removed all the way.
4. Rods (7) through fabric loops and underneath horizontal rod near top of seat.
5. Looped end of rods (7) to seat frame with retainer rings (8).

- Close the zipper.
- Route lumbar hose (2) under inboard side of seat cushion cover (3), up through slot in side of seat cushion cover (3).

6. Retainer rings (4) to inboard side of seat cushion.
7. Lumbar hose (2) to bulb/valve assembly (1).

Assemble

- Seat, with exception of seatback stop, as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

8. Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

SEAT CUSHION REPLACEMENT

Remove or Disconnect (Figure 1)

1. Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

Disassemble

- Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

2. Lumbar hose (2).
   - Pull lumbar hose (2) off bulb/valve assembly (1) and pull out of seat cushion.
3. Retainer rings (4) from seat cushion bottom.
4. Seat cushion cover (3).

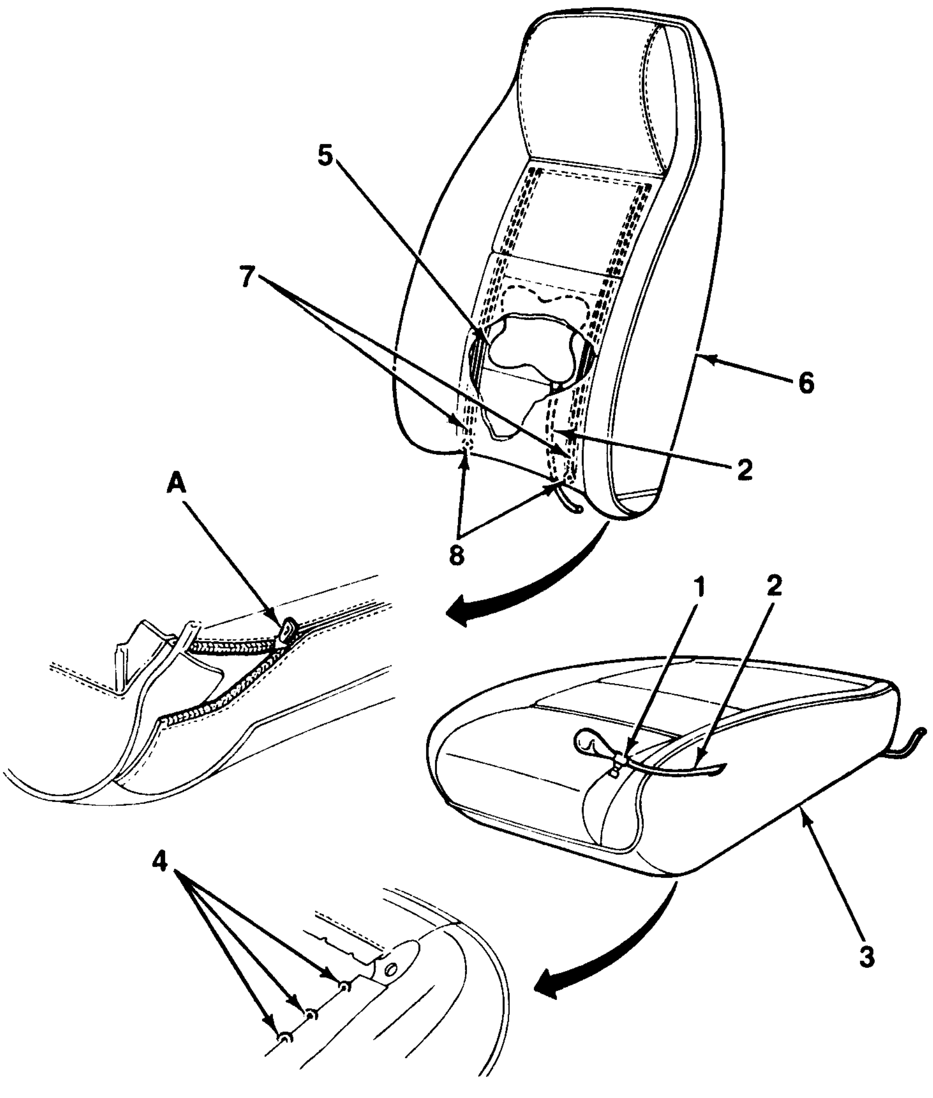
Install or Connect (Figure 1)

1. Seat cushion cover (3) over seat cushion.
2. Lumbar hose (2) under inboard side of seat cushion cover (3) up through slot in side of seat cushion cover (3).
3. Bulb/valve assembly (1) to lumbar hose (2).
4. Retainer rings (4) to seat cushion bottom.

Assemble

- Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.

5. Seat as described in SEATS (SEC. 10A2) in the 1992 Service Manual Sonoma and Jimmy Models.



A. Zipper
1. Bulb/Valve Assembly
2. Lumbar Hose
3. Seat Cushion Cover
4. Retainer Ring
5. Bladder
6. Seat Cover
7. Rod
8. Retainer Ring

V1810

Figure 1 - Lumbar Components

SECTION 10A4

INTERIOR TRIM

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

CONTENTS

ON-VEHICLE SERVICE

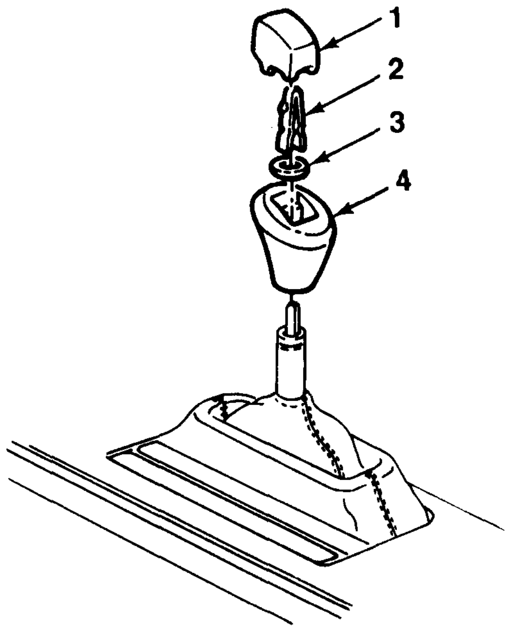
REAR CARPET PANEL REPLACEMENT

For rear carpet panel replacement, follow procedure as described in INTERIOR TRIM (SEC. 10A4) in the 1992 Service Manual Sonoma and Jimmy Models with the exception of using the special tool indicated. Use special tool J 24595-C.

CONSOLE ASSEMBLY REPLACEMENT

↔ Remove or Disconnect (Figures 1, 2 and 3)

1. Shifter button (1) with spring (2).
2. Snap ring (3).
3. Knob (4).
4. Bolts (32) from console assembly (28 or 34).
5. Gear indicator light bulb sockets from bottom of plate assembly (31).
6. Plate assembly (31).
7. Power auxiliary outlet connectors (38) from power auxiliary outlets (39) on Typhoon.
8. Bolts (29) from nuts (22).
9. Bolts (30) from brace assembly (20).
10. Console assembly (28 or 34).
11. Remote keyless entry connectors (37) from remote keyless entry receiver (38) on Typhoon.
12. Shift control cable and park lock cable. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in this manual.
13. Electrical connector (33).
14. Bolt (21) from nut (23).
15. Bolts (25) from nuts (24).
16. Brace assembly (20) from floor pan (26).



1. Shifter Button
2. Spring
3. Snap Ring
4. Knob

Figure 1 - Shifter

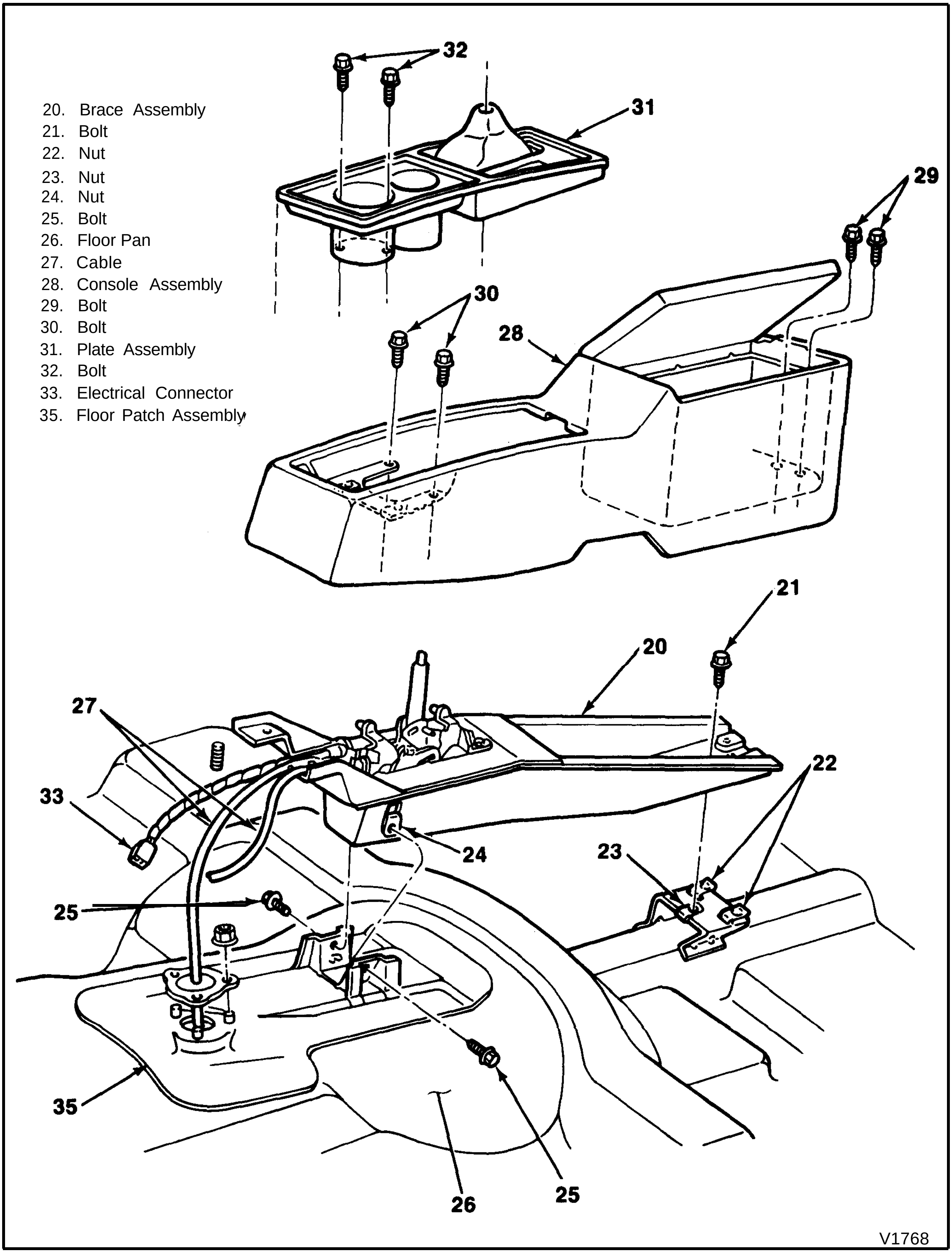


Figure 2 - Console Assembly (Sonoma GT and Syclone)

20. Brace Assembly
21. Bolt
22. Nut
23. Nut
25. Bolt
26. Floor Pan
27. Cable
29. Bolt
30. Bolt
31. Plate Assembly
32. Bolt
33. Electrical Connector
34. Console Assembly
35. Floor Patch Assembly
36. Power Auxiliary Outlet Connector
37. Remote Keyless Entry Connector
38. Remote Keyless Entry Receiver
39. Power Auxiliary Outlet

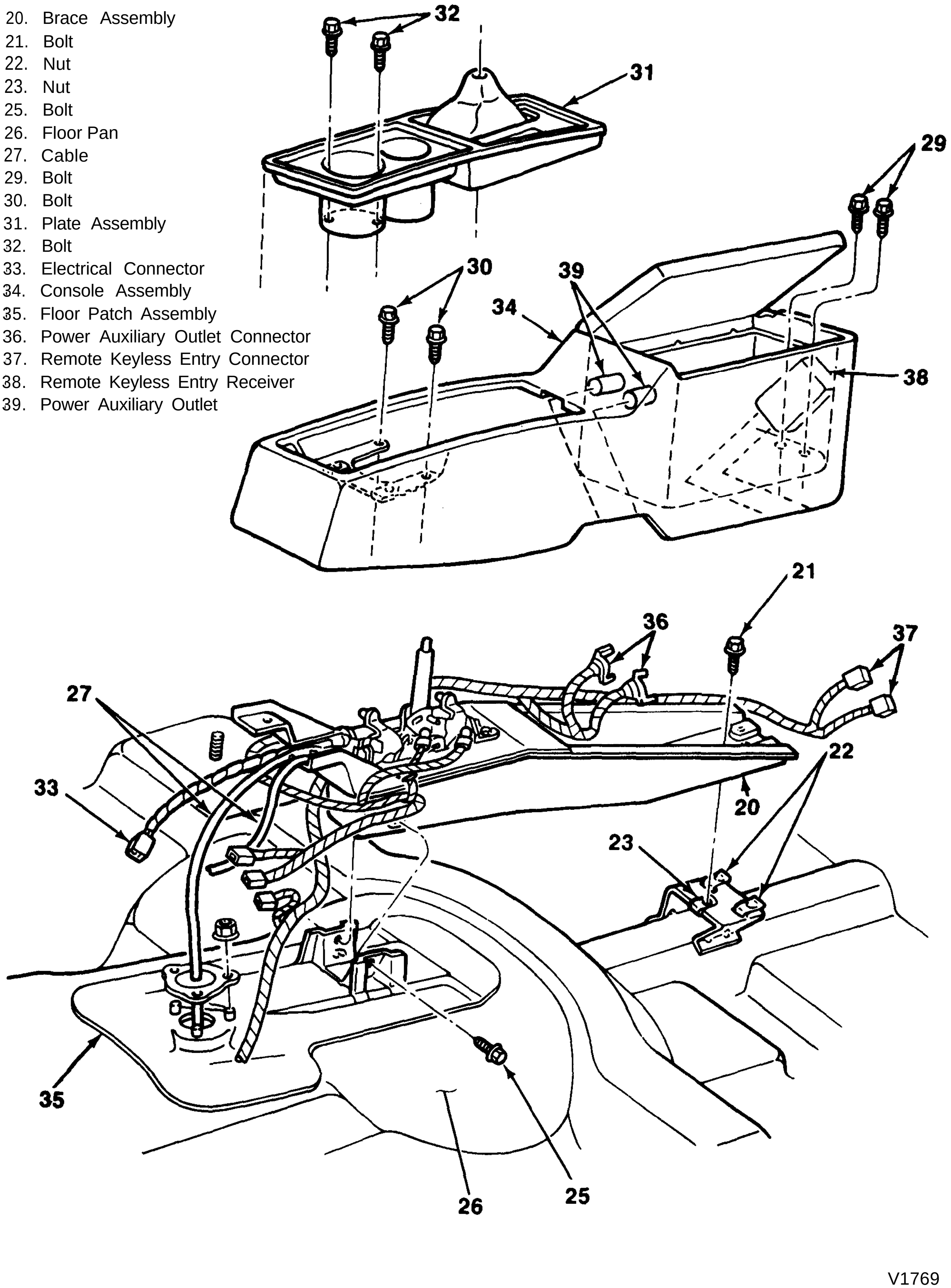


Figure 3 - Console Assembly (Typhoon)

Install or Connect (Figures 1, 2 and 3)

NOTICE: For steps 2, 3, 8, 9 and 13 see "Notice" on page 10A4-1 of this section.

1. Brace assembly (20) to floor pan (26).
2. Two bolts (25) to nuts (24).
3. Bolt (21) to nut (23).

Tighten

- Bolts (25) and bolt (21) to 6.5 N•m (58 in. lbs.).

4. Electrical connector (33).
5. Shift control cable and park lock cable. Refer to 4L60 AUTOMATIC TRANSMISSION (SEC. 7A1) in this manual.
6. Remote keyless entry connectors (37) to remote keyless entry receiver (38), on Typhoon.
7. Console assembly (28 or 34) over brace assembly (20).
8. Bolts (30) to brace assembly (20).

Tighten

- Bolts (30) to 6.5 N•m (58 in. lbs.).

9. Bolts (29) to nuts (22).

Tighten

- Bolts (29) to 1.9 N•m (17 in. lbs.)

10. Power auxiliary outlet connectors (36) to power auxiliary outlets (39), on Typhoon.
11. Gear indicator light bulb sockets to bottom of plate assembly (31).
12. Plate assembly (31).
13. Bolts (32) to console assembly (28 or 34).

Tighten

- Bolts (32) to 1.8 N•m (16 in. lbs.).

14. Knob (4).
15. Snap ring (3).
16. Shifter button (1) with spring (2).

POWER AUXILIARY OUTLETS

Typhoon

Remove or Disconnect (Figures 1 and 3)

1. Shifter button (1) with spring (2).
2. Snap ring (3).
3. Knob (4).
4. Bolts (32) from console assembly (34).
5. Gear indicator light bulb sockets from bottom of plate assembly (31).
6. Plate assembly (31).
7. Power auxiliary outlet connectors (38).
8. Power auxiliary outlets (39) by unscrewing from console assembly (34).

Install or Connect (Figures 1 and 3)

1. Power auxiliary outlets (39) by screwing into console assembly (34).
2. Power auxiliary outlet connectors (36).
3. Gear indicator light bulb sockets to bottom of plate assembly (31).
4. Plate assembly (31).

NOTICE: See "Notice" on page 10A4-1 of this section.

5. Bolts (32) to console assembly (34).

Tighten

- Bolts (32) to 1.8 N•m (16 in. lbs.).

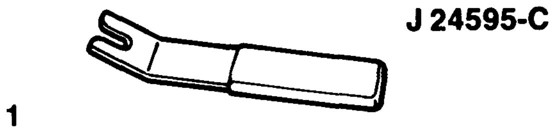
6. Knob (4).
7. Snap ring (3).
8. Shifter button (1) with spring (2).

SPECIFICATIONS

FASTENER TORQUE SPECIFICATIONS

	N•m	**In. Lbs.**
Brace Assembly Bolt	6.5	58
Rear Console Assembly Bolt	1.9	17
Front Console Assembly Bolt	6.5	58
Plate Assembly Bolt	1.8	16
Floor Patch Assembly Bolt	6.5	58

SPECIAL TOOLS



1. Door Trim Pad and Garnish Clip Remover

V1460

SONOMA GT
SYCLONE
TYPHOON

ELECTRICAL DIAGRAMS AND DIAGNOSIS MANUAL

The information provided in this supplement includes the complete engine wiring harness and a partial instrument panel wiring harness for the 1992 Syclone and Typhoon models. Also included are the Typhoon-specific power door lock, remote keyless entry and electronic level control harnesses.

All of the components and harnesses shared by the Sonoma GT, Syclone or Typhoon and the Sonoma or Jimmy may not appear in this supplement. A reference to the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual will be made when necessary.

Most of the references made in this supplement to the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual apply to the diagrams for Sonoma and Jimmy models with a 4.3L engine, a gage style instrument cluster and four-wheel antilock brakes.

For diagnosis procedures of circuits shared by the Sonoma GT, Syclone or Typhoon and the Sonoma or Jimmy, refer to the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

1992 SONOMA GT/ SYCLONE/TYPHOON

BLANK

SYMPTOM INDEX

GENERAL DESCRIPTION

Changes made to regular production 1992 Sonoma and Jimmy models for the Syclone and Typhoon electrical system include the addition of all turbocharger components, ECM, I/P cluster and the addition of the console.

Further differences include the addition of the Electronic Level Control and Remote Keyless Entry systems for Typhoon.

The fuse block retains the CRANK fuse for the Sonoma GT. This fuse is replaced, on the Typhoon, with the ELC (electronic level control) fuse. The DRL fuse is not used.

The Sonoma GT I/P cluster is not the same as the one used on Syclone and Typhoon. The Sonoma GT does not have a turbocharger or antilock brakes.

Some circuit numbers or wire colors and size may have changed, but the circuit operation remains the same as the 1992 Sonoma and Jimmy Models.

BLANK

CIRCUIT OPERATION

The circuit operation for the starting and charging circuits is the same as described in the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

DIAGNOSIS - STARTING AND CHARGING

BATTERY IS UNDERCHARGED OR OVERCHARGED

TEST	RESULT	ACTION
1. Disconnect generator connector C118. Place ignition switch in RUN position. Connect voltmeter from PNK/BLK (39) wire at generator connector Cl 18 to ground.	Battery voltage.	GO to step 2.
	No voltage.	CHECK condition of IGN/GAUGES fuse. If fuse is good, LOCATE and REPAIR open in PNK/BLK (39) wire from generator connector C118 to fuse block.
2. Connect voltmeter from BLK/RED (2) wire at generator to ground.	Battery voltage.	GO to step 3.
	No voltage.	REPLACE battery positive cable.
3. Reconnect generator connector C118 and terminal. Have all accessories turned off and engine running at fast idle. Connect voltmeter from battery terminal (2) on generator to ground.	Reading of 13-16 volts.	PERFORM Battery Load Test. Refer to BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.
	Reading of less than or greater than 13-18 volts.	PERFORM Generator Bench Test. Refer to BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models.

ENGINE DOES NOT CRANK AND STARTED SOLENOID DOES NOT CLICK

TEST	RESULT	ACTION
1. Place transmission in PARK. Connect a voltmeter from PPL (6) wire at starter motor solenoid to ground. Turn ignition switch to START position.	Battery voltage.	GO to step 2.
	No voltage.	GO to step 3.
2. Connect voltmeter from PPL (6) wire to starter mounting bolts.	Battery voltage.	REPLACE starter motor solenoid.
	Less than battery voltage.	CLEAN starter motor mounting bolts, starter motor, and mounting surface.
3. Disconnect neutral safety switch connector C384. Connect voltmeter from YEL (5) wire at neutral safety switch connector C384 to ground. Ignition switch must be in START position.	Battery voltage.	GO to step 4.
	No Voltage.	LOCATE and REPAIR open in YEL (5) wire from neutral safety switch to ignition switch. If wire is in good condition, GO to step 5.
4. Connect a fused jumper from YEL (5) to PPL (6) at neutral safety switch connector C384. Turn ignition switch to START position.	Engine cranks.	REPLACE neutral safety switch.
	Engine does not crank.	LOCATE and REPAIR open in PPL (6) wire from neutral safety switch to starter motor solenoid.
5. With ignition switch OFF, connect a voltmeter from BAT 2 terminal at ignition switch connector C301 to ground. Repeat step except connect from BAT 3 terminal to ground.	Battery voltage.	REPLACE ignition switch.
	No voltage.	CHECK condition of STOP/HAZ fuse. If fuse is good, LOCATE and REPAIR open in RED (2) wires and fusible link at generator.

STARTER SOLENOID CLICKS, ENGINE DOES NOT CRANK OR CRANKS SLOWLY

TEST	RESULT	ACTION
1. Remove battery lead from generator. Connect a voltmeter to positive and negative battery terminals. Turn ignition switch to START.	Voltage reading greater than 9.5 volts after 15 seconds cranking.	GO to step 2.
	Voltage less than 9.5 volts after 15 seconds cranking.	PERFORM a Battery Load Test. REFER to BATTERY (SEC. 6D1) in the 1992 Service Manual Sonoma and Jimmy Models. If battery passes load test, REPAIR starter motor.
2. Connect a voltmeter from negative battery terminal to engine block.	Less than .5 volts.	GO to step 3.
	More than .5 volts.	REPLACE negative battery cable.
3. Connect voltmeter from positive battery terminal to starter solenoid terminal at BLK (19) wire.	Less than 9 volts.	REPLACE positive battery cable.
	More than 9 volts.	REPAIR starter motor.

CIRCUIT OPERATION

The circuit operation for the digital ratio adapter controller (DRAC) is the same as described in the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

DIAGNOSIS - DIGITAL RATIO ADAPTER CONTROLLER

SPEED SENSOR COMPONENTS DO NOT OPERATE PROPERLY

TEST	RESULT	ACTION
1. Place ignition switch in RUN position and disconnect DRAC connector C309. Connect voltmeter from PNK/BLK (350) wire at DRAC connector C309 to ground.	Battery voltage.	GO to step 2.
	No voltage.	CHECK condition of BRAKE fuse. If fuse is good, LOCATE and REPAIR open in PNK/BLK (350) wire.
2. Connect voltmeter from PNK/BLK (350) wire to BLK (150) wire at DRAC connector C309.	Battery voltage.	GO to step 3.
	No voltage.	LOCATE and REPAIR open in BLK (150) wire from DRAC to ground terminal G302.
3. Properly support the vehicle so drive wheels are off the ground. Have engine running and gear selector in DRIVE. Connect an A/C voltmeter from PPL/WHT (821) wire to LT GRN/BLK (822) wire at DRAC connector C309.	A/C voltage reading.	GO to step 4.
	No voltage.	CHECK for open in PPL/WHT (821) and LT GRN/BLK (822) wires. If wires are good, REPLACE speed sensor.
5. Reconnect DRAC connector C309. Connect A/C voltmeter from LT BLU/BLK (824) wire to BLK (150) wire at connector C309.	A/C voltage reading.	LOCATE and REPAIR open in LT BLU/BLK (824) wire from DRAC to I/P cluster connector C200. If wire is good, REPLACE instrument cluster.
	No voltage.	REPLACE Digital Ratio Adapter Controller (DRAC).

CIRCUIT OPERATION

ELECTRONIC LEVEL CONTROL (TYPHOON)

The Electronic Level Control (ELC) keeps the rear of the vehicle at a constant height. If weight is added to the vehicle, the height sensor turns on the compressor. Air is pumped into the shock absorbers until the vehicle is level.

An actuator arm is connected between the rear axle tie rod and the height sensor which is mounted to the rear crossmember. It turns as the vehicle height changes. A solid state unit detects this motion and operates switches to control the air flow into and out of the shock absorbers.

Battery voltage is applied at all times to the height sensor, relay and second solenoid. This allows the ELC system to lower or raise the vehicle height even with the ignition switch in “OFF.” Voltage is applied to the height sensor with the ignition switch in “RUN,” “BULB TEST” or “START” (ignition voltage is for reset). The compressor, after an initial delay, will run for a few seconds to charge the system when the ignition switch is turned to “RUN.”

The height sensor delays 8-15 seconds after a change in vehicle height before closing switch C in the height sensor. This prevents system operation during normal ride motions. In addition, the height sensor limits compressor run time or exhaust solenoid energized time to a maximum of 3½ minutes.

This time limit is necessary to prevent continuous compressor operation in case of a severe system leak or continuous vent. Turning the ignition switch to “OFF” and back to “RUN” resets the 3½ minute maximum run time.

LOWERING THE VEHICLE

When a load is removed from the vehicle, the vehicle body is moved upward and the actuator arm rotates downward. Switch A closes in the height sensor. After an 8 to 15 second delay, switch C closes. The exhaust solenoid is energized and air is vented from the air shocks. As the vehicle body moves downward, the actuator arm is rotated back to its original position (plus or minus 1 inch), switch A opens and the exhaust solenoid is no longer energized.

RAISING THE VEHICLE

When a load is added to the vehicle, the vehicle body is moved downward and the actuator arm rotates upward. Switch B closes in the height sensor. After an 8 to 15 second delay, switch C closes. The coil in the relay is energized and the relay contacts close. Battery voltage is applied to the compressor motor. The compressor operates and pumps air into the adjustable shock absorbers. As the air shocks inflate, the vehicle body moves upward. When the actuator arm rotates back to its original position (plus or minus 1 inch), switch B opens, the relay is no longer energized, and the compressor drops.

DIAGNOSIS - ELECTRONIC LEVEL CONTROL (TYPHOON)

PRELIMINARY CHECKS:

1. Check to see that the ELC fuse is not blown. Replace if blown.
2. Turn ignition switch to "RUN" and add a 300-lb. load to rear of the cargo area. Compressor motor should turn "ON" to charge the system, then turn "OFF." After 8 to 15 seconds the compressor motor should turn "ON" and the rear of the vehicle should rise.
3. Remove load from passenger compartment. After 8 to 15 seconds the ELC system should vent and lower the rear of the vehicle.

COMPRESSOR MOTOR DOES NOT TURN "ON" TO RAISE REAR OF VEHICLE

TEST	RESULT	ACTION
1. Disconnect connector C472 from C473. Connect a fused jumper from YEL (321) wire at connector C472 to ground at connector C472.	Compressor motor turns "ON."	GO to step 2.
	Compressor motor does not turn "ON."	REPAIR open in YEL (321) wire.
2. Disconnect fused jumper. Connect test lamp from ORN (340) wire at connector C472 ground.	Test lamp lights.	GO to step 3.
	Test lamp does not light.	CHECK for poor connection at Inflation Timer Relay or open in ORN (340) wire. REPLACE Inflation Timer Relay if connection and wire are OK.
3. Connect test lamp from ORN (340) wire to BLK (150) wire at connector C472.	Test lamp lights.	GO to Step 4.
	Test lamp does not light.	REPAIR open in BLK (150) wire.
4. Turn ignition switch to "RUN." Connect a test lamp from PNK (39) wire at connector C472 to ground.	Test lamp lights.	CHECK for poor connection at connector C472 or Actuator Arm for damage or binding. Also, CHECK height sensor adjustment, refer to Electronic Level Control (SEC. 3D1) in this manual. REPLACE height sensor if connection and adjustment are OK.
	Test lamp does not light.	CHECK for open in PNK (39) wire.

ELC SYSTEM DOES NOT VENT TO LOWER REAR OF VEHICLE

TEST	RESULT	ACTION
1. Disconnect connector C472 from C473. Connect a fused jumper from WHT (320) at connector C472 to ground.	Solenoid clicks and vents air.	CHECK for poor connections at connector C472 and Actuator Arm for binding or damage. Also, CHECK height sensor adjustment, refer to Electronic Level Control (SEC. 3D1) in this manual. REPLACE height sensor if connection and adjustment are OK.
	Solenoid does not click and vent air.	GO to step 2.
2. Check to see if fuse in fused jumper opens.	Fuse opens.	REPAIR short in WHT (320) wire.
	Fuse does not open.	GO to step 3.
3. With fused jumper still connected, connect a test lamp from ORN (340) wire to BLK (150) wire at connector C473.	Test lamp lights.	CHECK for poor connections at connector C473. REPLACE exhaust solenoid if connection is OK.
	Test lamp does not light.	CHECK for open in WHT (320) wire or ORN (340) wire at connector C473.

COMPRESSOR MOTOR RUNS CONTINUOUSLY OR FOR MAXIMUM RUN TIME (3½ MINUTES), BUT DOES NOT RAISE REAR OF VEHICLE OR REAR OF VEHICLE RETURNS TO ORIGINAL HEIGHT

TEST	RESULT	ACTION
1. Turn ignition switch to "OFF." Disconnect connectors C473 and C472. Connect a test lamp from WHT (320) to 12 Volts at connector C472.	Test lamp lights.	REPAIR open in WHT (320) wire.
	Test lamp does not light.	GO to step 2.
2. Reconnect connector C472 to C473. Connect a test lamp from BLK (150) to 12 Volts at connector C473.	Test lamp lights.	REPLACE height sensor.
	Test lamp does not light.	CHECK ELC system for air leaks. If no leaks, replace exhaust solenoid.

CIRCUIT OPERATION

CLUSTER ILLUMINATION

The cluster illumination lamps are powered by the panel and interior lamps control switch through the INST LPS fuse and the GRA (8) wire. Ground for the lamps is provided through the BLK (150) wire.

SPEEDOMETER

The speedometer receives an A/C output signal from the digital ratio adapter controller (DRAC) through the LT BLU/BLK (824) wire and converts this to an analog (needle-type) display of vehicle speed.

FUEL GAGE

Power to the fuel gage is supplied through the PNK/BLK (39) wire with the ignition switch in START or RUN. The movement of the fuel gage needle is controlled by current flowing through two coils in the gage. This movement creates magnetic fields in the coils. The amount of current flowing through each coil is controlled by the fuel tank sender unit. Voltage from the PNK/BLK (39) wire is applied to one end of the EMPTY(E) coil. The other end of the E coil is connected to the FULL (F) coil and BLK (150) wire and the fuel tank sender and PNK (30) wire. (The (30) circuit changes to PPL at C100.) The (30) circuit wire is PPL on the cluster jumper harness.

When the fuel tank is empty the resistance of the fuel tank sender is low (zero ohm). This allows more current to flow through the E coil and the sender resistor and the magnetic field in the E coil pulls the pointer toward E on the fuel gage.

When the fuel tank is full, the resistance of the fuel tank sender is high (90 ohms). This allows more current to flow through the F coil to ground through the BLK (150) wire and the magnetic field in the F coil pulls the pointer toward F on the fuel gage.

OIL PRESSURE GAGE

The oil pressure gage operates the same as the fuel gage. The resistance controlling the current flow through the coils (high coil and low coil) is provided by the oil pressure sender through the TAN (31) wire. With no oil pressure, the resistance of the sender is low (one ohm). At 552 kPa (80 psi), the resistance is high (88 ohms).

COOLANT TEMPERATURE GAGE

The coolant temperature gage also operates the same as the fuel gage and oil pressure gage. Resistance controlling the coils (hot coil and cold coil) is provided by the coolant temperature sender through the DK GRN (35) wire. However, with a coolant temperature of 38°C (100°F), resistance of the sender is high (1365 ohms). With a coolant temperature of 127°C (260°F), resistance of the sender is low (55 ohms).

VOLTMETER

The voltmeter indicates battery voltage with the ignition switch in RUN and the engine not running. With the engine running, the voltmeter indicates generator output.

TACHOMETER (SYCLONE/TYPHOON)

The tachometer displays engine speed in rpm. Voltage pulses are taken from the ignition coil and sent to the tachometer on the 121 (WHT) wire. Solid state circuits process these pulses into a signal that drives the pointer of the meter. The tachometer responds to the frequency of the voltage pulses. These pulses increase with engine speed.

The tachometer has a total range of 0-7000 RPM. The YELLOW warning region has a range of 4750-5250 RPM and the RED warning region has a range of 5250-7000 RPM.

TURBO BOOST GAGE (SYCLONE/TYPHOON)

The turbo boost gage gets its signal from the manifold absolute pressure (MAP) sensor through the LT GRN (432) and DK GRN (932) wires. The MAP sensor gets a 5-volt reference and a ground feed from the ECM. The MAP sensor reads the manifold pressure and sends a signal voltage between 0 and 5 volts to the turbo boost gage. The voltage is proportional to the manifold pressure.

INDICATOR LAMPS

Power to the ANTILOCK, BRAKE, CHECK ENGINE, CHECK GAGES and LOW TURBO COOLANT indicators is provided through the IGN/GAUGES fuse and the PNK/BLK (39) wire with the ignition switch in START or RUN. Ground for the indicators is provided by various components in the vehicle.

Power to the RIGHT TURN, LEFT TURN, HIGH BEAM and FASTEN SAFETY BELT indicators is provided by various components in the vehicle. Ground is provided to these indicators through the BLK (150) wire.

ANTILOCK INDICATOR (SYCLONE/TYPHOON)

Ground to light the ANTILOCK indicator is provided by the 4-WAL module. When the ignition switch is turned to RUN, the antilock brake module provides a ground for about two seconds through the WHT/BLK (852) wire. This indicates the antilock brake system is operating properly.

BRAKE INDICATOR

Ground to light the BRAKE indicator is provided in one of four ways. When the ignition switch is turned to RUN, the antilock brake module provides a ground to the indicator for about two seconds through the TAN/WHT (33) wire. This indicates the antilock brake system is operating properly. If a malfunction occurs in the hydraulic portion of the four-wheel antilock brake system, the BRAKE indicator will light.

The BRAKE indicator will light when the parking brake is set. This closes the parking brake switch providing a ground to the BRAKE indicator.

If a brake hydraulic circuit loses pressure, the brake pressure warning switch closes, providing a ground to the BRAKE indicator. Refer to 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

CHECK ENGINE INDICATOR

The CHECK ENGINE indicator will light if a problem is detected with the engine running and the vehicle moving. Refer to DRIVEABILITY AND EMISSIONS - FUEL INJECTION (PORT) (SEC. 6E3).

CHECK GAGES INDICATOR

The CHECK GAGES indicator lights to alert the driver to a low oil pressure or high coolant temperature condition. The signals from the engine coolant temperature sender and the engine oil pressure sender are monitored by the CHECK GAGES lamp driver. The lamp driver controls the ground to the CHECK GAGES indicator mounted in the instrument cluster.

FASTEN SAFETY BELT WARNING INDICATOR

Battery voltage is applied to the FASTEN SAFETY BELT warning indicator for four to eight seconds when the ignition switch is in RUN, BULB TEST or START, by the YEL (237) wire from the convenience center.

DIRECTIONAL INDICATORS

Power to the directional indicators is provided by the directional switch or hazard switch. The LH indicator is powered through the LT BLU (14) wire. The RH indicator is powered through the DK BLU (15) wire. Refer to 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

HIGH BEAM INDICATOR

Power to the high beam indicator is provided by the LT GRN (11) wire with the headlamps on and the dimmer switch in HI position. Refer to 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

LOW TURBO COOLANT WARNING INDICATOR (SYCLONE/TYPHOON)

Ground path is provided by the LT GRN (994) wire to the coolant level sender. The lamp will light to indicate a low coolant condition in the charge air cooler radiator.

DIAGNOSIS - INSTRUMENT PANEL CLUSTER

The instrument panel cluster is not serviceable. If any component is defective, the entire cluster must be replaced.

For diagnosis of the Fuel Gage, Coolant Temperature Gage, Oil Pressure Gage, Voltmeter and CHECK GAUGES indicator, refer to the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.

PRELIMINARY CHECKS:

1. CHECK condition of IGN/GAUGES fuse. Replace if blown.
2. CHECK PNK/BLK (39) wire and BLK (150) wire for opens or shorts. Repair if necessary.

LOW TURBO COOLANT INDICATOR DOES NOT OPERATE (SYCLONE/TYPHOON)

TEST	RESULT	ACTION
1. Check condition of "LOW TURBO COOLANT" indicator bulb.	Bulb good.	GO to step 2.
	Bulb not good.	REPLACE bulb.
2. Disconnect turbo coolant level sensor connector C179. Connect a fused jumper from DK GRN (904) wire to ground. Place ignition switch in RUN position.	Indicator lights.	Replace low turbo coolant level sensor.
	Indicator does not light.	LOCATE and REPAIR open in DK GRN (904) wire between sensor and I/P cluster.

LOW TURBO COOLANT INDICATOR IS ALWAYS "ON" WHEN COOLANT LEVEL IS CORRECT (SYCLONE/TYPHOON)

TEST	RESULT	ACTION
1. Disconnect turbo coolant level sensor connector C179 and place ignition switch in RUN.	Indicator lamp turns OFF.	REPLACE low turbo coolant level sensor.
	Indicator lamp stays ON.	LOCATE and REPAIR short to ground in DK GRN (904) wire and bulb. If wire and bulb are good, REPLACE I/P cluster.

TURBO BOOST GAGE DOES NOT OPERATE PROPERLY (SYCLONE/TYPHOON)

TEST	RESULT	ACTION
1. CHECK ECM for codes 33 or 34.	No codes present.	CHECK DK GRN (932) or DK GRN (432) wire for open. If wire is good, REPLACE I/P cluster.
	Either code present.	Refer to DRIVEABILITY AND EMISSIONS-FUEL INJECTION (PORT) (SEC. 6E3) for ECM diagnosis.

CIRCUIT OPERATION

POWER DOOR LOCKS/REMOTE KEYLESS ENTRY (TYPHOON)

The power door locks/remote keyless entry control system allows the driver to operate the vehicle door locks and rear window release from outside the vehicle using a hand-held radio transmitter. The transmitter operates in the UHF band; it sends coded signals to the Remote Keyless Entry Module. The Remote Keyless Entry Module detects and decodes the signals and issues signals to control the door locks and rear window release and illuminate two courtesy lamps and the front and rear dome lamps. These systems can also be operated in the usual manner; for instance, the door locks will respond to the power door lock switches.

DOOR LOCK OPERATION - SWITCHES

LOCK

When either the LH or RH Door Lock Switches are pressed to the “LOCK” position, voltage is supplied from the PWR ACC Circuit Breaker, through the ORN/ BLK (60) wire, through the Door Lock Switch to terminal F of the Door Lock Relay. This voltage energizes the Lock Relay Coil allowing voltage to flow through the relay to the Door Lock Motors, locking all doors. Ground for the LH Door Lock Motor is supplied through the Remote Keyless Entry Module. Ground for the other motor is supplied through the Door Lock Relay.

UNLOCK

When either of the Door Lock Switches are pressed to the “UNLOCK” position, voltage is supplied from the PWR ACC unlocking the doors. (The LH door is unlocked by the Remote Keyless Entry Module.) Ground for the motors is supplied through the Door Lock Relay.

Door LOCK/UNLOCK functions will not operate correctly, if the Remote Keyless Entry Module is disconnected.

DOOR LOCK OPERATION - REMOTE KEYLESS ENTRY

LOCK

When the LOCK button is pressed on the transmitter and the Remote Keyless Entry Module receives a signal with a valid Vehicle Access Code (VAC), the lock function sequence is performed. The Remote Keyless Entry Module will lock all doors.

The Remote Keyless Entry Module supplies battery voltage from terminal E, to the coil of the Door Lock Relay through the LT BLU (195) wire. The Door Lock Relay is energized, and battery voltage is supplied to the Door Lock Motors. Ground for the LH Door Lock Motor is provided at the Remote Keyless Entry Module terminal C through internal contacts. Ground for the other door lock motor is provided through the contacts of the UNLOCK Switch, inside the Door Lock Relay. All door lock motors run to lock all doors.

When the LOCK button is pressed, both courtesy and both dome lamps will illuminate for approximately 5 seconds and then go out.

UNLOCK

The unlock function is separated into two operations depending on how the UNLOCK button is pressed on the transmitter. If the UNLOCK button is pressed once, only the LH door is unlocked. If the UNLOCK button is pressed twice within 1-5 seconds, the other doors will be unlocked.

When the UNLOCK button is pressed once on the transmitter and the Remote Keyless Entry Module receives a valid VAC, the unlock function sequence is performed. The Remote Keyless Entry Module supplies battery voltage to the LH Front Door Lock Motor through the TAN (294) wire. The motor is grounded through the contacts of the Lock Switch inside the Door Lock Relay. The LH Door Lock Motor runs to unlock the LH door.

If the UNLOCK button on the transmitter is pressed twice to unlock all doors, the Remote Keyless Entry Module activates the door unlock output at terminal D. The Remote Keyless Entry Module supplies battery voltage to the coil of the unlock relay in the Door Lock Relay. The unlock relay is energized and closes its contacts. Battery voltage is supplied to the RH Door Lock Motor. The motor is grounded through contacts of the Lock Switch, inside the Door Lock Relay. The motor runs to unlock the RH door.

When the UNLOCK button is pressed, both courtesy and the front and rear dome lamps will illuminate for approximately 40 seconds or until the ignition switch is placed in START/RUN.

REAR WINDOW RELEASE

When the Rear Window Release button is pressed on the transmitter and the Remote Keyless Entry Module receives a valid VAC, the Remote Keyless Entry Module supplies battery voltage at its terminal B. This battery voltage is then applied to the Rear Window Release solenoid through the Rear Window Release Control Relay.

Ground for the relay is supplied through the Park/ Neutral switch only in the PARK or NEUTRAL position. This prevents the window from being opened while the vehicle is being driven. Refer to 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual for circuit description.

DIAGNOSIS - POWER DOOR LOCKS (MANUAL OPERATION) (TYPHOON)

PRELIMINARY CHECK:

1. CHECK to see that PWR/ACC circuit breaker is resetting. Replace if not resetting.

POWER DOOR LOCK/UNLOCK FUNCTION INOPERATIVE

TEST	RESULT	ACTION
1. Disconnect connector C345 from door lock relay. Connect a test lamp from ORN/BLK (60) wire at connector C345 to ground.	Test lamp does not light.	LOCATE and REPAIR open in ORN/BLK (60) wire from door lock relay to fuse block.
	Test lamp lights.	GO to step 2.
2. Connect a test lamp from ORN/BLK (60) wire to heavy gauge BLK (150) wire at door lock relay connector C345.	Test lamp does not light.	LOCATE and REPAIR open in heavy gauge BLK (150) wire from door lock relay to bus bar ground.
	Test lamp lights.	GO to step 3.
3. Connect a test lamp from LT BLU (195) wire at door lock relay connector C345 to ground. Place LH door lock switch in LOCK position. REPEAT for RH door lock switch.	Test lamp does not light when LH or RH door lock switch is activated.	REFER to “LH or RH Door Lock Switch Does Not Operate” procedure.
	Test lamp lights for both switches.	GO to step 4.
4. Connect a test lamp from small gauge BLK (194) wire at door lock relay connector C345 to around. Place LH door lock switch in UNLOCK position. REPEAT for RH door lock switch.	Test lamp does not light when LH or RH door lock switch is activated.	REFER to “LH or RH Door Lock Switch Does Not Operate” procedure.
	Test lamp lights for both switches.	GO to step 5.
5. Using a pair of jumper wires, jumper ORN/BLK (60) wire to GRA (295) wire and heavy gauge BLK (150) wire to TAN (294) wire at connector C345. Observe operation of each door lock motor.	LH door lock motor does not lock.	REFER to appropriate door lock motor diagnostic procedure “LH or RH Door Lock Motor Does Not Lock.” Go to step 6.
	RH door lock motor does not lock.	
	Both door lock motors lock.	REPLACE door lock relay.
6. Using a pair of jumper wires, jumper ORN/BLK (60) wire to TAN (294) wire and heavy gauge BLK (150) wire to GRA (295) wire at connector C345. Observe operation of each door lock motor.	LH or RH door lock motors do not work.	REFER to appropriate door lock motor diagnostic procedure “LH or RH Door Lock Motor Does Not Unlock.”
	RH door lock motor unlocks.	REPLACE door lock relay.

LH OR RH DOOR LOCK SWITCH DOES NOT OPERATE

TEST	RESULT	ACTION
1. Connect a test lamp from ORN/BLK (60) wire at LH or RH door lock switch connector C502 or C602 to ground.	Test lamp does not light.	LOCATE and REPAIR open in ORN/BLK (60) wire from affected door lock switch to fuse block.
	Test lamp lights.	GO to step 2.
2. Connect a test lamp from LT BLU (195) wire at door lock relay connector C345. Place affected door lock switch in LOCK position.	Test lamp does not light.	LOCATE and REPAIR open in LT BLU (195) wire between C345 and affected door lock switch. If wire is in good condition, REPLACE inoperative door lock switch.
	Test lamp lights.	GO to step 3.
3. Connect a test lamp from small gauge BLK (194) wire at door lock relay connector C345. Place affected door lock switch in UNLOCK position.	Test lamp does not light.	LOCATE and REPAIR open in small gauge BLK (194) wire between C345 and affected door lock switch. If wire is in good condition, REPLACE inoperative door lock switch.

LH OR RH DOOR LOCK MOTOR DOES NOT LOCK

TEST	RESULT	ACTION
1. Connect a test lamp from GRA (295) wire at LH or RH door lock motor connector C503 or C603 to ground. Place either door lock switch in LOCK position.	Test lamp does not light.	LOCATE and REPAIR open in GRA (295) wire between door lock motor and door lock relay.
	Test lamp lights.	GO to step 3 if diagnosing LH door lock motor.
2. Connect a test lamp from GRA (295) wire to TAN (294) wire at RH door lock motor connector C603. Place either door lock switch in LOCK position.	Test lamp does not light.	LOCATE and REPAIR open in TAN (294) wire between C603 and door lock relay.
	Test lamp lights.	REPLACE RH door lock motor.
3. Connect a test lamp from GRA (295) wire to TAN (294) wire at LH door lock motor connector C503. Place either door lock switch in LOCK position.	Test lamp does not light.	LOCATE and REPAIR open in TAN (294) wire between C503 and remote keyless entry receiver connector C386. If wire is in good condition, GO to step 4.
	Test lamp lights.	REPLACE LH door lock motor.
4. Connect a test lamp from ORN/BLK (60) wire at remote keyless entry receiver connector C386 to ground.	Test lamp does not light.	LOCATE and REPAIR open in ORN/BLK (60) wire from C386 to fuse block.
	Test lamp lights.	GO to step 5.
5. Disconnect connector C386 from remote keyless entry receiver. Connect a test lamp from ORN/BLK (80) wire to BLK (150) wire.	Test lamp does not light.	LOCATE and REPAIR open in BLK (150) wire from C386 to bus bar ground.
	Test lamp lights.	GO to step 6.
6. Using a jumper wire, jumper TAN (294) wire to BLK (150) wire at remote keyless entry receiver connector C386. Place either door lock switch in LOCK position.	LH door lock motor does not lock.	REPLACE LH door lock motor.
	LH door lock motor locks.	REPLACE remote keyless entry receiver.

LH OR RH DOOR LOCK MOTOR DOES NOT UNLOCK

TEST	RESULT	ACTION
1. Connect a test lamp from TAN (294) wire at LH or RH door lock motor connector C503 or C603 to ground. Place either door lock switch in UNLOCK position.	Test lamp does not light at RH door lock motor.	GO to step 2.
	Test lamp does not light at LH door lock motor.	GO to step 3.
	Test lamp lights.	GO to step 2.
2. Connect a test lamp from TAN (294) wire to GRA (295) wire at LH or RH door lock motor connector C503 or C603. Place either door lock switch in UNLOCK position.	Test lamp does not light.	LOCATE and REPAIR open in GRA (295) wire from C345 to door lock motor.
	Test lamp lights.	REPLACE inoperative door lock motor.
3. Connect a test lamp from BLK (194) wire at remote keyless entry receiver connector C386 to ground. Place LH door lock switch in UNLOCK position. REPEAT for RH door lock switch.	Test lamp does not light when LH or RH door lock switch is activated.	LOCATE and REPAIR open in BLK (194) wire from C386 to affected door lock switch.
	Test lamp lights.	GO to step 4.
4. Connect a test lamp from ORN/BLK (60) wire at remote keyless entry receiver connector C386 to ground.	Test lamp does not light.	LOCATE and REPAIR open in ORN/BLK (60) wire from C386 to fuse block.
	Test lamp lights.	GO to step 5.
5. Disconnect connector C386 from remote keyless entry receiver. Using a jumper wire, jumper BLK (194) wire to TAN (294) wire. Place either door lock switch in UNLOCK position.	LH door lock motor does not unlock.	LOCATE and REPAIR open in TAN (294) wire from C386 to door lock motor. REPEAT step 2.
	LH door lock motor unlocks.	REPLACE remote keyless entry receiver.

DIAGNOSIS - REMOTE KEYLESS ENTRY (TYPHOON)

PRELIMINARY CHECKS:

1. CHECK manual operation of the lock and unlock functions of BOTH the right and left power door locks. If one or both functions do not work properly from BOTH doors, refer to the appropriate procedure under "Power Door Locks (Manual)" diagnosis.
2. CHECK manual operation of rear window release circuit. If not working correctly, refer to "Rear Window Release" diagnosis procedure in the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual.
3. CHECK operation of interior lamps by opening both doors. The interior lamps should turn on when either door is opened. If the interior lamps do not turn on, refer to the 1992 Electrical Diagrams and Diagnosis Sonoma and Jimmy Models Manual for diagnostic procedure.
4. REPLACE batteries in non-functioning transmitter. CHECK transmitter functions. If transmitter functions do not operate, OBTAIN a known functioning transmitter. Program the remote keyless entry receiver for this transmitter, refer to "Programming Remote Keyless Entry Receiver" procedure.
5. If interior lamps turn on for transmitter UNLOCK function only, REPLACE remote keyless entry module.
6. If interior lamps do not turn off for transmitter LOCK function, before turning ignition switch to START or RUN, REPLACE remote keyless entry receiver.
7. During the following procedure, if the interior lamps do not function properly, refer to appropriate diagnostic procedure.

SOME OR ALL TRANSMITTER FUNCTIONS ARE INOPERATIVE

TEST	RESULT	ACTION
1. CHECK transmitter operation of Driver's Door Unlock function.	Driver's door does not unlock.	REPLACE remote keyless entry receiver.
	Driver's door unlocks.	GO to step 2.
2. CHECK transmitter operation of Passenger Door Unlock function.	Passenger door does not unlock.	REPLACE remote keyless entry receiver.
	Passenger door unlocks.	GO to step 3.
3. CHECK transmitter operation of Lock function.	Neither door locks.	GO to step 4.
	Both doors lock.	GO to step 5.
4. Disconnect connector C386 from remote keyless entry receiver. Using a jumper wire, jumper ORN/BLK (60) wire to LT BLU (195) wire at C386. Observe operation of door lock motors.	Neither door lock motor locks.	LOCATE and REPAIR open in LT BLU (195) wire from C386 to door lock relay. RECONNECT connector C386 to remote keyless entry receiver and GO to step 5.
	Both door lock motors lock.	REPLACE remote keyless entry receiver.
5. CHECK transmitter operation of Rear Window Release function.	Rear window release does not operate.	GO to step 6.
	Rear window release operates.	GO to step 7.
6. Disconnect connector C386 from remote keyless entry receiver. Using a jumper wire, jumper ORN/BLK (60) wire to BRN (900) wire at C386. Observe rear window release operation.	Rear window release does not operate.	LOCATE and REPAIR open in BRN (900) wire from C386 to rear window release relay. If wire is ok, GO to step 7.
	Rear window release operates.	REPLACE remote keyless entry receiver.
7. Connect an ohmmeter from PPL (950) wire at remote keyless entry receiver connector C385 to PPL (950) wire at ALDL connector C308. CHECK for continuity.	No continuity.	LOCATE and REPAIR open in PPL (950) wire between C308 and C385.
	Continuity.	REPLACE defective transmitter.

INTERIOR LAMPS DO NOT TURN ON WITH TRANSMITTER UNLOCK FUNCTION

TEST	RESULT	ACTION
1. Disconnect connector C386 from remote keyless entry receiver. Using a jumper wire, jumper WHT (156) wire from C386 to ground.	Interior lamps do not turn on.	LOCATE and REPAIR open in WHT (156) wire.
	Interior lamps turn on.	GO to step 2.
2. Using same jumper wire, jumper WHT (156) wire to BLK (150) wire at connector C386.	Interior lamps do not turn on.	LOCATE and REPAIR open in BLK (150) wire from C386 to bus bar around.
	Interior lamps turn on.	REPLACE remote keyless entry receiver.

INTERIOR LAMPS DO NOT TURN OFF WITH IGNITION IN START OR RUN

TEST	RESULT	ACTION
1. Disconnect connector C385 from remote keyless entry receiver. Connect a test lamp from PNK (39) wire at C385 to ground. Place ignition switch in START or RUN.	Test lamp does not light.	LOCATE and REPAIR open in PNK (39) wire.
	Test lamp lights.	REPLACE remote keyless entry receiver.

PROGRAMMING REMOTE KEYLESS ENTRY RECEIVER MODULE

The remote keyless entry receiver module must be programmed whenever it is being replaced or a new transmitter is used.

When programming the module use the following steps:

1. Connect a fused jumper from BLK/WHT (450) wire to PPL (950) wire at ALDL connector C308. Both doors will LOCK and then UNLOCK.
2. Press the LOCK button on the transmitter to be used.
3. Remove jumper wire from connector C308. Module is now programmed for the transmitter.
4. Repeat steps 1 through 3 if programming for a second transmitter.

BULB DATA

Lamp Usage	Quantity	C/P	Trade No.
Fog Lamps	2	55W	H3
Direction Signal Indicator Lamp	2	.7	174
Hi Beam Indicator Lamp	1	.7	174
Brake Indicator Lamp	1	.7	174
Low Turbo Coolant Indicator Lamp (Syclone/Typhoon)	1	.7	174
Antilock Indicator Lamp (Syclone/Typhoon)	1	.7	174
I/P Illumination Lamp	6	2	194
PRNDL Illumination Lamp	2	1	161
Fasten Safety Belt Indicator Lamp	1	.7	174
Check Engine Indicator Lamp	1	.7	174
Check Gages Indicator Lamp	1	.7	174

COMPONENT LOCATOR INDEX

COMPONENT	LOCATION	Page-Figure
A/C Compressor	RH front side of engine, at AC compressor	20-7
A/C Compressor Control relay	LH side of dash panel (engine compartment)	*
Assembly Line Diagnostic Link (ALDL)	Bottom LH side of I/P, to right of steering column	*
Battery	RH front part of engine compartment	22-7
Charge Air Cooler (CAC) Pump Motor	Lower front of engine compartment, at CAC radiator	-
Charge Air Cooler (CAC) Pump Relay	RH side of dash panel (engine compartment)	21-6
Cluster	Behind LH side of I/P	24-10
Coil	Rear LH side of engine	20-5
CONNECTORS:		
C100	Behind LH side of VP	24-10
C100	LH side of dash panel (engine compartment)	21-6
C101	Behind RH side of VP	25-11
C108	RH side of engine compartment, on turbocharger outlet pipe	19-4
C109	Rear RH side of engine, near distributor	21-6
C110	Near RH front radiator support	22-7
C112	LH side of engine compartment	-
C118	Front LH side of engine, at generator	19-4
C119	Rear of engine, at distributor	21-6
C120	Rear LH side of engine, at coil	20-5
C121	Rear of engine, at coil and distributor	21-6
C123	RH side of engine, at throttle body	19-4
C125	RH side of engine, at throttle body	19-4
C126	LH side of dash panel (engine compartment)	21-6
C128	Center of dash panel (engine compartment)	21-6
C129	Top rear of engine	21-6
C132	LH side of intake manifold	20-5
C133	Top front side of intake manifold	20-5
C134	Above LH rocker cover	20-5
C137	LH side of dash panel (engine compartment)	21-6
C138	RH front side of engine, at AC compressor	20-5
C139	Rear LH side of transmission	23-8
C140	LH rear of engine	21-6
C142	Above LH rocker cover	20-5
C144	Near RH front radiator support	22-7
C145	Near RH front radiator support	22-7
C146	LH side of engine compartment, at antilock module	*
C153	LH side of engine	20-5
C155	Center of dash panel (engine compartment), at wiper motor	*
C160	LH side of engine compartment, at antilock brake module	*
C161	LH side of engine compartment, at antilock brake module	*
C162	Near RH front radiator support	22-7
C163	Rear LH side of transfer case	23-8
C165	LH side of intake manifold	23-9
C166	RH side of intake manifold	23-9
C167	LH side of intake manifold	23-9
C168	RH side of intake manifold	23-9
C169	LH side of intake manifold	23-9

***ABOVE REFERENCES ARE TO THE 1992 ELECTRICAL DIAGRAMS AND DIAGNOSIS SONOMA AND JIMMY MODELS MANUAL.**

COMPONENT LOCATOR INDEX

C170	RH side of intake manifold	23-9
C175	RH side of dash panel (engine compartment).	21-6
C176	RH side of dash panel (engine compartment).	21-6
C177	RH front of engine, at turbocharger	20-5
C178	LH rear of engine compartment	21-6
C179	Lower front of engine compartment, at CAC radiator.	-
C181	Behind RH side of I/P	-
C184	LH rear of engine, above rocker cover	21-6
C200	LH side of I/P, at cluster	24-10
C201	LH side of I/P, at cluster	24-10
C202	LH side of I/P, at cluster	24-10
C301	LH side of I/P, above steering column	-
C307	Behind RH side of I/P	25-11
C308	Bottom LH side of I/P, to right of steering column	-
C309	Behind RH side of I/P	25-11
C310	Behind RH side of I/P	25-11
C311	Behind RH side of I/P	25-11
C346	At door lock relay	-
C380	Underconsole	-
C381	Underconsole	-
C382	At PRNDL illumination lamp	-
C383	At PRNDL illumination lamp.	-
C384	Transmission gear selector lever	-
C385	At remote keyless entry receiver module	-
C386	At remote keyless entry receiver module	-
C387	Console auxiliary power outlets	-
C388	Console auxiliary power outlets	-
C389	Underconsole	-
C390	Underconsole	-
C391	Near RH kick panel.	-
C392	Near RH kick panel.	-
C393	Near LH kick panel	-
C394	Near LH kick panel	-
C465	At ELC compressor motor assembly	-
C472	At ELC height sensor	-
C473	At ELC height sensor	-
C502	At LH door lock switch	-
C503	At LH door lock motor.	-
C602	At RH door lock switch	-
C603	At RH door lock motor.	-
Console Lamp	Console, at PRNDL indicator	-
Coolant Level Sensor.	Lower front of engine compartment, at CAC radiator.	-
Coolant Temperature Sender.	LH side of engine.	20-5
Coolant Temperature Sensor.	Top front side of intake manifold.	20-5
Digital Ratio Adapter Controller (DRAC)	Behind RH side of I/P	25-11
Door Lock Motors.	Rear of door	-
Door Lock Relay	Under LH side of I/P	-
Door Lock Switches	Indoorpanel	-
EGR Vacuum Regulator Valve (EVRV) Solenoid.	Above LH rocker cover	20-5
Electronic Level Control Compressor Motor Assembly	Rear LH frame rail.	-
Electronic Level Control Height Sensor.	Rear axle	-
Electronic Level Control Relay.	Rear LH frame rail.	-
Electronic Spark Control (ESC) Knock Sensor	LH rear of engine.	21-6
Electronic Spark Timing (EST) Distributor.	Rear of engine.	21-6

COMPONENT LOCATOR INDEX

Engine Control Module (ECM)	Behind RH side of I/P	25-11
Four-Wheel Antilock Brake Module	LH side of engine compartment.	*
Four-Wheel Antilock Pump Motor	LH side of engine compartment, at antitock module.	*
Fuel Pump Prime	Center of dash panel (engine compartment)	-
Fuel Pump Relay	LH side of dash panel (engine compartment)	*
Generator	Front LH side of engine.	22-7
GROMMET:		
Grommet 301	RH side of engine compartment.	-
Grommet 304	LH A-pillar.	-
Grommet 305	RH A-pillar.	-
Grommet 500	At LH door.	-
Grommet 600.	At RH door.	-
GROUNDS:		
G100	RH rear of engine, below rocker cover	22-7
G101	At RH radiator support.	22-7
G107	LH rear of engine, near rocker cover.	21-6
G108	Top front center of engine.	19-4
G109	Top front center of engine.	19-4
Heated 02 Sensor	RH side of engine compartment, on turbocharger outlet pipe	19-4
Idle Air Control (IAC).	RH side of engine, at throttle body	19-4
Ignition Switch	LH side of I/P, above steering column	*
Injector-1.	LH side of intake manifold.	23-9
Injector-2.	RH side of intake manifold	23-9
Injector-3.	LH side of intake manifold.	23-9
Injector-4.	RH side of intake manifold	23-9
Injector-5.	LH side of intake manifold.	23-9
Injector-6.	RH side of intake manifold	23-9
Manifold Absolute Pressure (MAP) Sensor	Above LH rocker cover	20-5
Manifold Absolute Temperature (MAT) Sensor	LH side of intake manifold.	20-5
Neutral Safety Switch.	At transmission gear selector lever	-
Oil Pressure Switch	Top rear of engine.	21-6
Remote Keyless Entry Receiver Module	Underconsole	-
Set Timing Bypass	Behind RH side of I/P	-
SPLICES:		
S101	Fusible link at generator	19-4
S102	Fusible link at generator	19-4
S104	LH rear of engine, near ESC knock sensor.	21-6
S105	LH side of dash panel (engine compartment), above C100	21-6
S109	RH side of dash panel (I/P compartment), near C101	25-11
S114	LH side of dash panel (engine compartment), near wiper motor	21-6
S115	LH side of dash panel (engine compartment).	21-6
S116	LH rear of engine, above rocker cover	21-6
S118	LH rear of engine, near ESC knock sensor.	21-6
S120	LH side of dash panel (engine compartment), near wiper motor	21-6
S122	LH rear of engine, above rocker cover	21-6

***ABOVE REFERENCES ARE TO THE 1992 ELECTRICAL DIAGRAMS AND DIAGNOSIS SONOMA AND JIMMY MODELS MANUAL.**

COMPONENT LOCATOR INDEX

S123	Center rear of engine, near distributor	21-6
S150	Injector harness, above distributor	23-9
S151	LH side injector harness, above injector-5	23-9
S152	LH side injector harness, above injector-5	23-9
S153	RH side injector harness, above injector-6	23-9
S154	RH side injector harness, above injector-6.	23-9
S155	LH side injector harness, above injector-5	23-9
S156	LH side injector harness, above injector-5	23-9
S157	RH side injector harness, above injector-4.	23-9
S158	RH side injector harness, above injector-4.	23-9
S159	LH side injector harness, above injector-1	23-9
S160	LH side injector harness, above injector-1	23-9
S161	RH side injector harness, above injector-4.	23-9
S162	RH side injector harness, above injector-4	23-9
S300	Behind I/P, LH side of steering column.	24-10
S301	Behind LH side of I/P.	24-10
S302	Behind LH side of I/P, above steering column	24-10
S306	Behind LH side of I/P, above steering column	24-10
S307	Behind LH side of I/P, above steering column	24-10
S308	Behind LH side of I/P, above steering column	24-10
S309	Behind center of I/P.	25-11
S310	Behind LH side of I/P.	24-10
S316	Behind LH side of I/P	-
S318	Behind LH side of I/P	-
S328	Console lamp harness	-
S329	Console lamp harness	-
S340	Cross body harness	-
S345	Cross body harness	-
S350	Cross body harness	-
S351	Cross body harness	-
S352	Cross body harness	-
S353	Cross body harness	-
S361	Remote keyless entry harness	-
S450	Electronic level control harness	-
S451	Electronic level control harness	-
S500	LH door lock harness	-
S501	LH door lock harness	-
S601	RH door lock harness	-
Throttle Position Sensor (TPS)	RH side of engine, at throttle body	19-4
Transmission Converter Clutch (TCC) Solenoid	Rear LH side of transmission	23-8
Turbo Boost Cut-Out Relay	RH side of dash panel (engine compartment).	21-6
Vehicle Speed Sensor (VSS)	Rear LH side of transfer case	23-8
Wastegate Solenoid.	RH front of engine, at turbocharger	19-4
Wiper Motor Module.	Center of dash panel (engine compartment), at wiper motor.	*

***ABOVE REFERENCES ARE TO THE 1992 ELECTRICAL DIAGRAMS AND DIAGNOSIS SONOMA AND JIMMY MODELS MANUAL.**

CIRCUIT NO.	WIRE SIZE	COLOR	CAVITY	DESCRIPTION
			A1	NOT USED
			A2	NOT USED
			A3	NOT USED
474	0.8	GRA	A4	5V MAP REFERENCE
416	0.8	GRA	A5	5V TPS REFERENCE
439	0.6	PNK/BLK	A6	12V IGNITION (FUSED)
			A7	NOT USED
			A8	NOT USED
461	0.8	ORN	A9	ALDL SERIAL DATA
			A10	NOT USED
465	0.8	GRN/WHT	A11	FUEL PUMP RELAY CONTROL
450	1.0	BLK/WHT	A12	SYSTEM GROUND
440	0.8	ORN	B1	12V BATTERY (FUSED)
			B2	NOT USED
			B3	NOT USED
			B4	NOT USED
155	0.8	BLK	B5	MAT AND TPS GROUND
452	0.5	BLK	B6	COOLANT TEMP SENSOR AND MAP GROUND
			B7	NOT USED
			B8	NOT USED
			B9	NOT USED
			B10	NOT USED
			B11	NOT USED
			B12	NOT USED

V1619

Figure 1 - ECM Connector C307

CIRCUIT NO.	WIRE SIZE	COLOR	CAVITY	DESCRIPTION
			C1	NOT USED
			C2	NOT USED
			C3	NOT USED
			C4	NOT USED
			C5	NOT USED
437	0.8	BRN	C6	DRAC SIGNAL
424	0.8	TAN/BLK	C7	EST BY PASS
423	0.8	WHT	C8	EST CONTROL
59	0.8	DK GRN	C9	A/C SIGNAL
			C10	NOT USED
467	0.8	BLU	C11	INJECTOR 2, 4, 6 DRIVER
468	0.8	GRN	C12	INJECTOR 1, 3, 5 DRIVER
450	1.0	BLK/WHT	C13	INJECTOR GROUND
			C14	NOT USED
			C15	NOT USED
440	0.8	ORN	C16	12V BATTERY (FUSED)
551	1.0	TAN/WHT	D1	SYSTEM GROUND
			D2	NOT USED
			D3	NOT USED
			D4	NOT USED
			D5	NOT USED
			D6	NOT USED
450	0.8	BLK/WHT	D7	INJECTOR GROUND
430	0.8	PPL/WHT	D8	DISTRIBUTOR REFERENCE HIGH
453	0.8	BLK/RED	D9	DISTRIBUTOR REFERENCE LOW
			D10	NOT USED
			D11	NOT USED
			D12	NOT USED
			D13	NOT USED
			D14	NOT USED
			D15	NOT USED
434	0.5	ORN/BLK	D16	PARK/NEUTRAL SWITCH SIGNAL

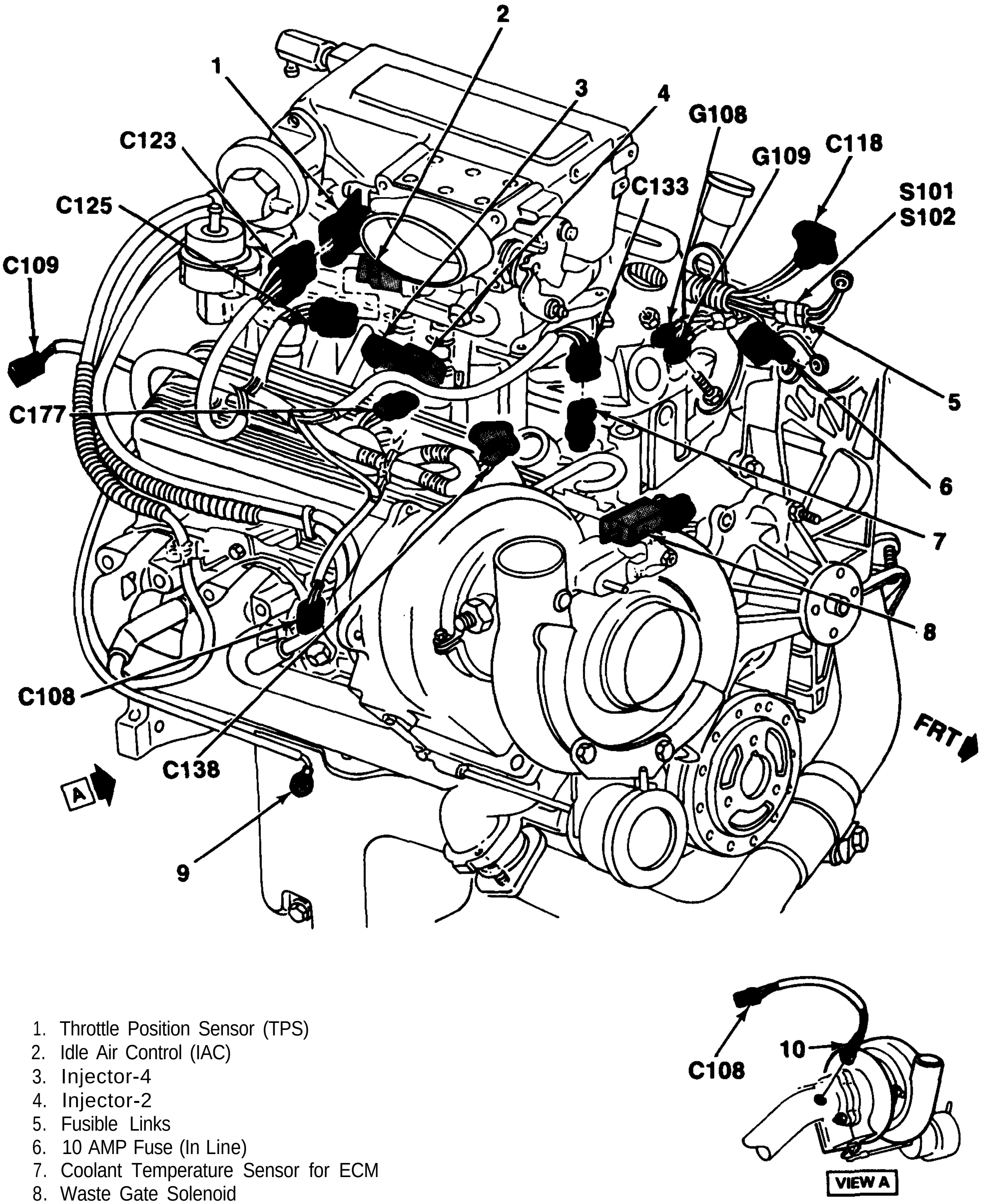
V1620

Figure 2 - ECM Connector C310

CIRCUIT NO.	WIRE SIZE	COLOR	CAVITY	DESCRIPTION
			E1	NOT USED
			E2	NOT USED
444	0.8	LT GRN/WHT	E3	IAC COIL B LOW
443	0.8	LT GRN/BLK	E4	IAC COIL B HIGH
442	0.8	BLU/BLK	E5	IAC COIL A LOW
441	0.8	LT BLU/WHT	E6	IAC COIL A HIGH
419	0.8	GRA/WHT	E7	CHECK ENGINE LAMP CONTROL
901	0.8	YEL	E8	CAC CONTROL
435	0.5	GRA	E9	EVRV SOLENOID CONTROL
			E10	NOT USED
			E11	NOT USED
451	0.8	WHT/BLK	E12	ALDL DIAGNOSTIC TEST
			E13	NOT USED
412	0.8	PPL	E14	OXYGEN SENSOR SIGNAL
413	0.8	TAN	E15	OXYGEN SENSOR GROUND
410	0.8	YEL	E16	COOLANT TEMP SENSOR SIGNAL
459	0.8	GRN/WHT	F1	A/C RELAY CONTROL
471	0.8	BLK/GRN	F2	WASTE GATE SOLENOID SIGNAL
			F3	NOT USED
422	0.8	TAN/BLK	F4	TCC SOLENOID CONTROL
			F5	NOT USED
			F6	NOT USED
			F7	NOT USED
			F8	NOT USED
496	0.8	DK BLU	F9	ESC KNOCK SENSOR SIGNAL
			F10	NOT USED
			F11	NOT USED
			F12	NOT USED
417	0.5	DK BLU	F13	TPS SIGNAL
			F14	NOT USED
432	0.8	LT GRN	F15	MAP SIGNAL
472	0.8	TAN	F16	MAT SIGNAL

V1621

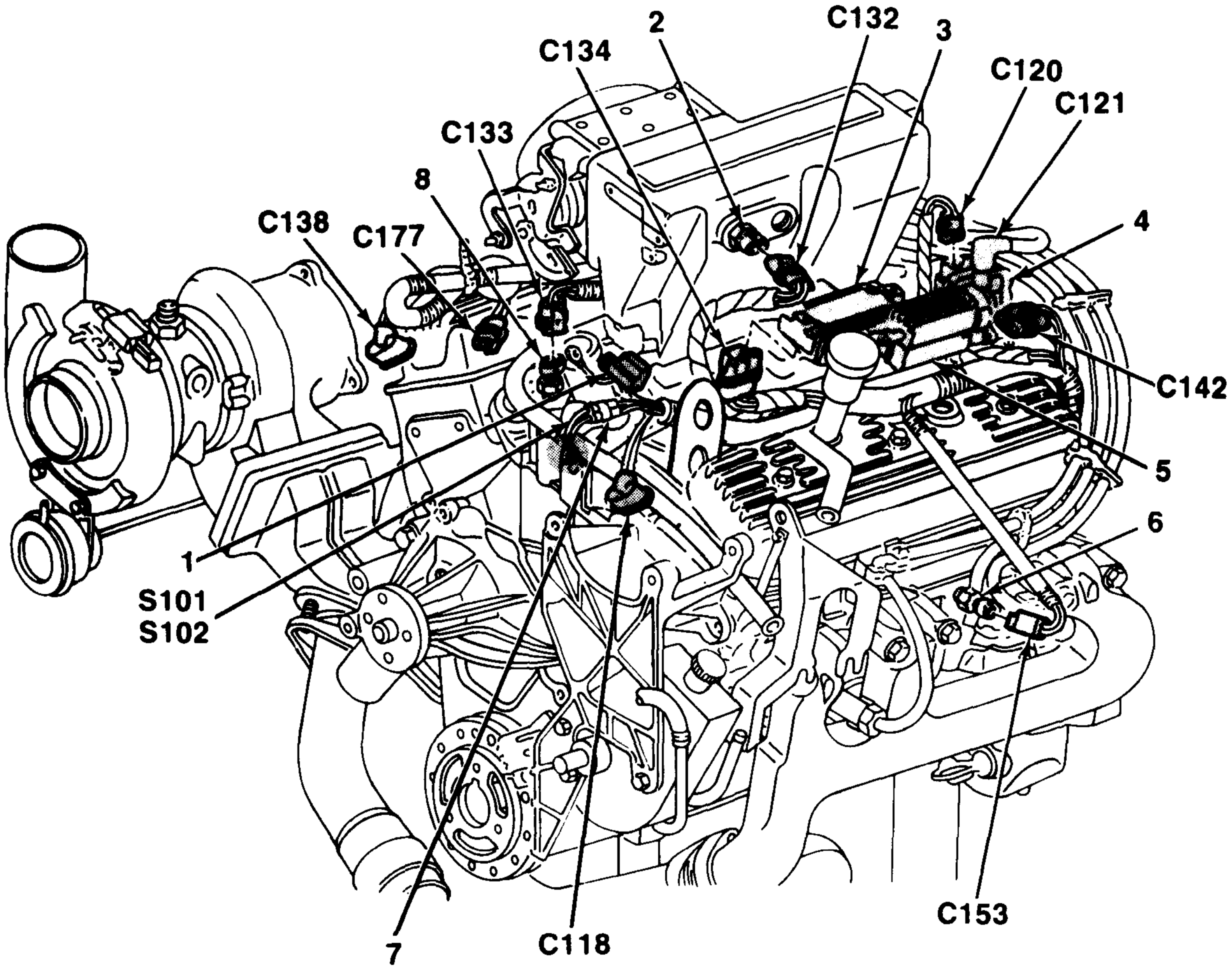
Figure 3 - ECM Connector C311



1. Throttle Position Sensor (TPS)
2. Idle Air Control (IAC)
3. Injector-4
4. Injector-2
5. Fusible Links
6. 10 AMP Fuse (In Line)
7. Coolant Temperature Sensor for ECM
8. Waste Gate Solenoid
9. To Starter Motor
10. Oxygen Sensor

V1865

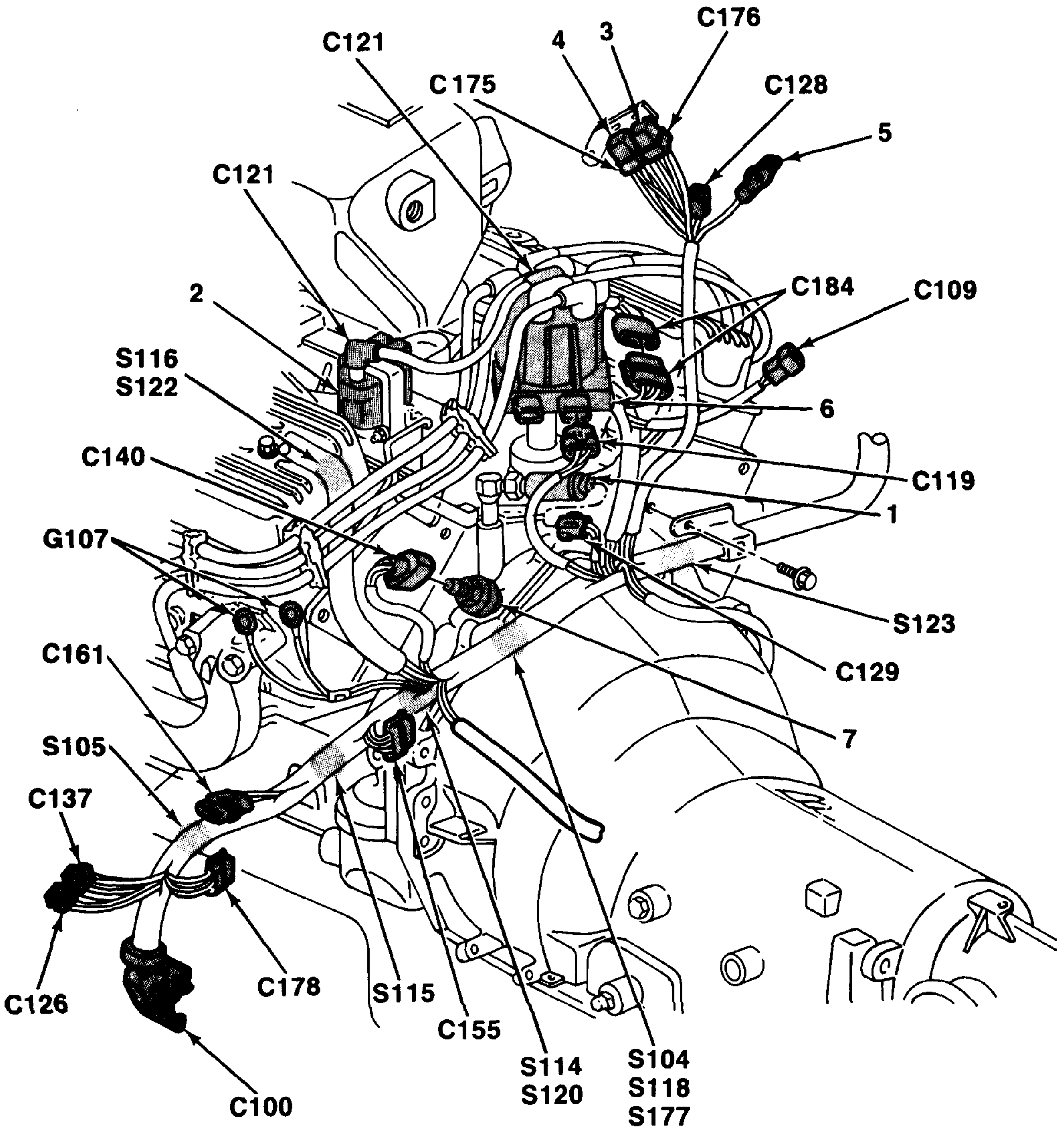
Figure 4 - Right Front Engine Harness-4.3L Turbo (Syclone and Typhoon)



1. 10 AMP Fuse
2. Manifold Absolute Temperature (MAT) Sensor
3. Manifold Absolute Pressure (MAP) Sensor
4. Coil
5. Electronic Vacuum Regulator Valve (EVRV) Solenoid
6. Coolant Temperature Sender for Gage
7. Fusible Links
8. Coolant Temperature Sensor for ECM

V1866

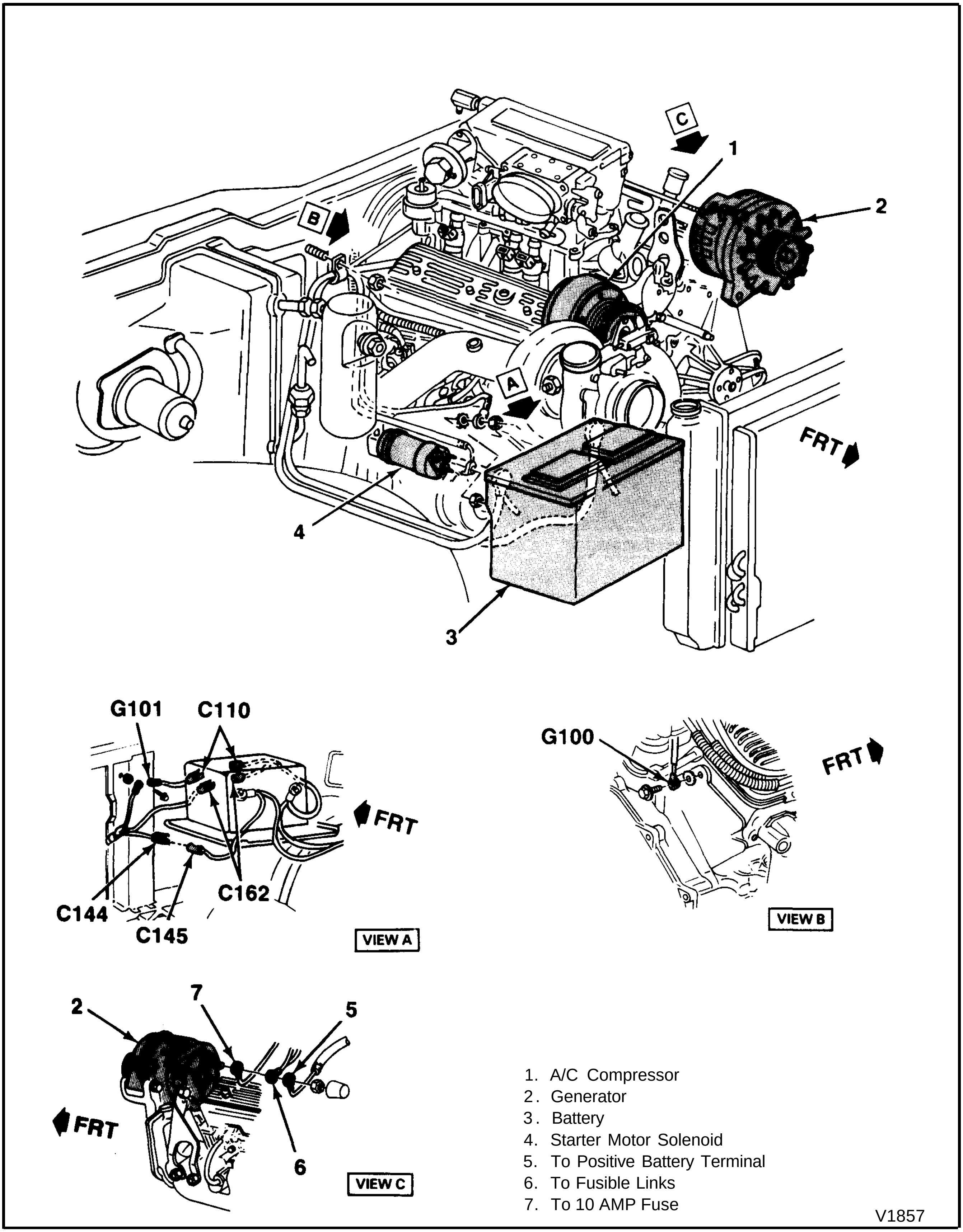
Figure 5 - Left Front Engine Harness-4.3L Turbo (Syclone and Typhoon)



1. Oil Pressure Switch
2. Coil
3. Charge Air Cooler (CAC) Pump Relay
4. Turbo Boost Cut-Out Relay
5. To Junction Block
6. Electronic Spark Timing (EST) Distributor
7. Electronic Spark Control (ESC) Knock Sensor

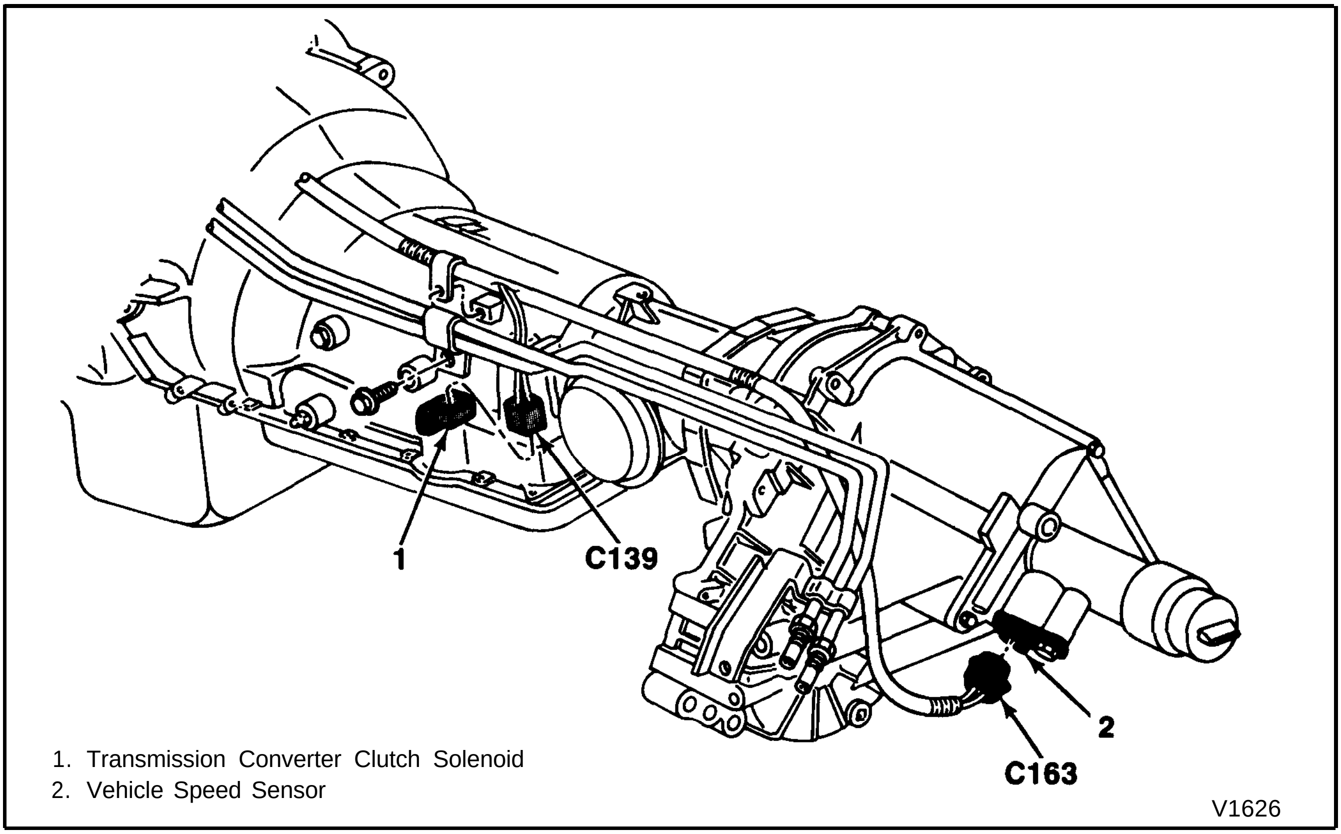
V1793

Figure 6 - Rear Engine Harness-4.3L Turbo (Syclone and Typhoon)



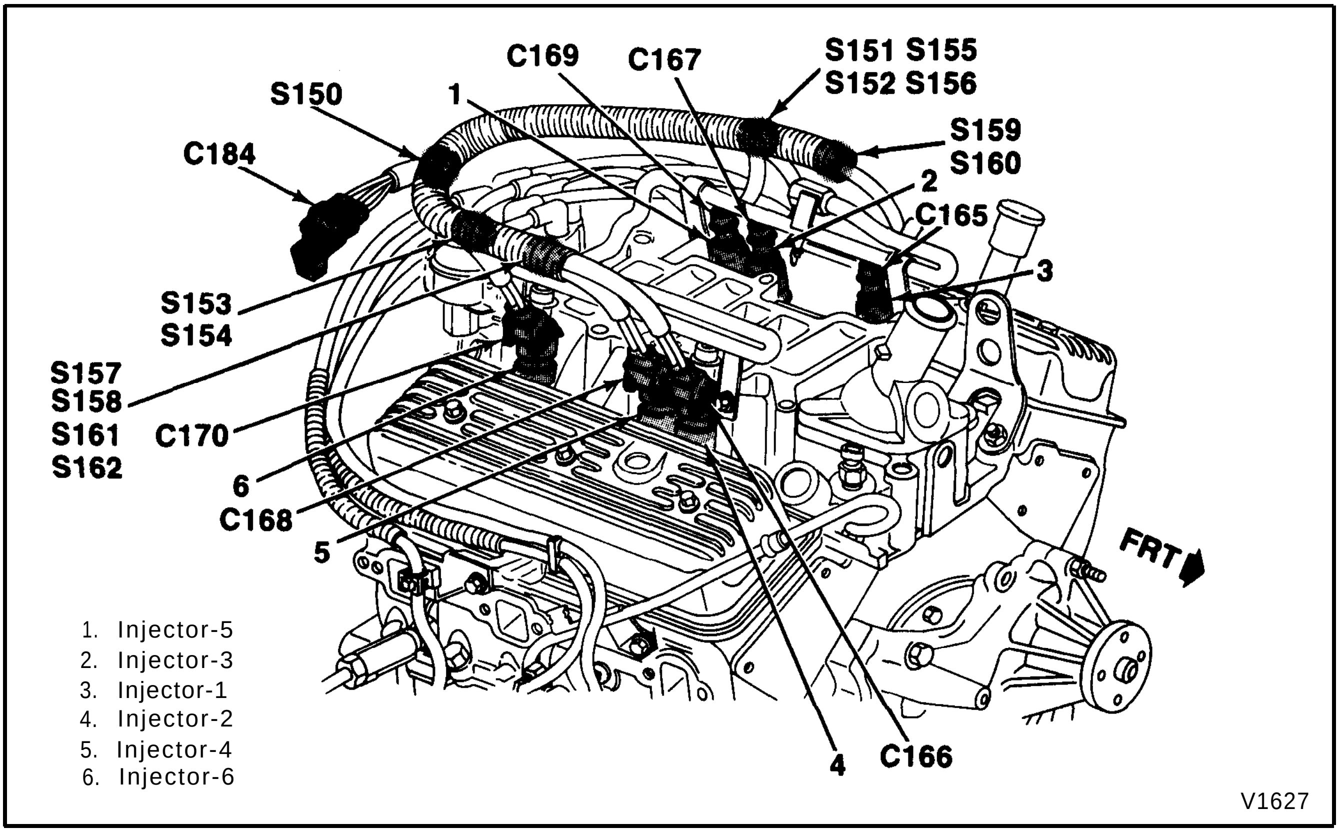
1. A/C Compressor
2. Generator
3. Battery
4. Starter Motor Solenoid
5. To Positive Battery Terminal
6. To Fusible Links
7. To 10 AMP Fuse

Figure 7 - Battery Cable Routing-4.3L Turbo (Syclone and Typhoon)



1. Transmission Converter Clutch Solenoid
2. Vehicle Speed Sensor

Figure 8 - Rear Engine Harness at Transmission-4.3L Turbo (Syclone and Typhoon)



1. Injector-5
2. Injector-3
3. Injector-1
4. Injector-2
5. Injector-4
6. Injector-6

Figure 9 - Injector Sub Harness-4.3L Turbo (Syclone and Typhoon)

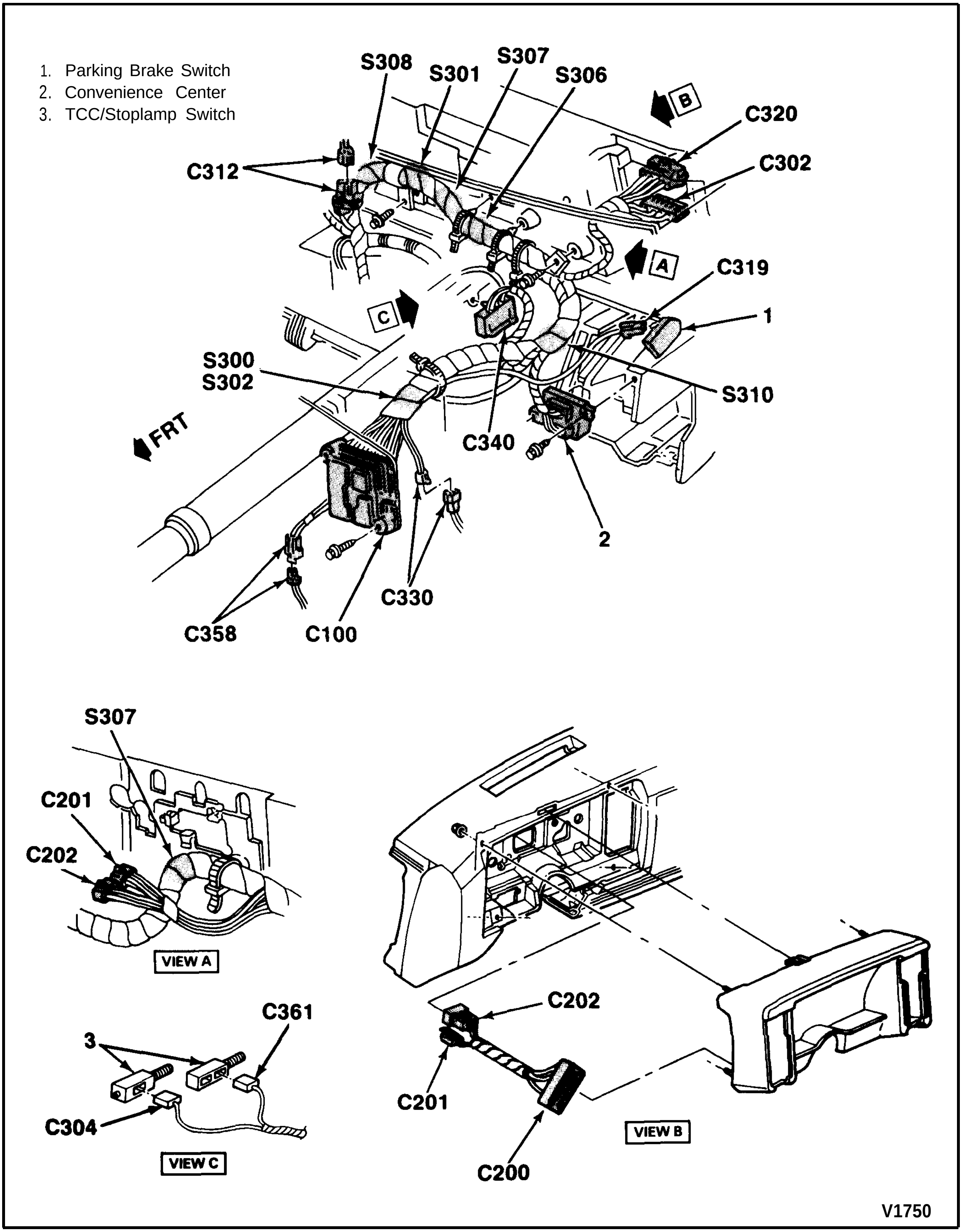
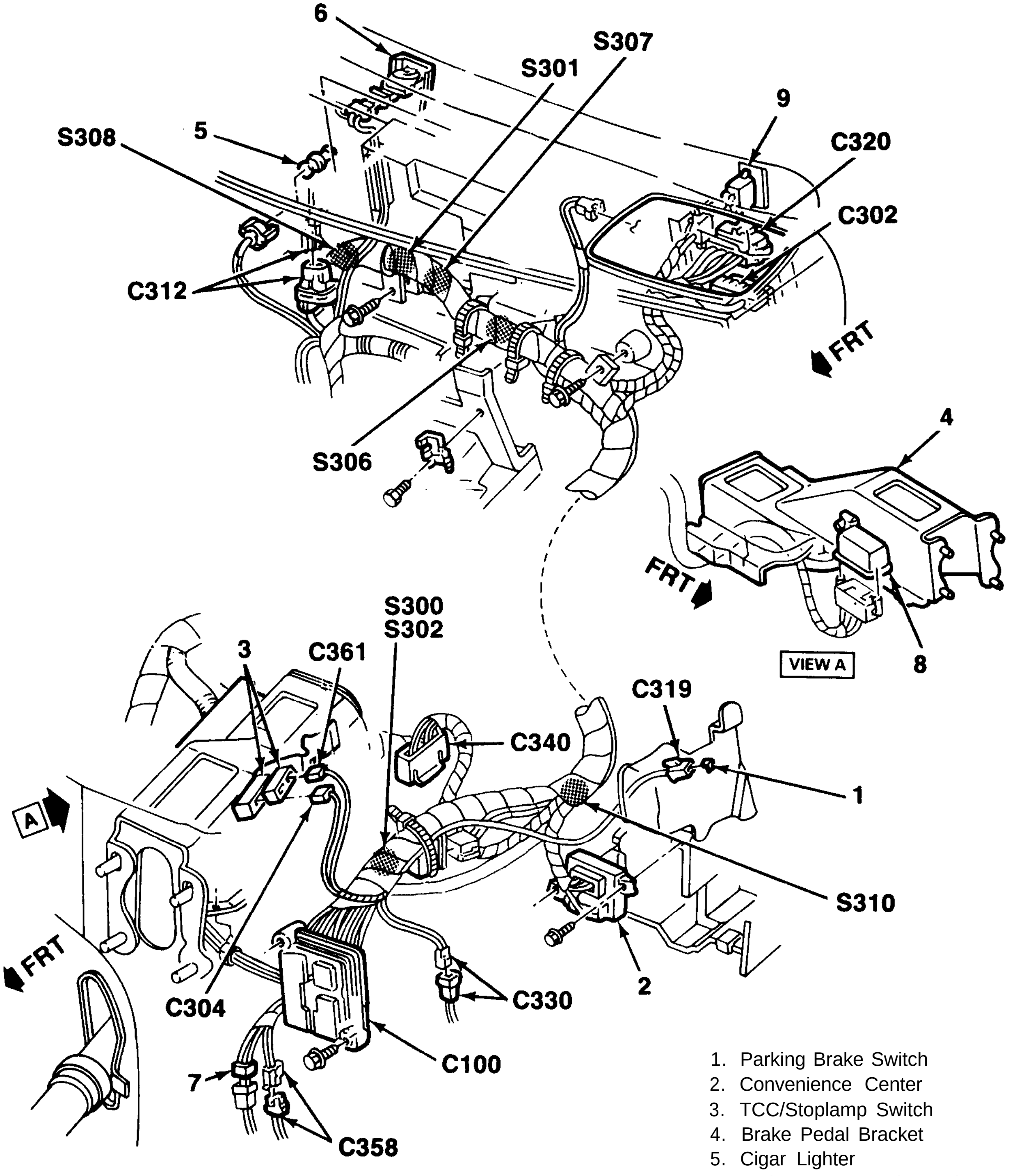


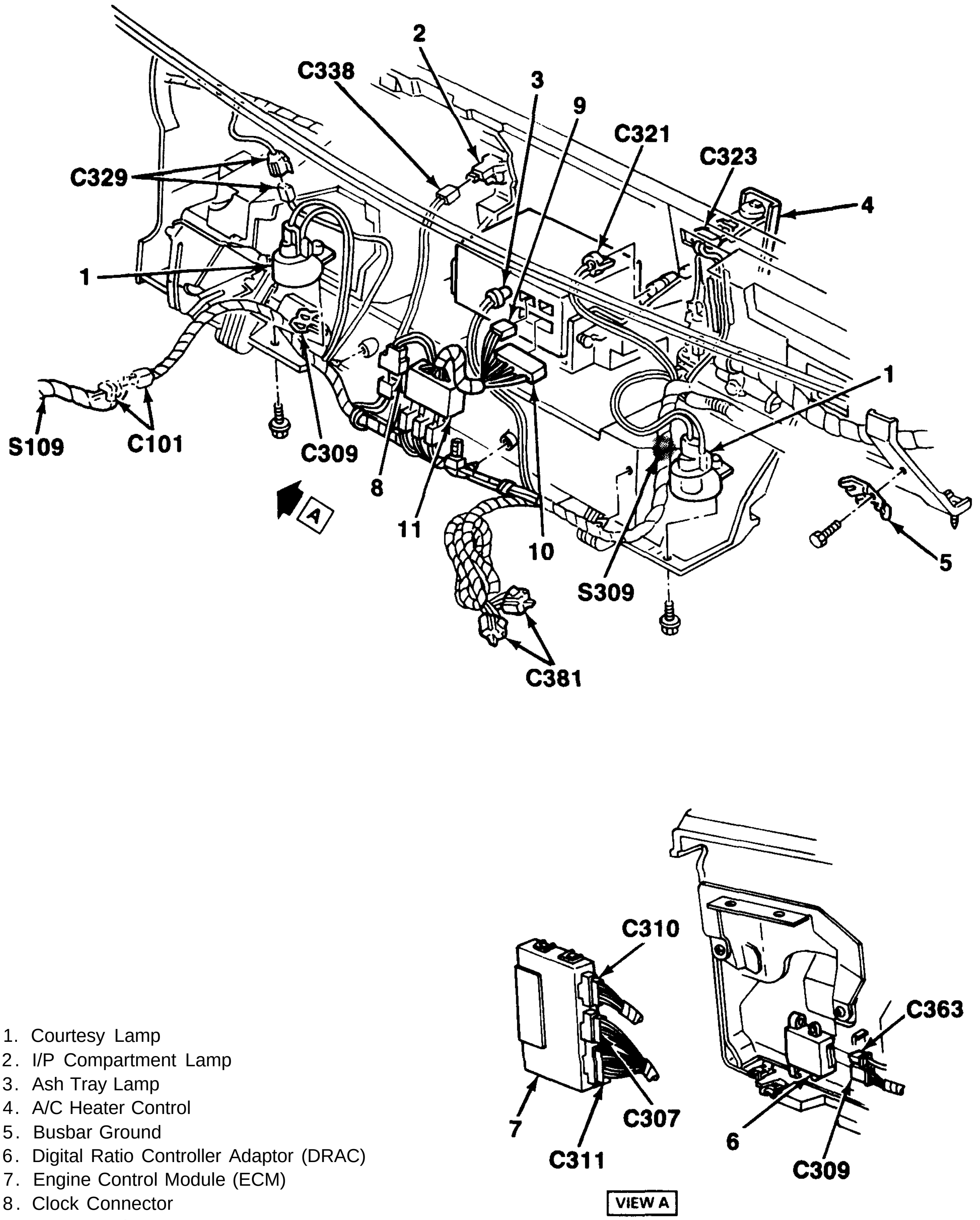
Figure 10 - Instrument Panel Harness-Left Side (Sonoma GT and Syclone)



1. Parking Brake Switch
2. Convenience Center
3. TCC/Stoplamp Switch
4. Brake Pedal Bracket
5. Cigar Lighter
6. AC/Heater Control Panel
7. Rear Speaker Connector
8. Rear Window Defogger Relay
9. Rear Window Defogger Switch

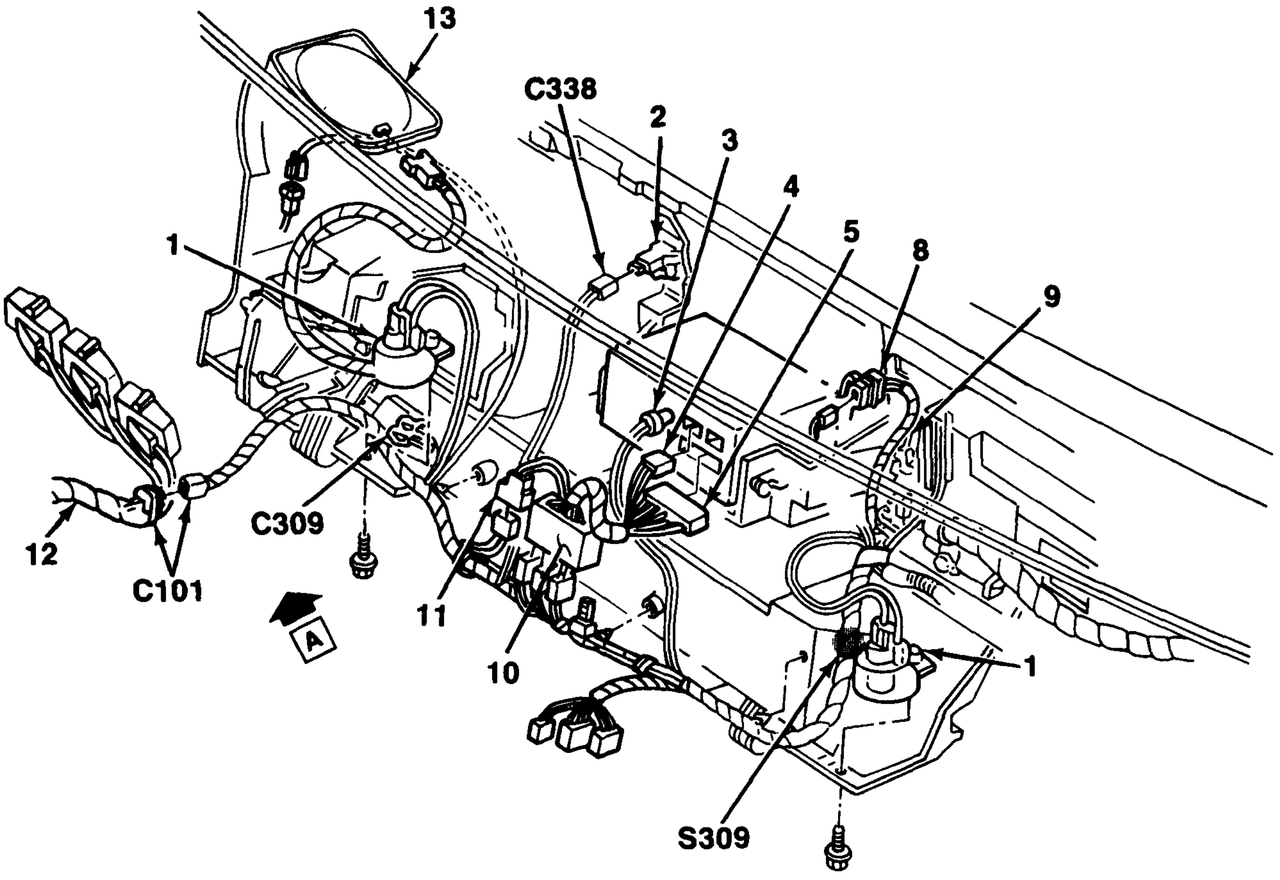
V3202

Figure 11 - Instrument Panel Harness-Left Side (Typhoon)

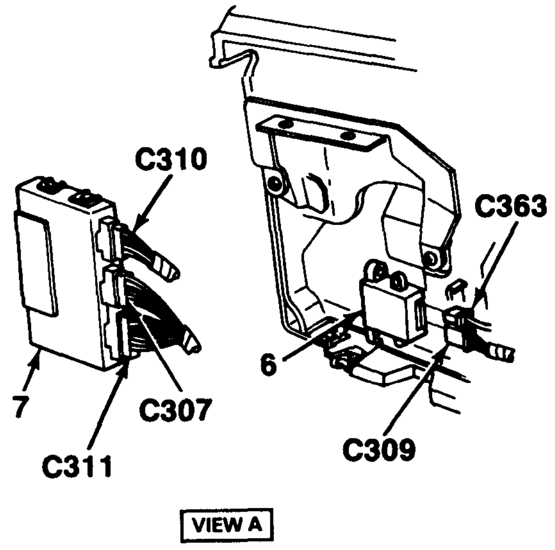


1. Courtesy Lamp
2. I/P Compartment Lamp
3. Ash Tray Lamp
4. A/C Heater Control
5. Busbar Ground
6. Digital Ratio Controller Adaptor (DRAC)
7. Engine Control Module (ECM)
8. Clock Connector
9. Rear Speaker Connector
10. Power and Front Speaker Connector
11. Jumper Harness

Figure 12 - Instrument Panel Harness-Right Side (Sonoma GT and Syclone)



1. Courtesy Lamp
2. I/P Compartment Lamp
3. Ash Tray Lamp
4. Rear Speaker Connector
5. Power and Front Speaker Connector
6. Digital Ratio Controller Adaptor (DRAC)
7. Engine Control Module (ECM)
8. Rear Window Release Connector
9. AC/Heater Harness Assembly
10. Jumper Harness
11. Clock Connector
12. Engine Harness
13. Right Front Speaker



V3203

Figure 13 - Instrument Panel Harness-Right Side (Typhoon)

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TRUCK SERVICE MASTER

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Transportation Technician

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AUTOMOTIVE SERVICE EXCELLENCE

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Automotive
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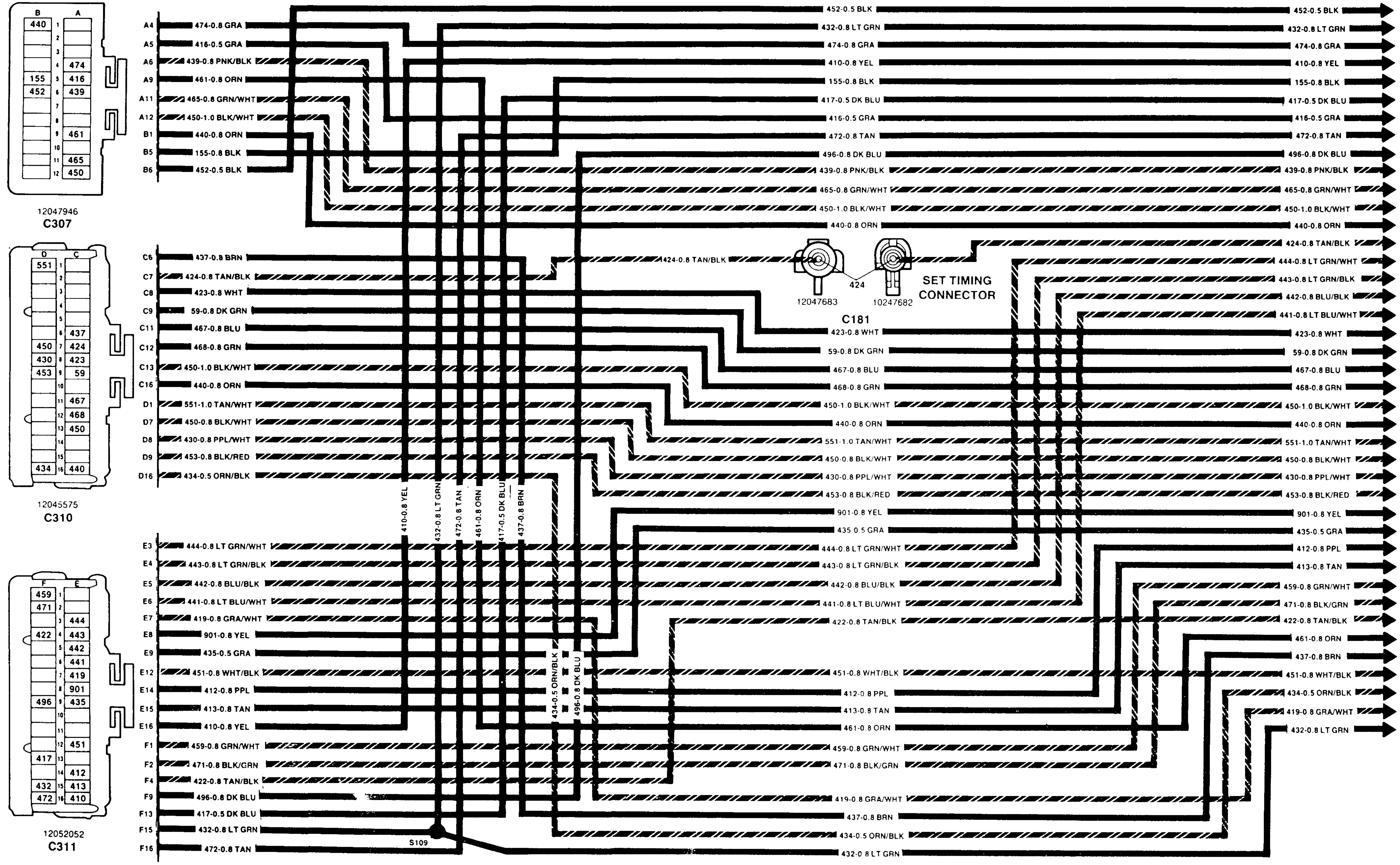
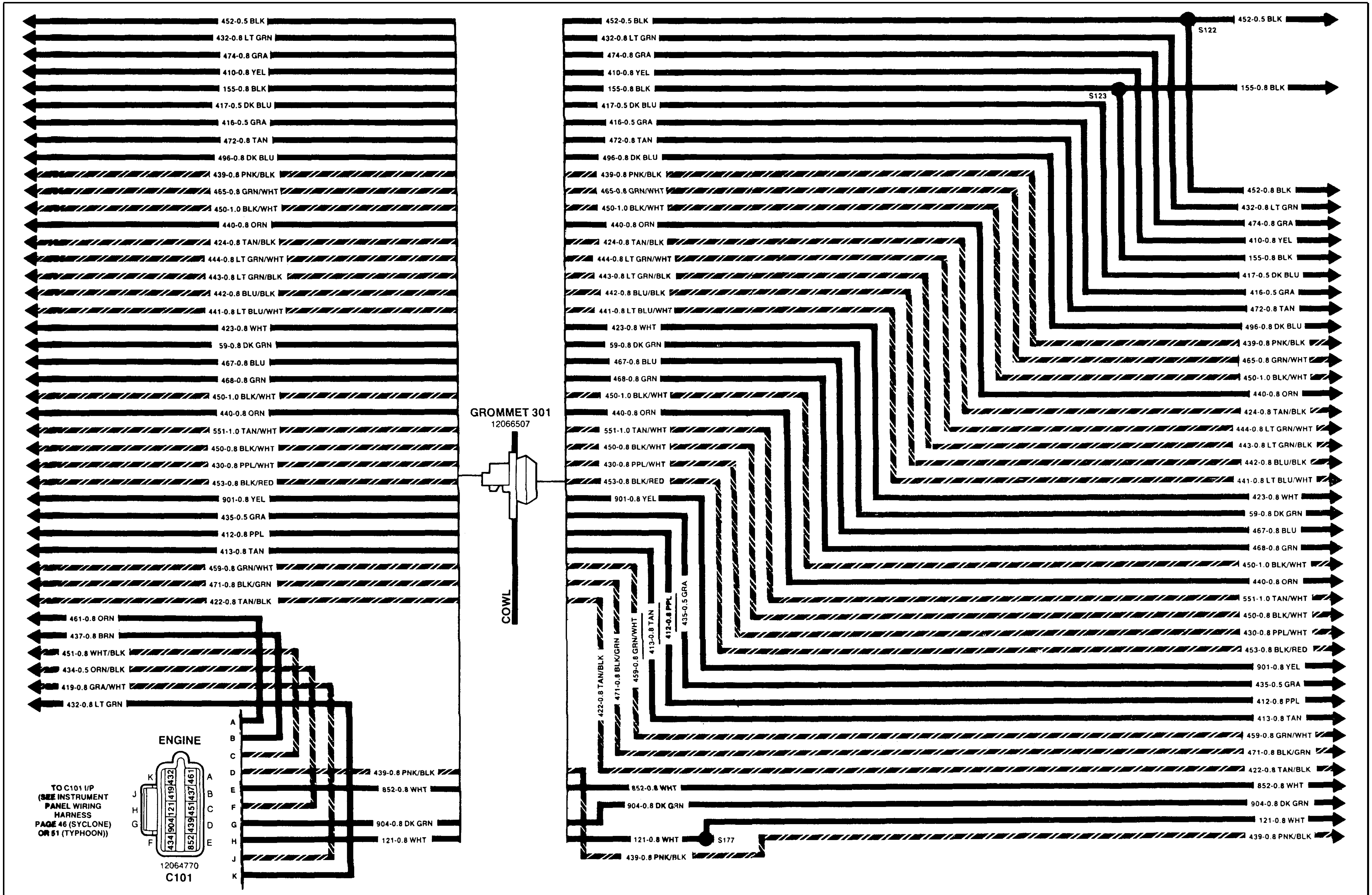
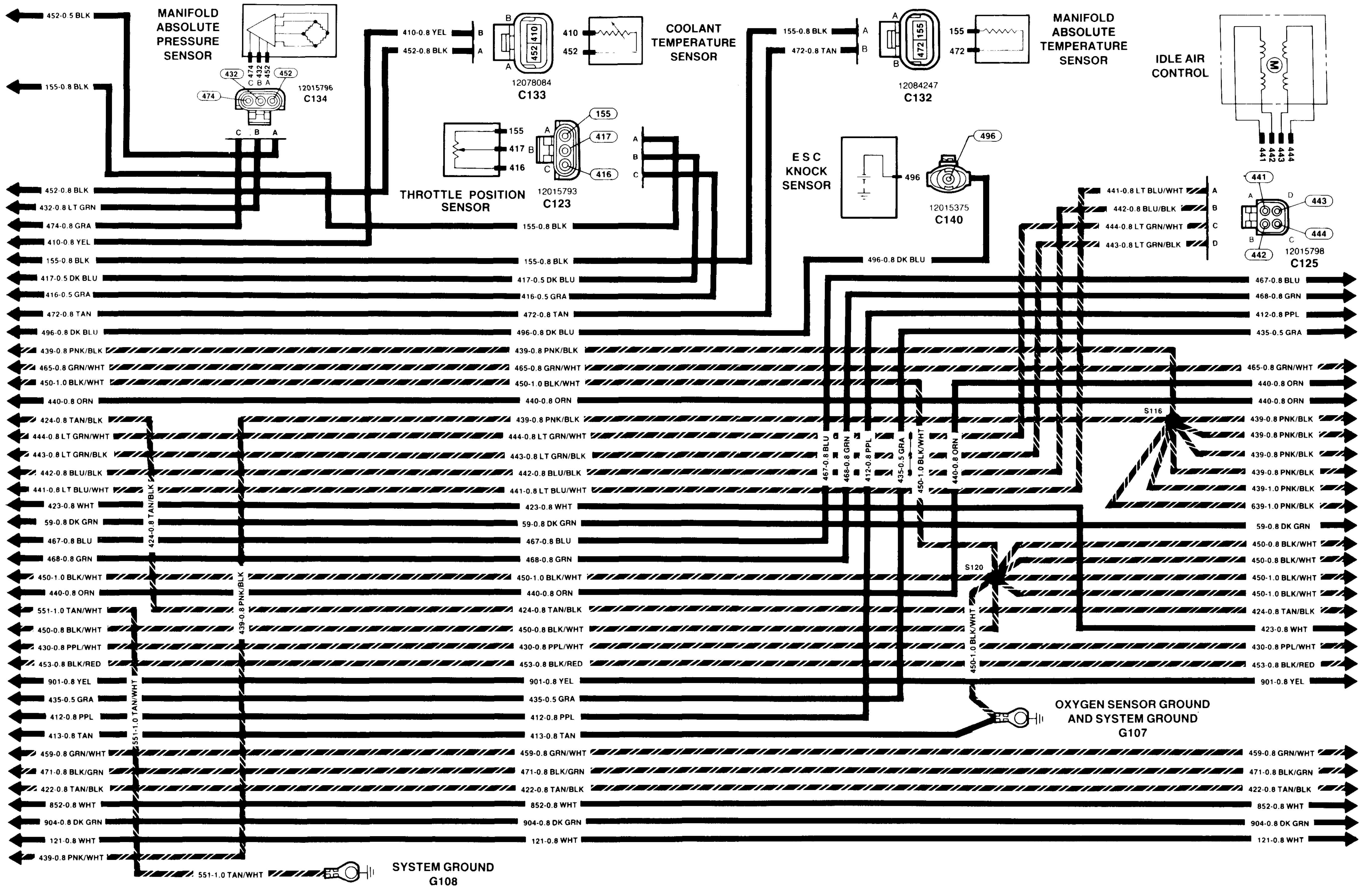
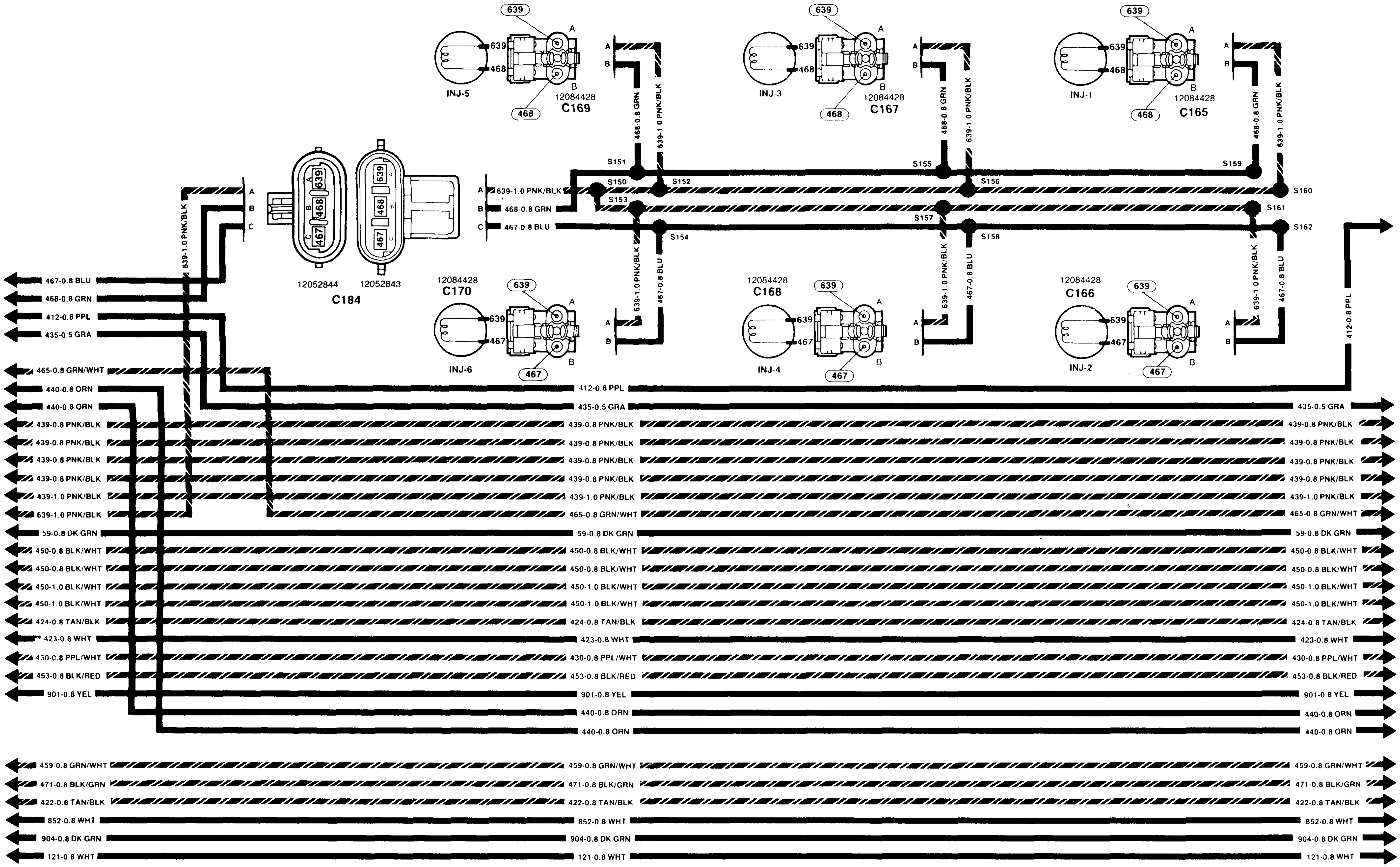

B
A
440
474
155
416
452
439
461
465
450
12047946
C307
A4
474-0.8 GRA
A5
416-0.5 GRA
A6
439-0.8 PNK/BLK
A9
461-0.8 ORN
A11
465-0.8 GRN/WHT
A12
450-1.0 BLK/WHT
B1
440-0.8 ORN
B5
155-0.8 BLK
B6
452-0.5 BLK
D
C
551
437
450
424
430
423
453
59
467
468
450
434
440
12045575
C310
C6
437-0.8 BRN
C7
424-0.8 TAN/BLK
C8
423-0.8 WHT
C9
59-0.8 DK GRN
C11
467-0.8 BLU
C12
468-0.8 GRN
C13
450-1.0 BLK/WHT
C16
440-0.8 ORN
D1
551-1.0 TAN/WHT
D7
450-0.8 BLK/WHT
D8
430-0.8 PPL/WHT
D9
453-0.8 BLK/RED
D16
434-0.5 ORN/BLK
F
E
459
471
444
422
443
442
441
419
901
496
435
451
417
412
432
413
472
410
12052052
C311
E3
444-0.8 LT GRN/WHT
E4
443-0.8 LT GRN/BLK
E5
442-0.8 BLU/BLK
E6
441-0.8 LT BLU/WHT
E7
419-0.8 GRA/WHT
E8
901-0.8 YEL
E9
435-0.5 GRA
E12
451-0.8 WHT/BLK
E14
412-0.8 PPL
E15
413-0.8 TAN
E16
410-0.8 YEL
F1
459-0.8 GRN/WHT
F2
471-0.8 BLK/GRN
F4
422-0.8 TAN/BLK
F9
496-0.8 DK BLU
F13
417-0.5 DK BLU
F15
432-0.8 LT GRN
F16
472-0.8 TAN
S109
410-0.8 YEL
432-0.8 LT GRN
472-0.8 TAN
461-0.8 ORN
417-0.5 DK BLU
437-0.8 BRN
434-0.5 ORN/BLK
496-0.8 DK BLU
424-0.8 TAN/BLK
424
12047683
10247682
C181
SET TIMING CONNECTOR
452-0.5 BLK
432-0.8 LT GRN
474-0.8 GRA
410-0.8 YEL
155-0.8 BLK
417-0.5 DK BLU
416-0.5 GRA
472-0.8 TAN
496-0.8 DK BLU
439-0.8 PNK/BLK
465-0.8 GRN/WHT
450-1.0 BLK/WHT
440-0.8 ORN
423-0.8 WHT
59-0.8 DK GRN
467-0.8 BLU
468-0.8 GRN
450-1.0 BLK/WHT
440-0.8 ORN
551-1.0 TAN/WHT
450-0.8 BLK/WHT
430-0.8 PPL/WHT
453-0.8 BLK/RED
901-0.8 YEL
435-0.5 GRA
444-0.8 LT GRN/WHT
443-0.8 LT GRN/BLK
442-0.8 BLU/BLK
441-0.8 LT BLU/WHT
422-0.8 TAN/BLK
451-0.8 WHT/BLK
412-0.8 PPL
413-0.8 TAN
461-0.8 ORN
459-0.8 GRN/WHT
471-0.8 BLK/GRN
419-0.8 GRA/WHT
437-0.8 BRN
434-0.5 ORN/BLK
432-0.8 LT GRN
452-0.5 BLK
432-0.8 LT GRN
474-0.8 GRA
410-0.8 YEL
155-0.8 BLK
417-0.5 DK BLU
416-0.5 GRA
472-0.8 TAN
496-0.8 DK BLU
439-0.8 PNK/BLK
465-0.8 GRN/WHT
450-1.0 BLK/WHT
440-0.8 ORN
424-0.8 TAN/BLK
444-0.8 LT GRN/WHT
443-0.8 LT GRN/BLK
442-0.8 BLU/BLK
441-0.8 LT BLU/WHT
423-0.8 WHT
59-0.8 DK GRN
467-0.8 BLU
468-0.8 GRN
450-1.0 BLK/WHT
440-0.8 ORN
551-1.0 TAN/WHT
450-0.8 BLK/WHT
430-0.8 PPL/WHT
453-0.8 BLK/RED
901-0.8 YEL
435-0.5 GRA
412-0.8 PPL
413-0.8 TAN
459-0.8 GRN/WHT
471-0.8 BLK/GRN
422-0.8 TAN/BLK
461-0.8 ORN
437-0.8 BRN
451-0.8 WHT/BLK
434-0.5 ORN/BLK
419-0.8 GRA/WHT
432-0.8 LT GRN

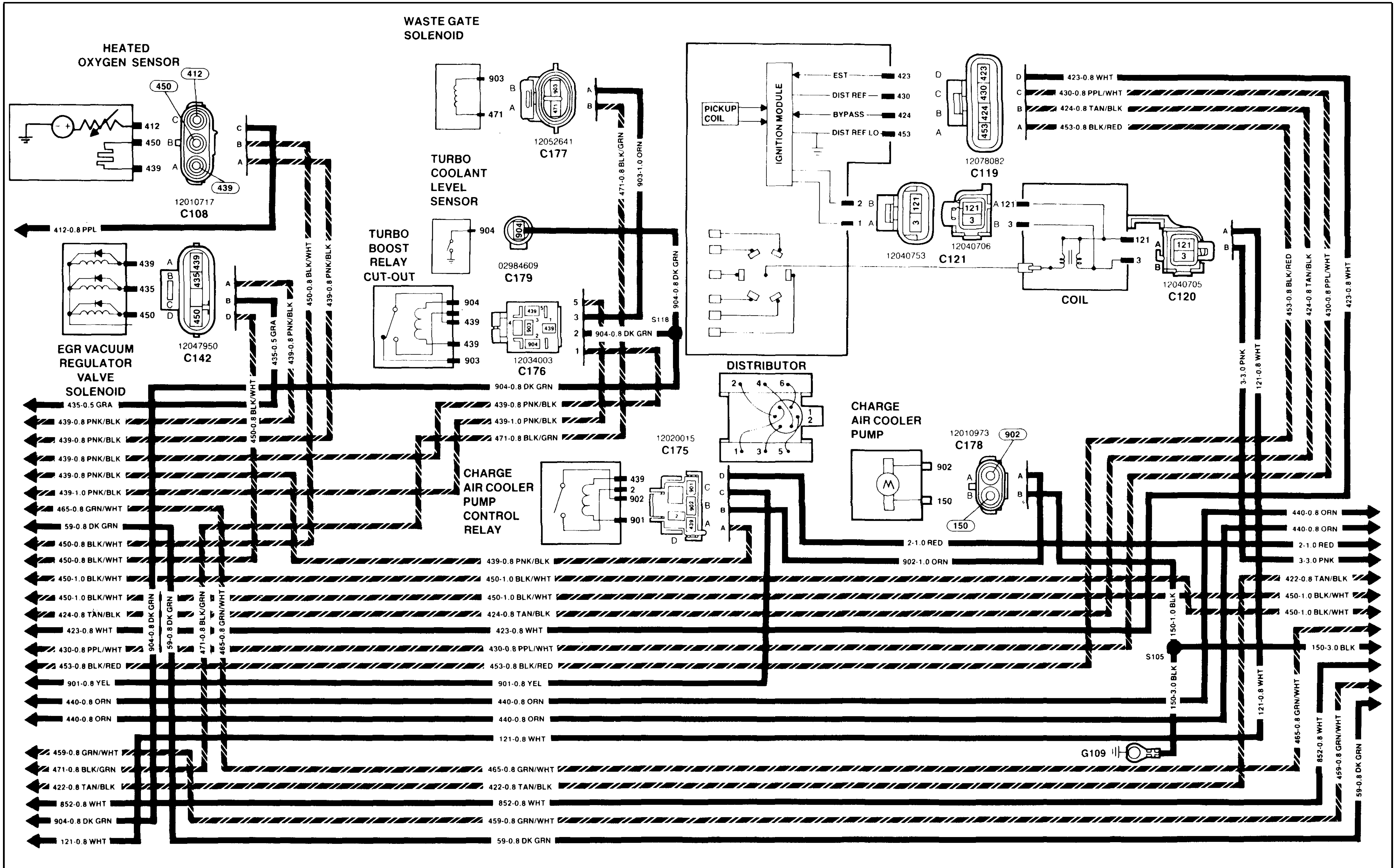


38 ENGINE WIRING HARNESS (SYCLONE/TYPHOON)

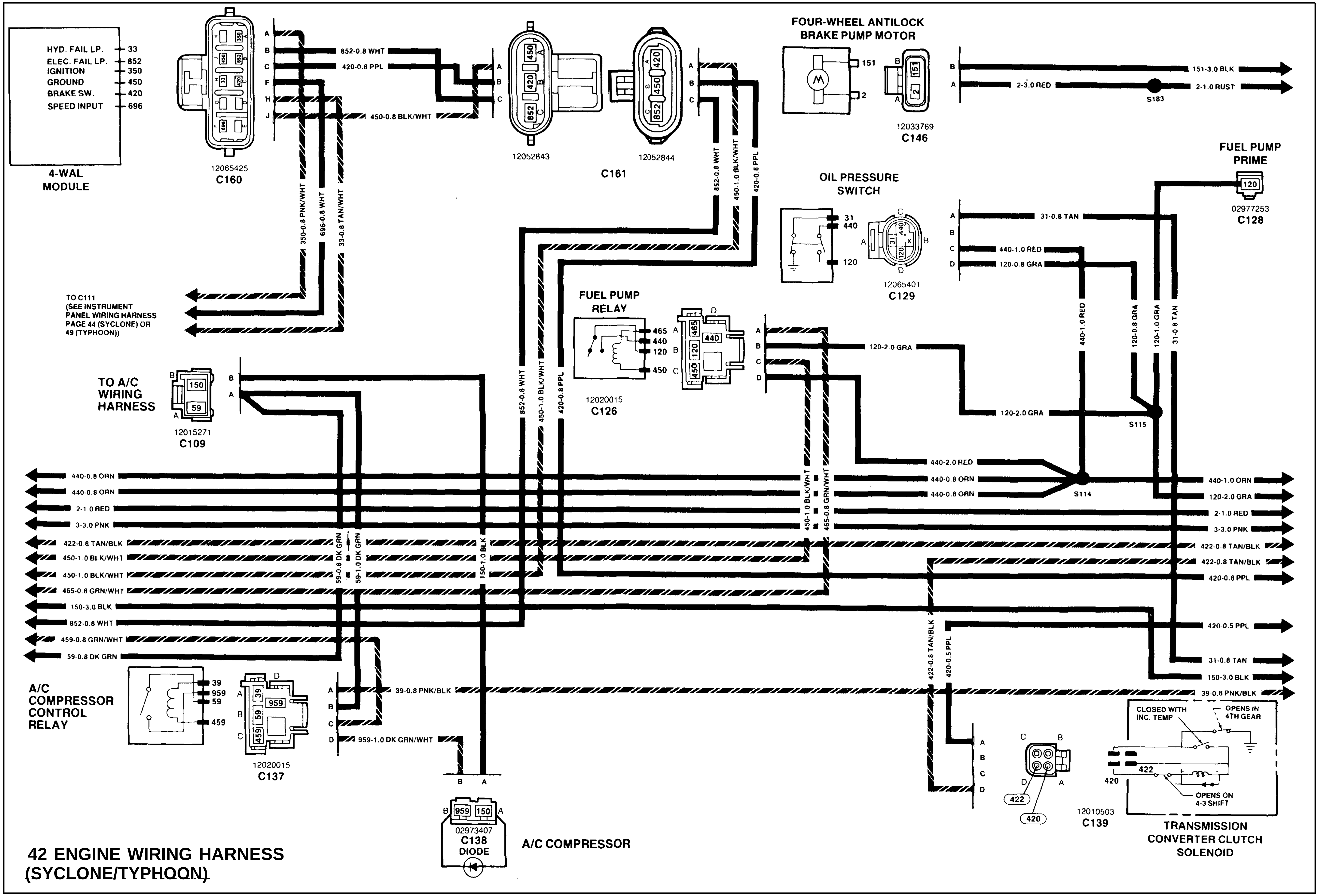

MANIFOLD ABSOLUTE PRESSURE SENSOR
12015796
C134
COOLANT TEMPERATURE SENSOR
12078084
C133
MANIFOLD ABSOLUTE TEMPERATURE SENSOR
12084247
C132
IDLE AIR CONTROL
THROTTLE POSITION SENSOR
12015793
C123
ESC KNOCK SENSOR
12015375
C140
12015798
C125
S116
S120
OXYGEN SENSOR GROUND AND SYSTEM GROUND
G107
SYSTEM GROUND
G108
452-0.5 BLK
155-0.8 BLK
410-0.8 YEL
452-0.8 BLK
472-0.8 TAN
452-0.8 BLK
432-0.8 LT GRN
474-0.8 GRA
410-0.8 YEL
155-0.8 BLK
417-0.5 DK BLU
416-0.5 GRA
472-0.8 TAN
496-0.8 DK BLU
439-0.8 PNK/BLK
465-0.8 GRN/WHT
450-1.0 BLK/WHT
440-0.8 ORN
424-0.8 TAN/BLK
444-0.8 LT GRN/WHT
443-0.8 LT GRN/BLK
442-0.8 BLU/BLK
441-0.8 LT BLU/WHT
423-0.8 WHT
59-0.8 DK GRN
467-0.8 BLU
468-0.8 GRN
450-1.0 BLK/WHT
440-0.8 ORN
551-1.0 TAN/WHT
450-0.8 BLK/WHT
430-0.8 PPL/WHT
453-0.8 BLK/RED
901-0.8 YEL
435-0.5 GRA
412-0.8 PPL
413-0.8 TAN
459-0.8 GRN/WHT
471-0.8 BLK/GRN
422-0.8 TAN/BLK
852-0.8 WHT
904-0.8 DK GRN
121-0.8 WHT
439-0.8 PNK/WHT
424-0.8 TAN/BLK
439-0.8 PNK/BLK
551-1.0 TAN/WHT
467-0.8 BLU
468-0.8 GRN
412-0.8 PPL
435-0.5 GRA
450-1.0 BLK/WHT
440-0.8 ORN
450-1.0 BLK/WHT
441-0.8 LT BLU/WHT
442-0.8 BLU/BLK
444-0.8 LT GRN/WHT
443-0.8 LT GRN/BLK
467-0.8 BLU
468-0.8 GRN
412-0.8 PPL
435-0.5 GRA
465-0.8 GRN/WHT
440-0.8 ORN
440-0.8 ORN
439-0.8 PNK/BLK
439-0.8 PNK/BLK
439-0.8 PNK/BLK
439-0.8 PNK/BLK
439-1.0 PNK/BLK
639-1.0 PNK/BLK
59-0.8 DK GRN
450-0.8 BLK/WHT
450-0.8 BLK/WHT
450-1.0 BLK/WHT
450-1.0 BLK/WHT
424-0.8 TAN/BLK
423-0.8 WHT
430-0.8 PPL/WHT
453-0.8 BLK/RED
901-0.8 YEL
459-0.8 GRN/WHT
471-0.8 BLK/GRN
422-0.8 TAN/BLK
852-0.8 WHT
904-0.8 DK GRN
121-0.8 WHT
A
B
C
D
155
417
416
410
452
472
496
441
442
443
444
432
474



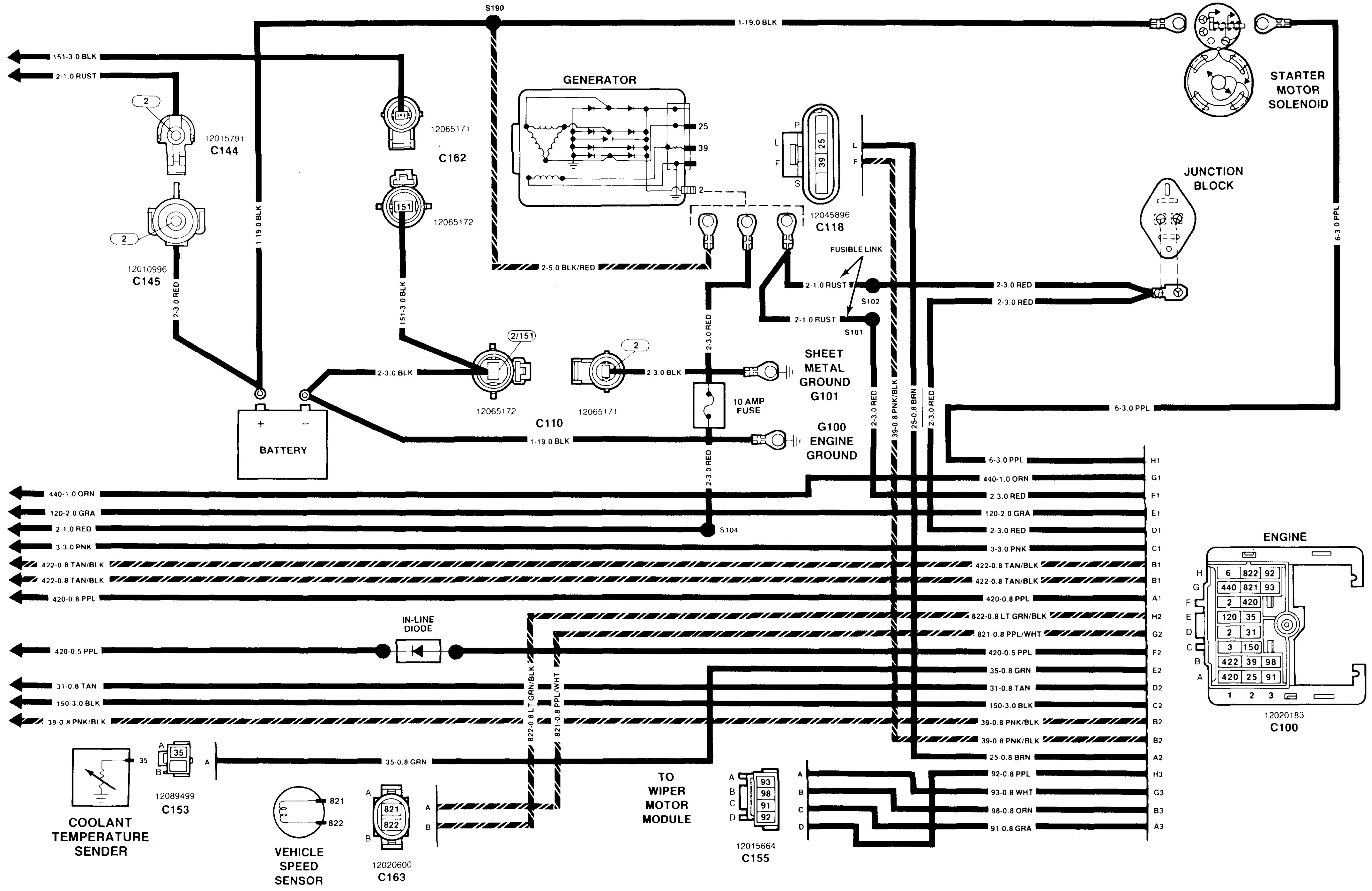
40 ENGINE WIRING HARNESS (SYCLONE/TYPHOON)



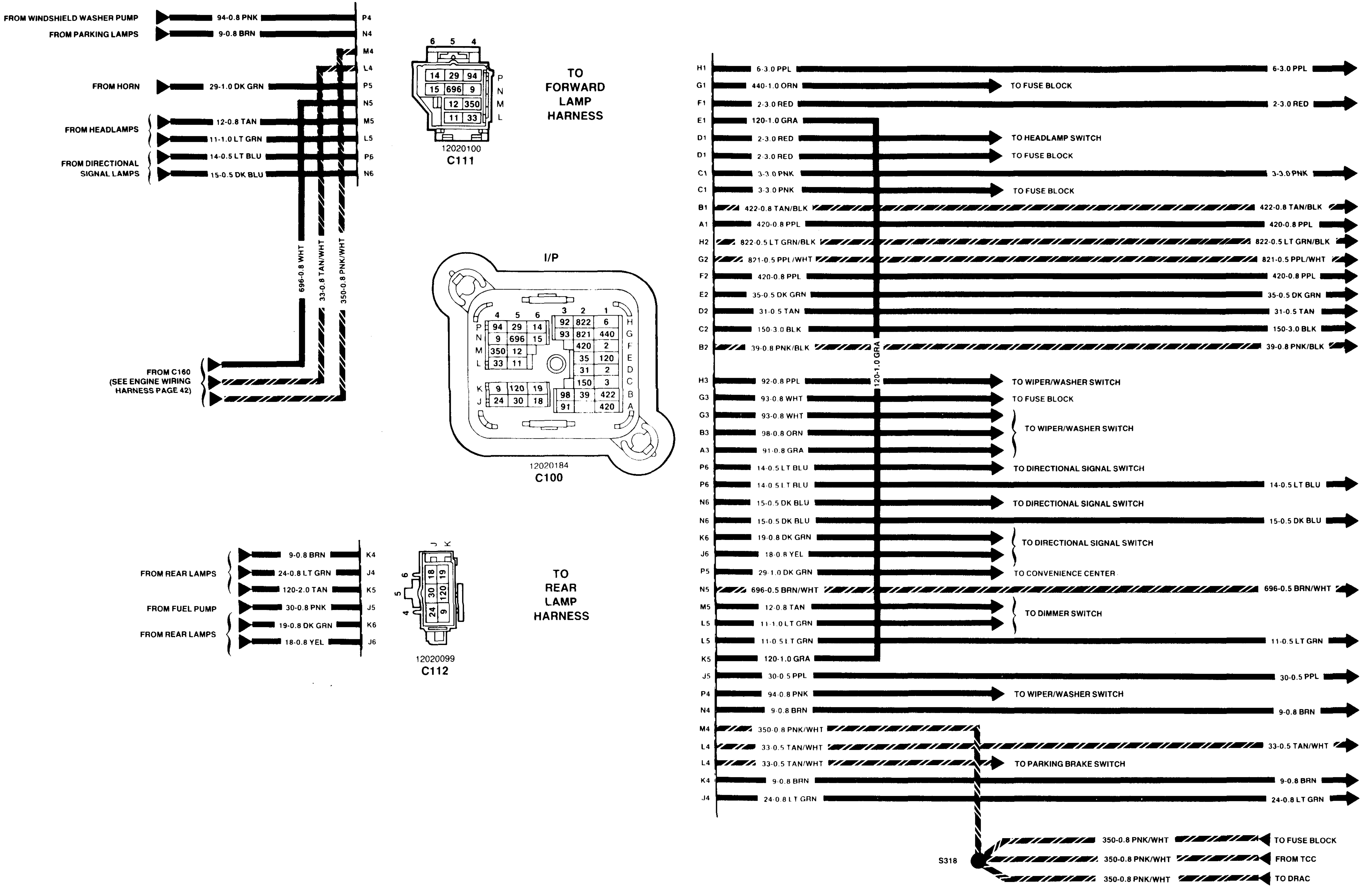
ENGINE WIRING HARNESS (SYCLONE/TYPHOON) 41



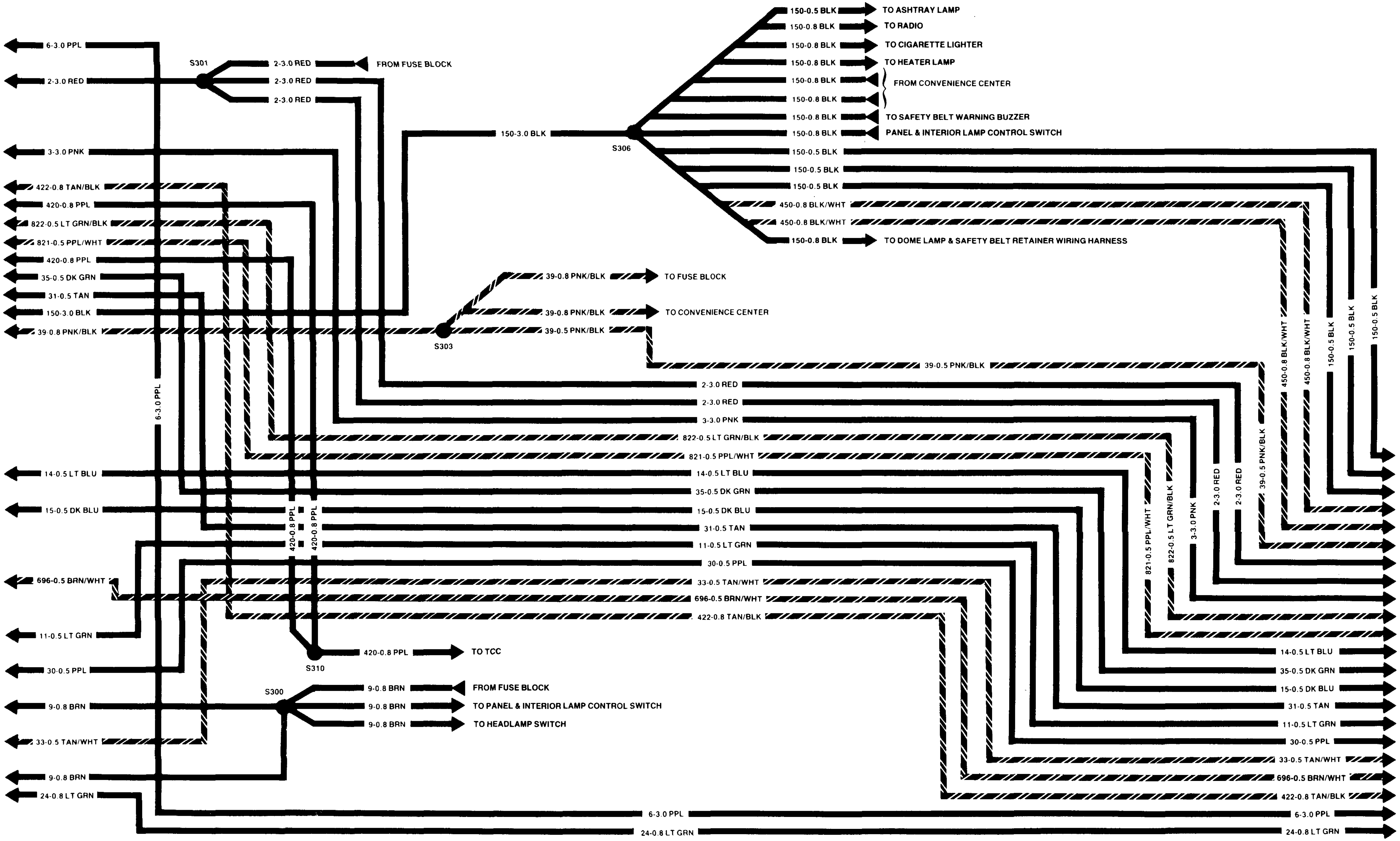
42 ENGINE WIRING HARNESS (SYCLONE/TYPHOON)



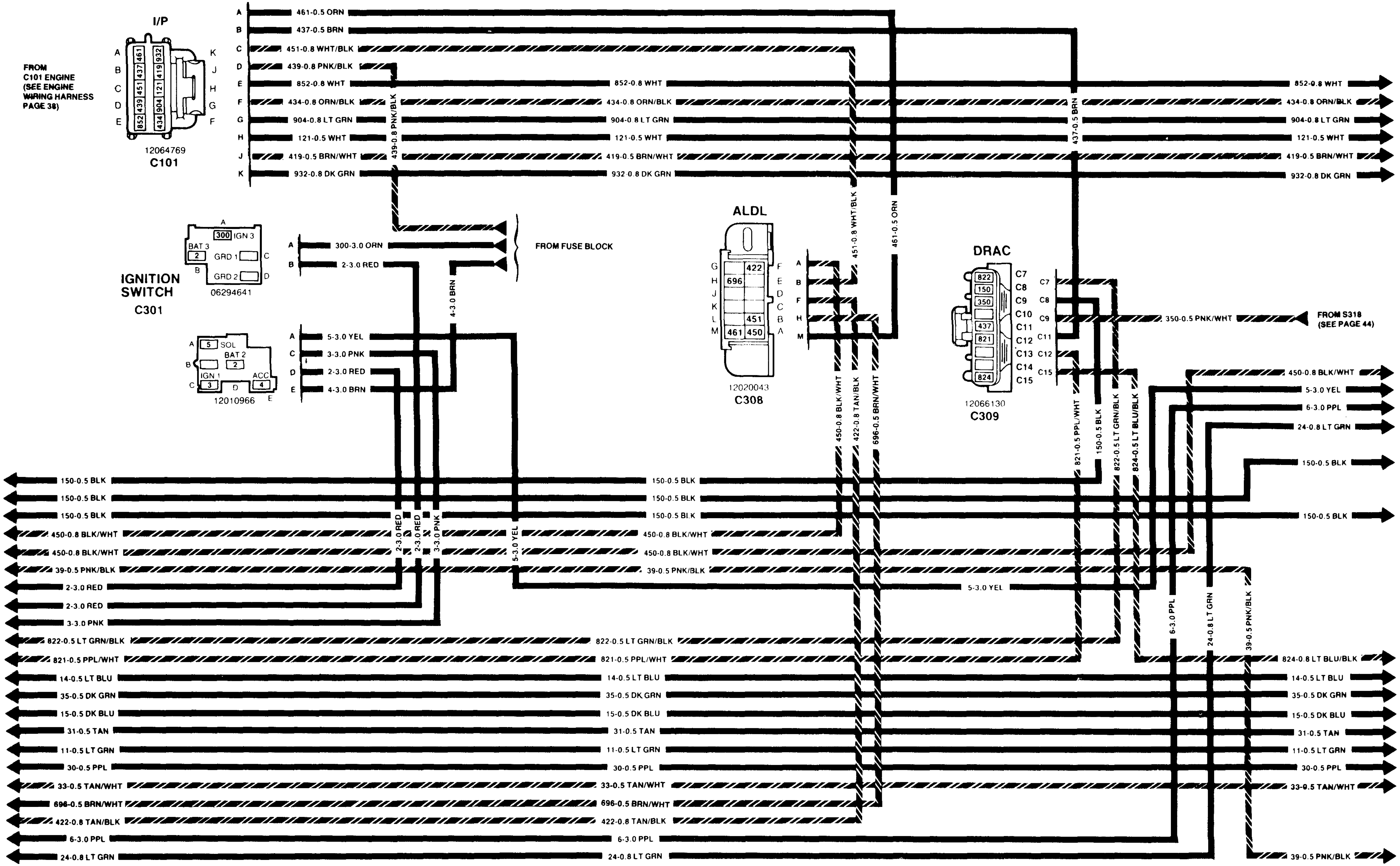
ENGINE WIRING HARNESS (SYCLONE/TYPHOON) 43



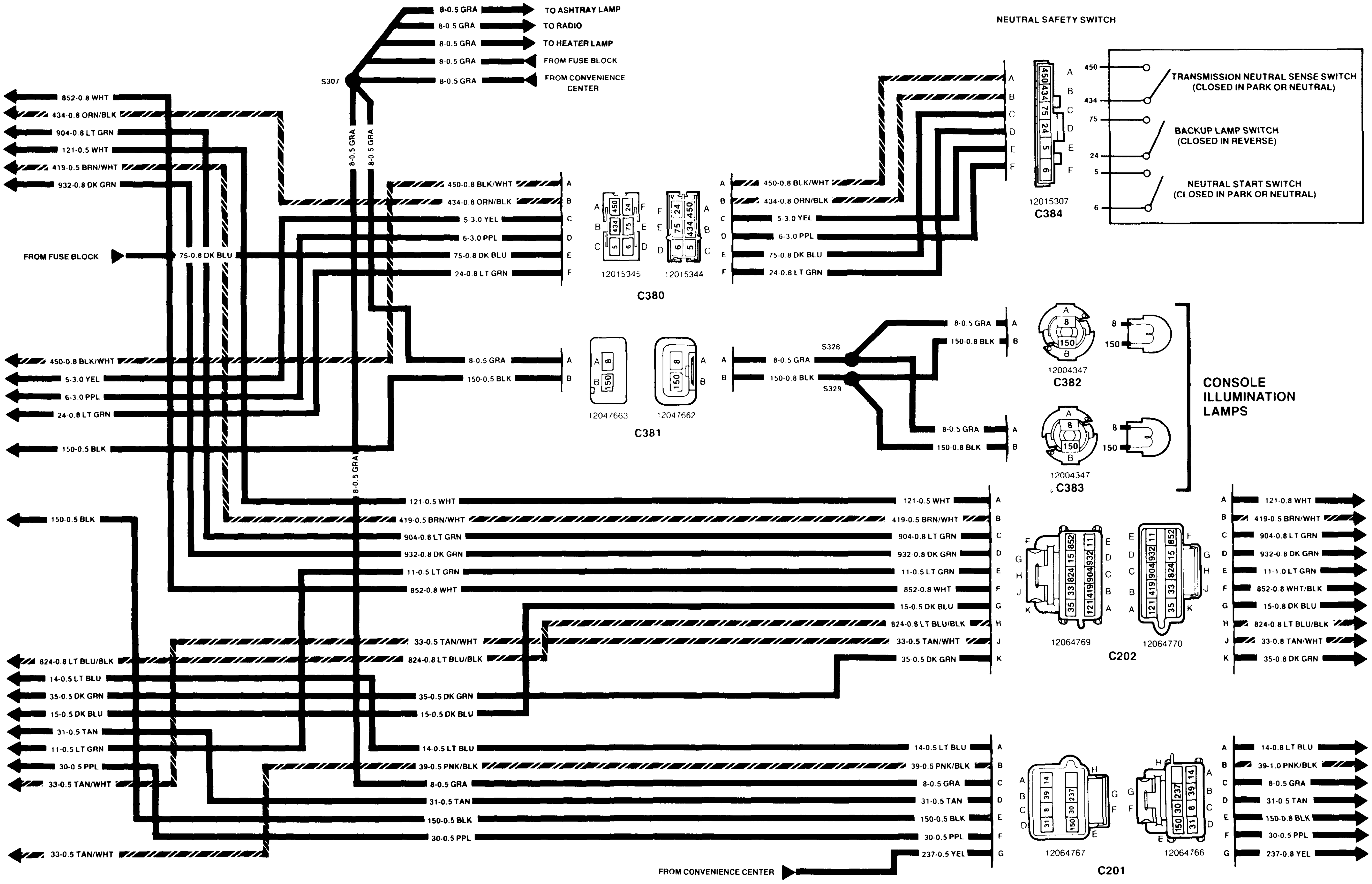
44 INSTRUMENT PANEL WIRING HARNESS (SYCLONE)



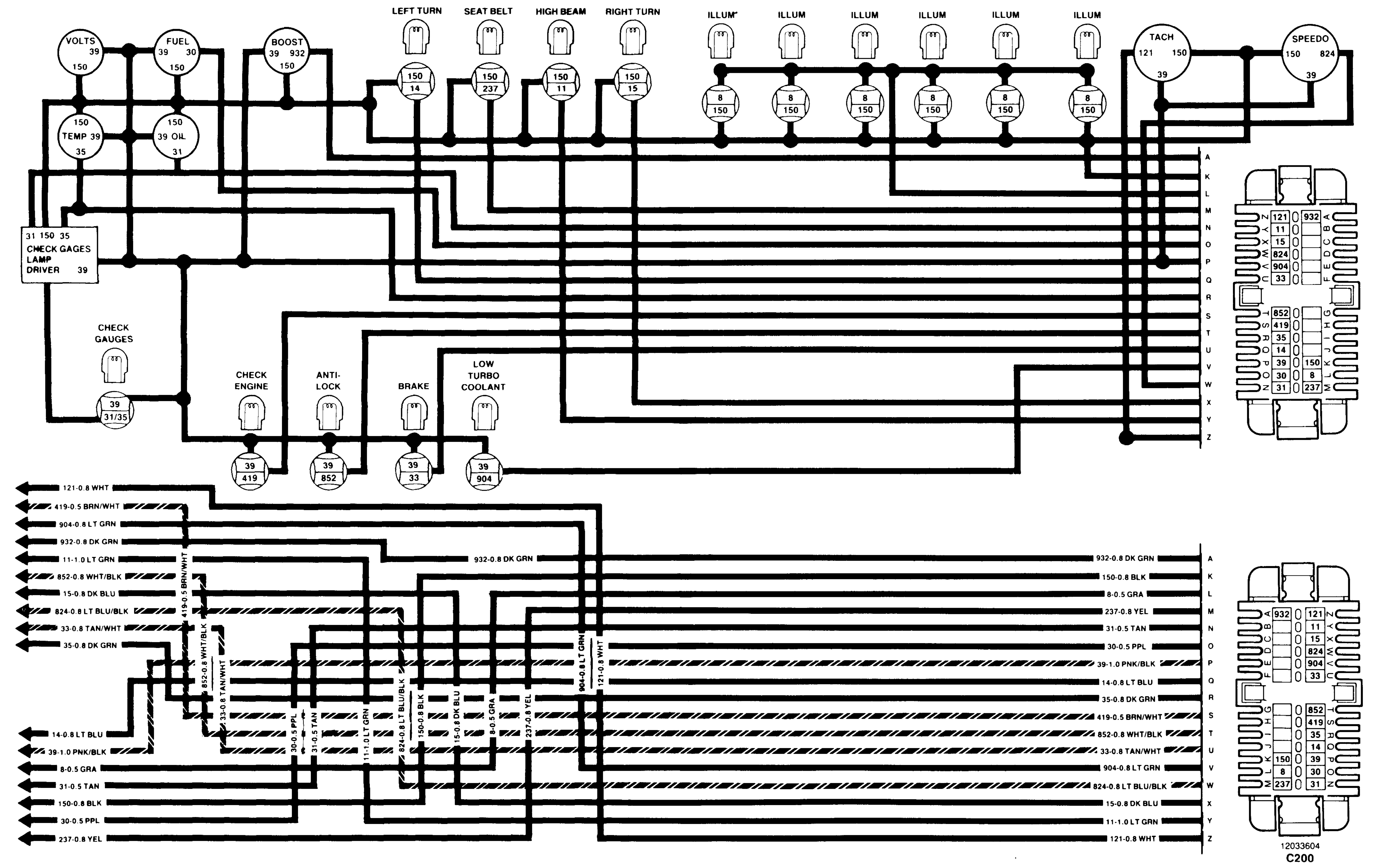
INSTRUMENT PANEL WIRING HARNESS (SYCLONE) 45



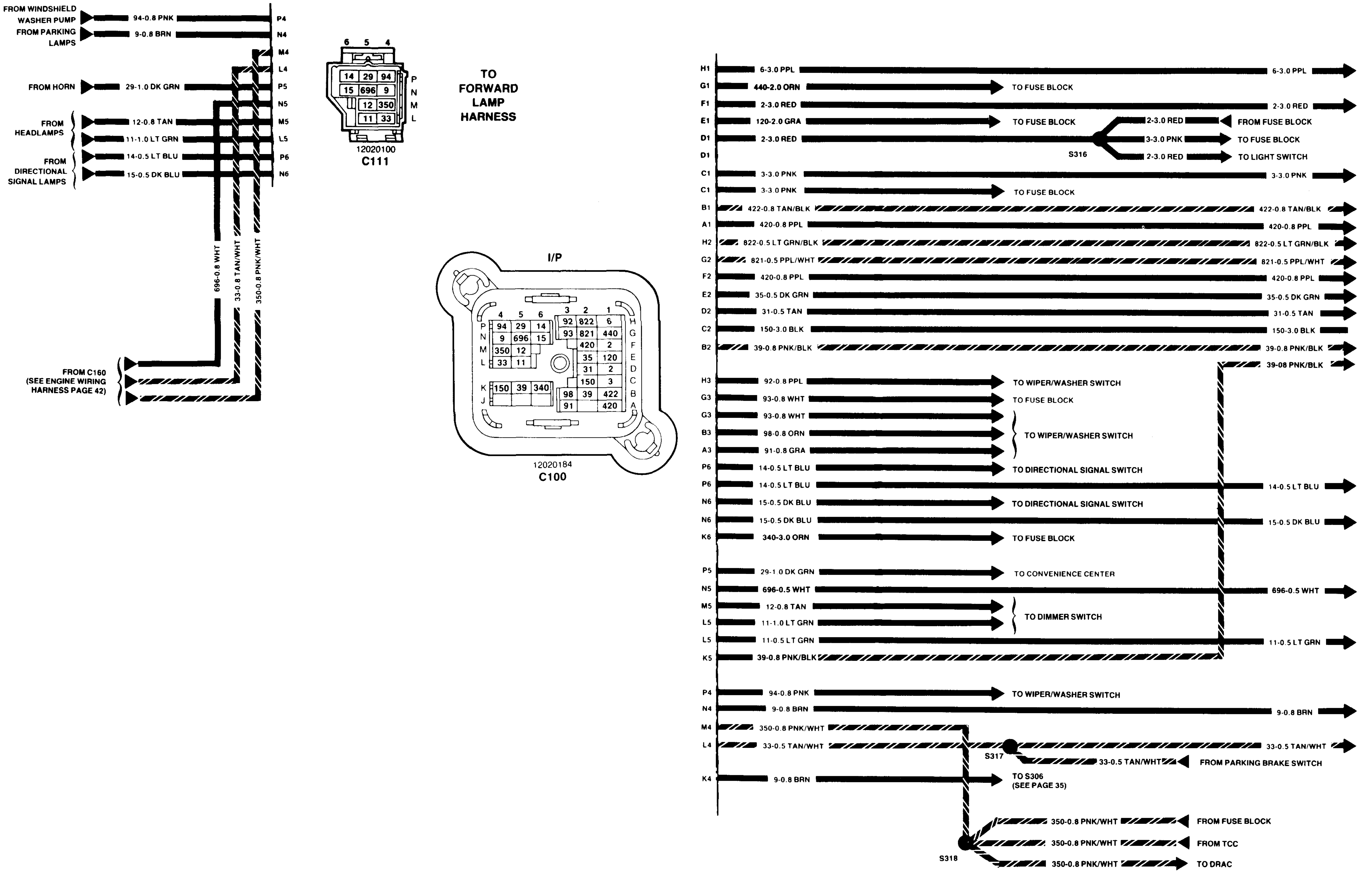
46 INSTRUMENT PANEL WIRING HARNESS (SYCLONE)

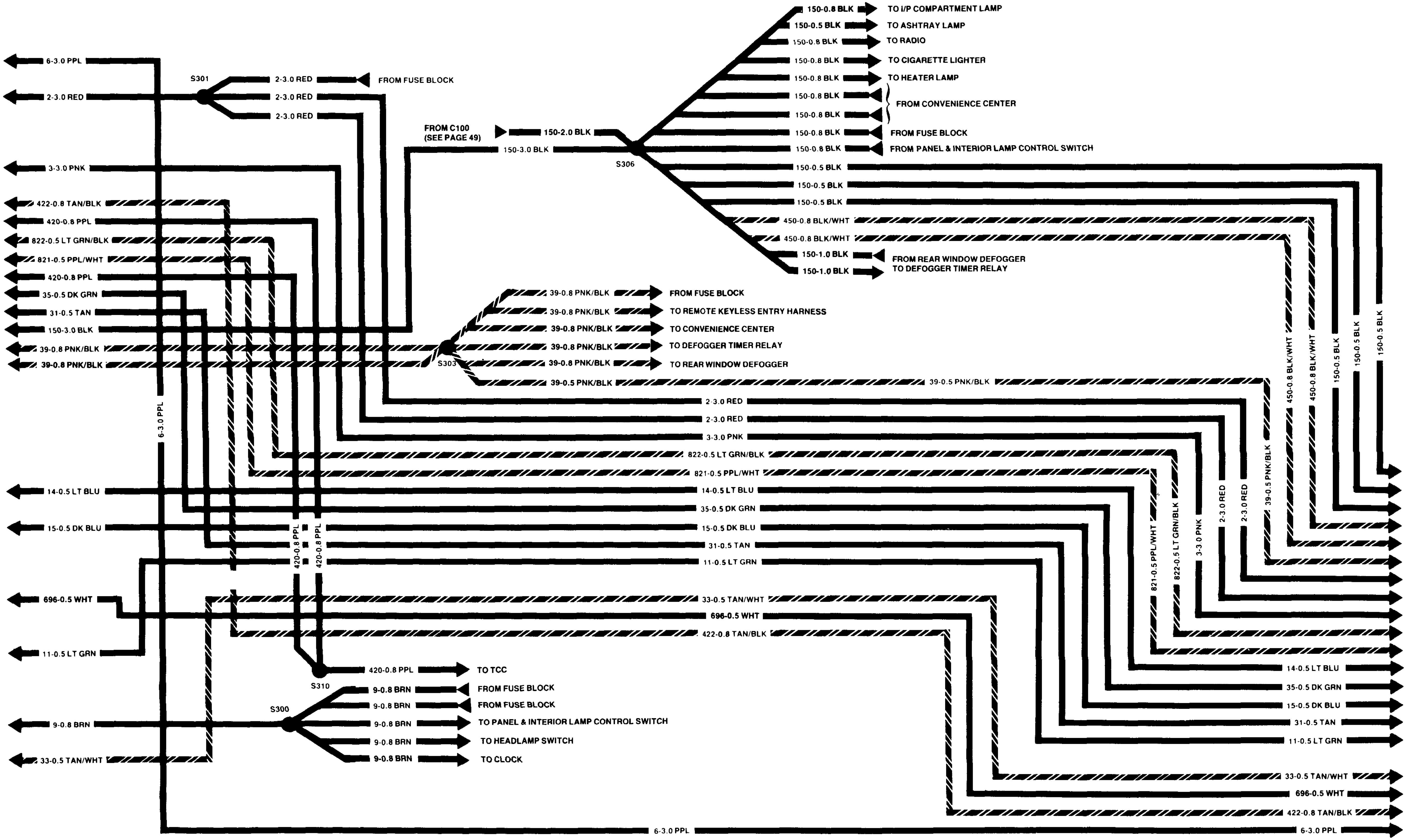


INSTRUMENT PANEL WIRING HARNESS (SYCLONE)

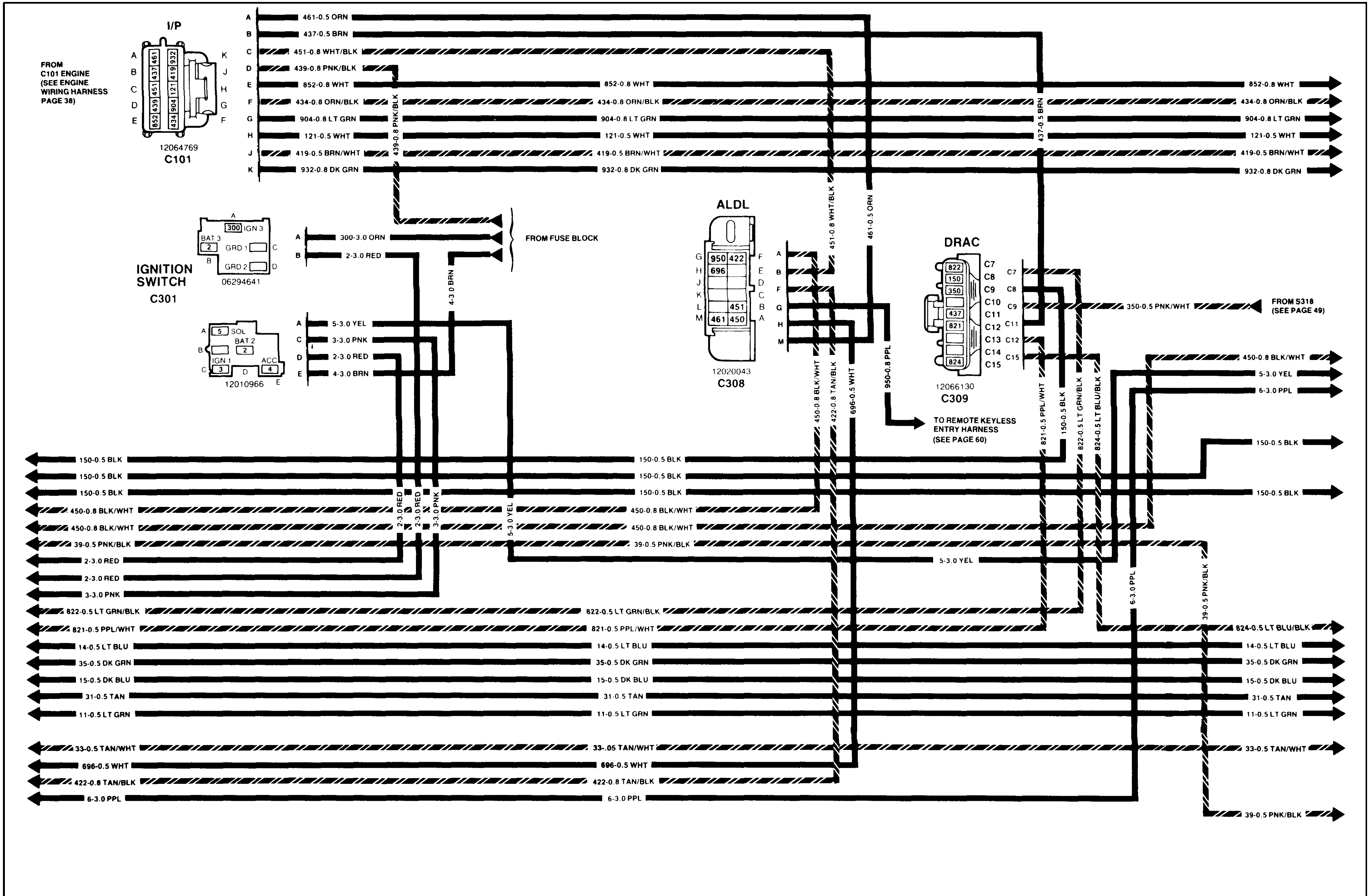


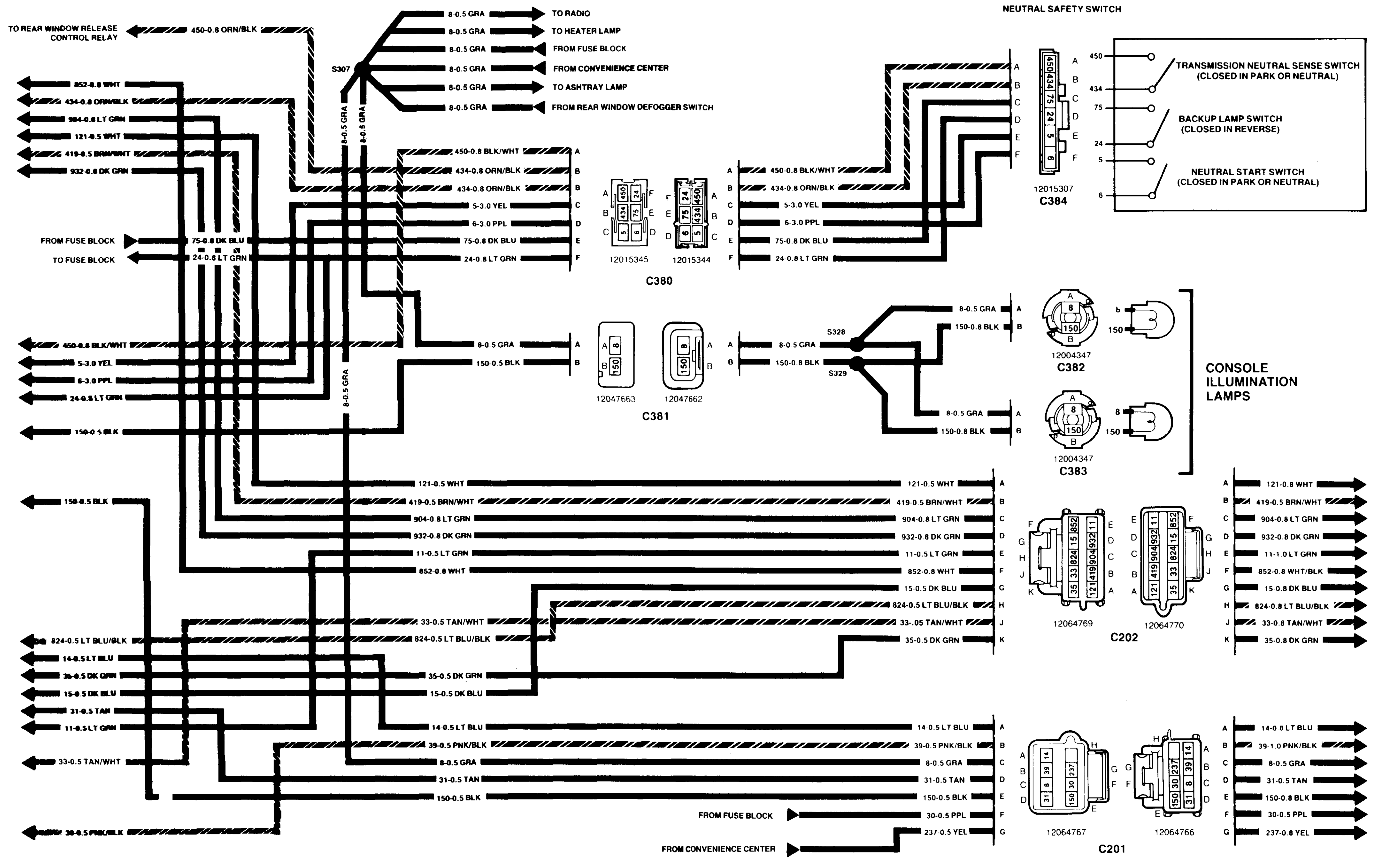
48 INSTRUMENT PANEL WIRING HARNESS (SYCLONE)


FROM WINDSHIELD WASHER PUMP
94-0.8 PNK
P4
FROM PARKING LAMPS
9-0.8 BRN
N4
M4
L4
FROM HORN
29-1.0 DK GRN
P5
N5
FROM HEADLAMPS
12-0.8 TAN
M5
11-1.0 LT GRN
L5
FROM DIRECTIONAL SIGNAL LAMPS
14-0.5 LT BLU
P6
15-0.5 DK BLU
N6
696-0.8 WHT
33-0.8 TAN/WHT
350-0.8 PNK/WHT
FROM C160 (SEE ENGINE WIRING HARNESS PAGE 42)
6 5 4
14 29 94
15 696 9
12 350
11 33
P N M L
12020100
C111
TO FORWARD LAMP HARNESS
I/P
4 5 6
3 2 1
P 94 29 14
N 9 696 15
M 350 12
L 33 11
K 150 39 340
J
H 92 822 6
G 93 821 440
F 420 2
E 35 120
D 31 2
C 150 3
B 98 39 422
A 91 420
12020184
C100
H1 6-3.0 PPL
6-3.0 PPL
G1 440-2.0 ORN
TO FUSE BLOCK
F1 2-3.0 RED
2-3.0 RED
E1 120-2.0 GRA
TO FUSE BLOCK
2-3.0 RED
FROM FUSE BLOCK
D1 2-3.0 RED
3-3.0 PNK
TO FUSE BLOCK
D1
S316
2-3.0 RED
TO LIGHT SWITCH
C1 3-3.0 PNK
3-3.0 PNK
C1 3-3.0 PNK
TO FUSE BLOCK
B1 422-0.8 TAN/BLK
422-0.8 TAN/BLK
A1 420-0.8 PPL
420-0.8 PPL
H2 822-0.5 LT GRN/BLK
822-0.5 LT GRN/BLK
G2 821-0.5 PPL/WHT
821-0.5 PPL/WHT
F2 420-0.8 PPL
420-0.8 PPL
E2 35-0.5 DK GRN
35-0.5 DK GRN
D2 31-0.5 TAN
31-0.5 TAN
C2 150-3.0 BLK
150-3.0 BLK
B2 39-0.8 PNK/BLK
39-0.8 PNK/BLK
39-08 PNK/BLK
H3 92-0.8 PPL
TO WIPER/WASHER SWITCH
G3 93-0.8 WHT
TO FUSE BLOCK
G3 93-0.8 WHT
B3 98-0.8 ORN
A3 91-0.8 GRA
TO WIPER/WASHER SWITCH
P6 14-0.5 LT BLU
TO DIRECTIONAL SIGNAL SWITCH
P6 14-0.5 LT BLU
14-0.5 LT BLU
N6 15-0.5 DK BLU
TO DIRECTIONAL SIGNAL SWITCH
N6 15-0.5 DK BLU
15-0.5 DK BLU
K6 340-3.0 ORN
TO FUSE BLOCK
P5 29-1.0 DK GRN
TO CONVENIENCE CENTER
N5 696-0.5 WHT
696-0.5 WHT
M5 12-0.8 TAN
L5 11-1.0 LT GRN
TO DIMMER SWITCH
L5 11-0.5 LT GRN
11-0.5 LT GRN
K5 39-0.8 PNK/BLK
P4 94-0.8 PNK
TO WIPER/WASHER SWITCH
N4 9-0.8 BRN
9-0.8 BRN
M4 350-0.8 PNK/WHT
L4 33-0.5 TAN/WHT
33-0.5 TAN/WHT
S317
33-0.5 TAN/WHT
FROM PARKING BRAKE SWITCH
K4 9-0.8 BRN
TO S306 (SEE PAGE 35)
350-0.8 PNK/WHT
FROM FUSE BLOCK
350-0.8 PNK/WHT
FROM TCC
S318
350-0.8 PNK/WHT
TO DRAC

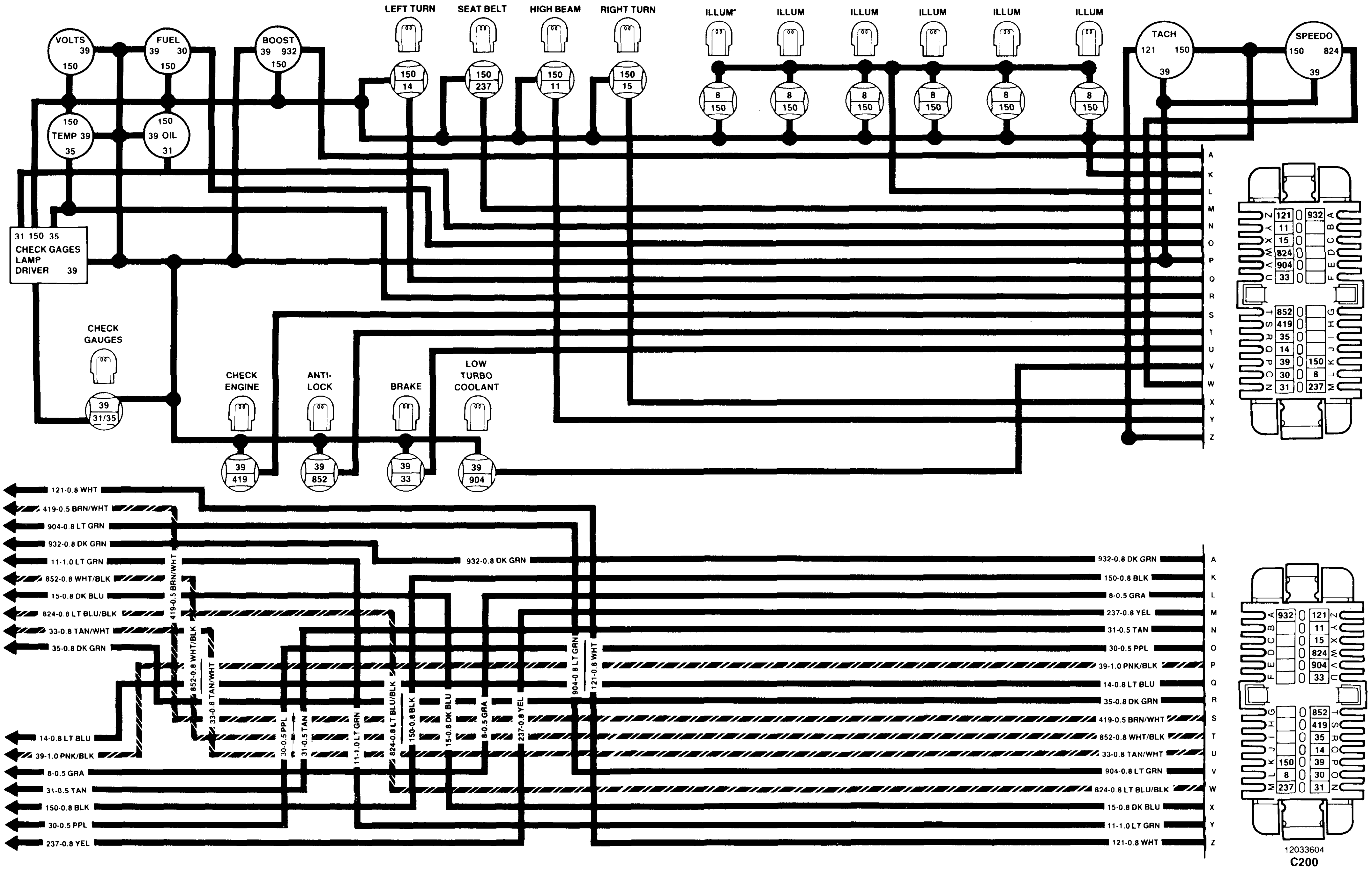


50 INSTRUMENT PANEL WIRING HARNESS (TYPHOON)

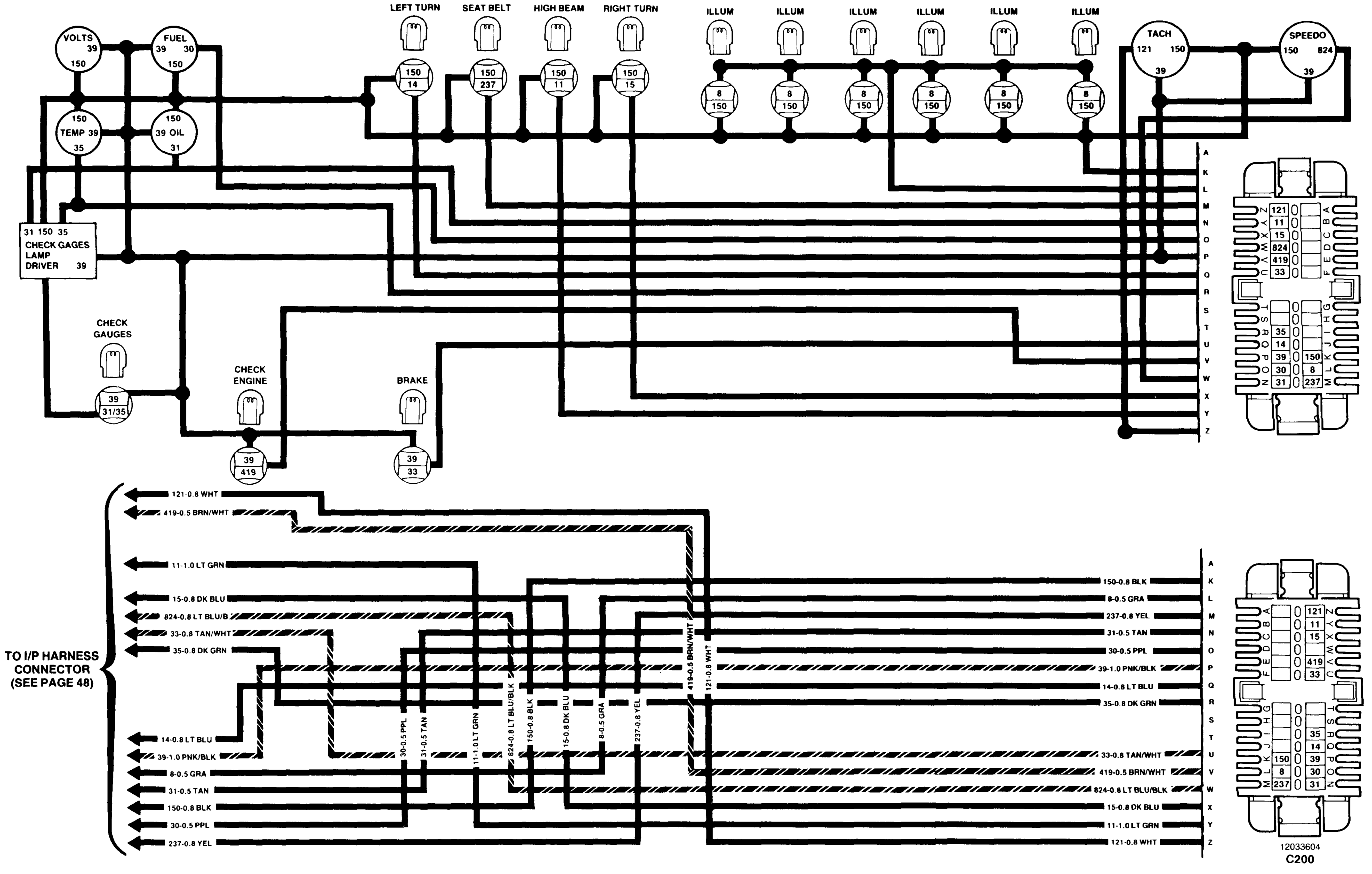

I/P
FROM C101 ENGINE (SEE ENGINE WIRING HARNESS PAGE 38)
A B C D E K J H G F
852 439 451 437 461
434 904 121 419 932
12064769
C101
A 461-0.5 ORN
B 437-0.5 BRN
C 451-0.8 WHT/BLK
D 439-0.8 PNK/BLK
E 852-0.8 WHT
F 434-0.8 ORN/BLK
G 904-0.8 LT GRN
H 121-0.5 WHT
J 419-0.5 BRN/WHT
K 932-0.8 DK GRN
439-0.8 PNK/BLK
437-0.5 BRN
852-0.8 WHT
434-0.8 ORN/BLK
904-0.8 LT GRN
121-0.5 WHT
419-0.5 BRN/WHT
932-0.8 DK GRN
300 IGN 3
BAT 3
2
GRD 1
GRD 2
A B C D
IGNITION SWITCH
C301
06294641
A 300-3.0 ORN
B 2-3.0 RED
4-3.0 BRN
FROM FUSE BLOCK
5 SOL
BAT 2
2
IGN 1
3
ACC
4
A B C D E
12010966
A 5-3.0 YEL
C 3-3.0 PNK
D 2-3.0 RED
E 4-3.0 BRN
ALDL
G H J K L M F E D C B A
950 422
696
451
461 450
12020043
C308
A B F G H M
451-0.8 WHT/BLK
461-0.5 ORN
950-0.8 PPL
450-0.8 BLK/WHT
422-0.8 TAN/BLK
696-0.5 WHT
TO REMOTE KEYLESS ENTRY HARNESS (SEE PAGE 60)
DRAC
822
150
350
437
821
824
C7 C8 C9 C10 C11 C12 C13 C14 C15
12066130
C309
C7 C8 C9 C11 C12 C15
350-0.5 PNK/WHT
FROM S318 (SEE PAGE 49)
450-0.8 BLK/WHT
5-3.0 YEL
6-3.0 PPL
821-0.5 PPL/WHT
150-0.5 BLK
822-0.5 LT GRN/BLK
824-0.5 LT BLU/BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
150-0.5 BLK
450-0.8 BLK/WHT
450-0.8 BLK/WHT
450-0.8 BLK/WHT
450-0.8 BLK/WHT
39-0.5 PNK/BLK
39-0.5 PNK/BLK
2-3.0 RED
2-3.0 RED
3-3.0 PNK
5-3.0 YEL
2-3.0 RED
2-3.0 RED
3-3.0 PNK
5-3.0 YEL
822-0.5 LT GRN/BLK
822-0.5 LT GRN/BLK
821-0.5 PPL/WHT
821-0.5 PPL/WHT
6-3.0 PPL
39-0.5 PNK/BLK
824-0.5 LT BLU/BLK
14-0.5 LT BLU
14-0.5 LT BLU
14-0.5 LT BLU
35-0.5 DK GRN
35-0.5 DK GRN
35-0.5 DK GRN
15-0.5 DK BLU
15-0.5 DK BLU
15-0.5 DK BLU
31-0.5 TAN
31-0.5 TAN
31-0.5 TAN
11-0.5 LT GRN
11-0.5 LT GRN
11-0.5 LT GRN
33-0.5 TAN/WHT
33-.05 TAN/WHT
33-0.5 TAN/WHT
696-0.5 WHT
696-0.5 WHT
422-0.8 TAN/BLK
422-0.8 TAN/BLK
6-3.0 PPL
6-3.0 PPL
39-0.5 PNK/BLK



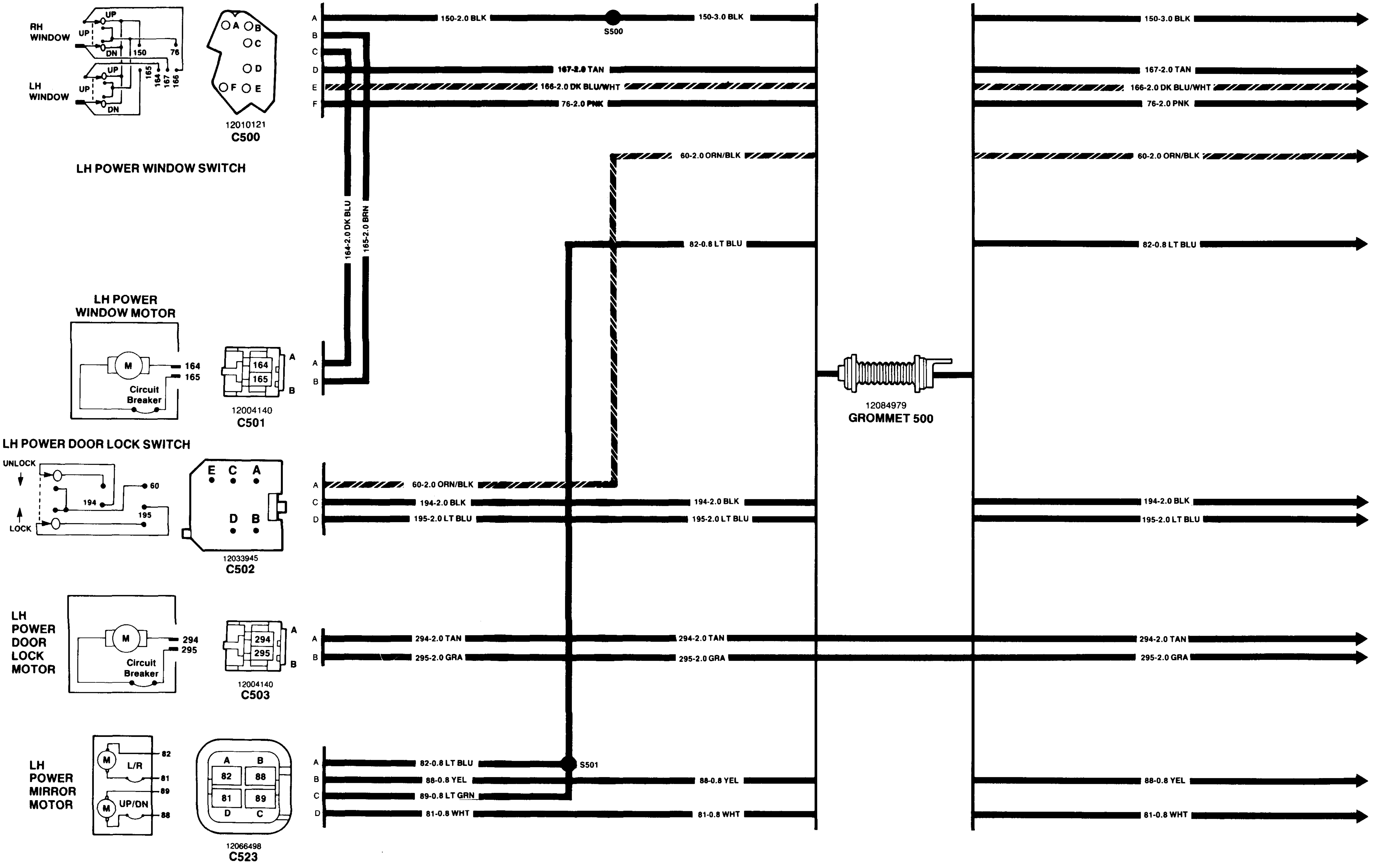
52 INSTRUMENT PANEL WIRING HARNESS (TYPHOON)

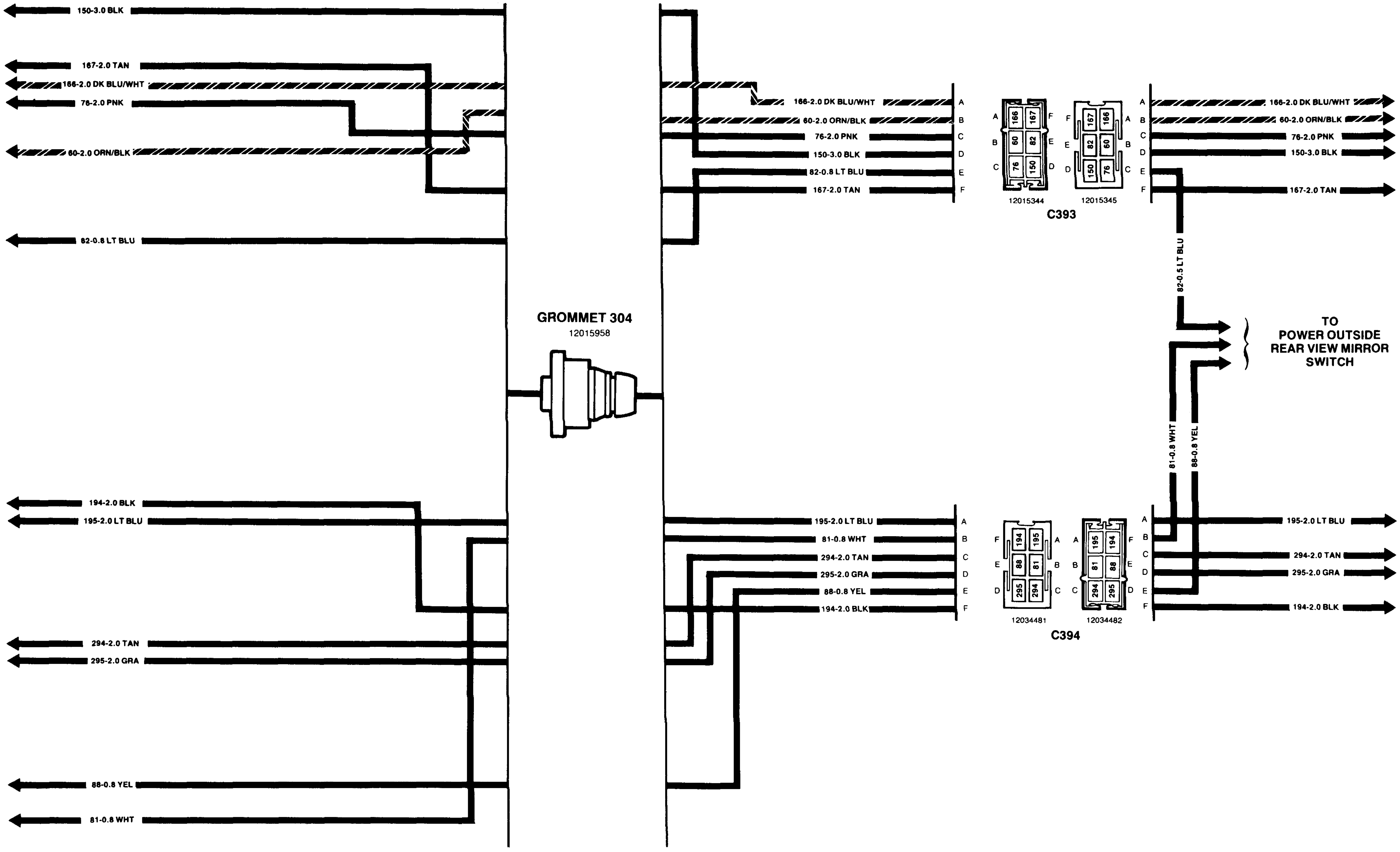


INSTRUMENT PANEL WIRING HARNESS (TYPHOON) 53

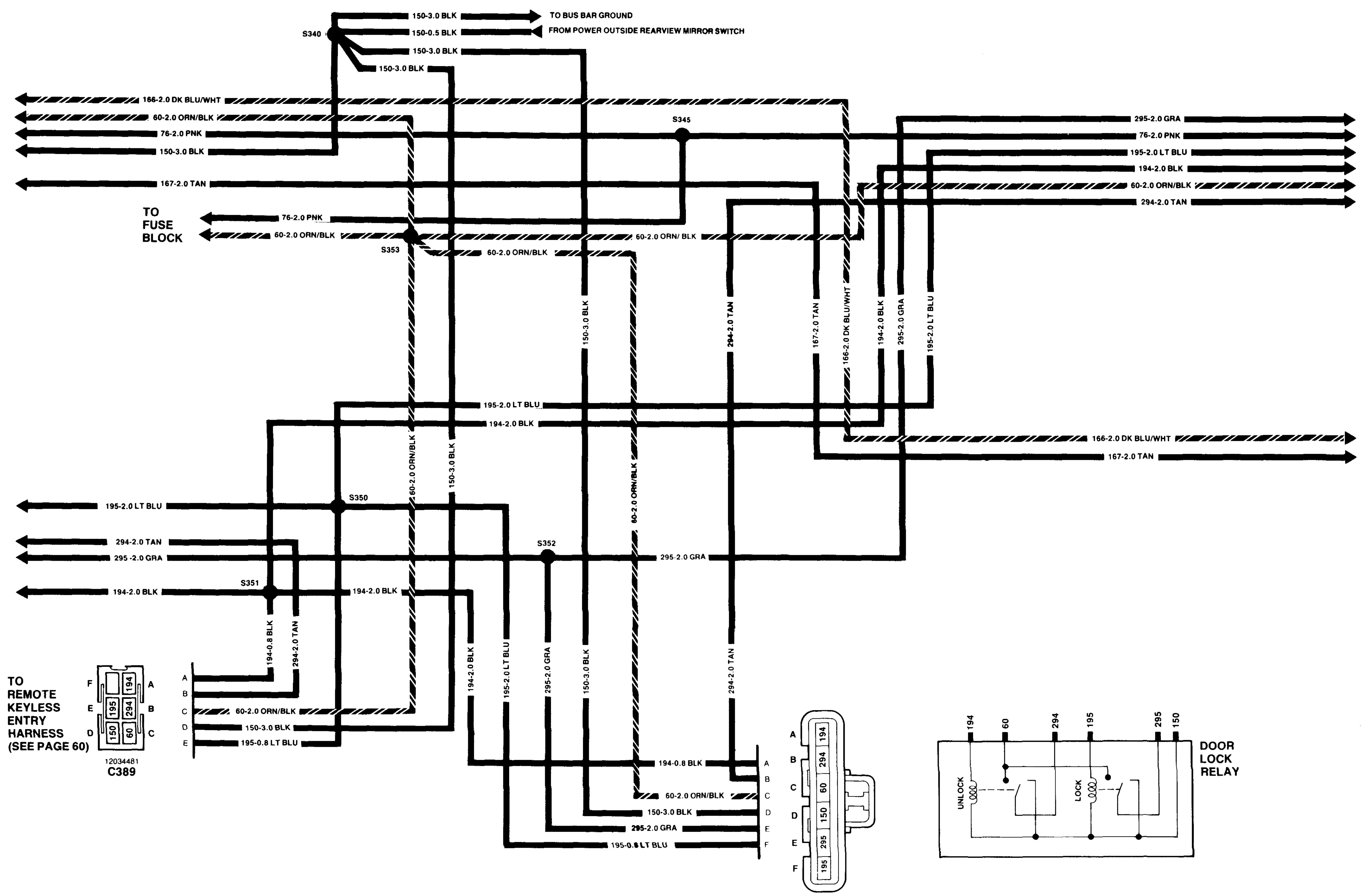


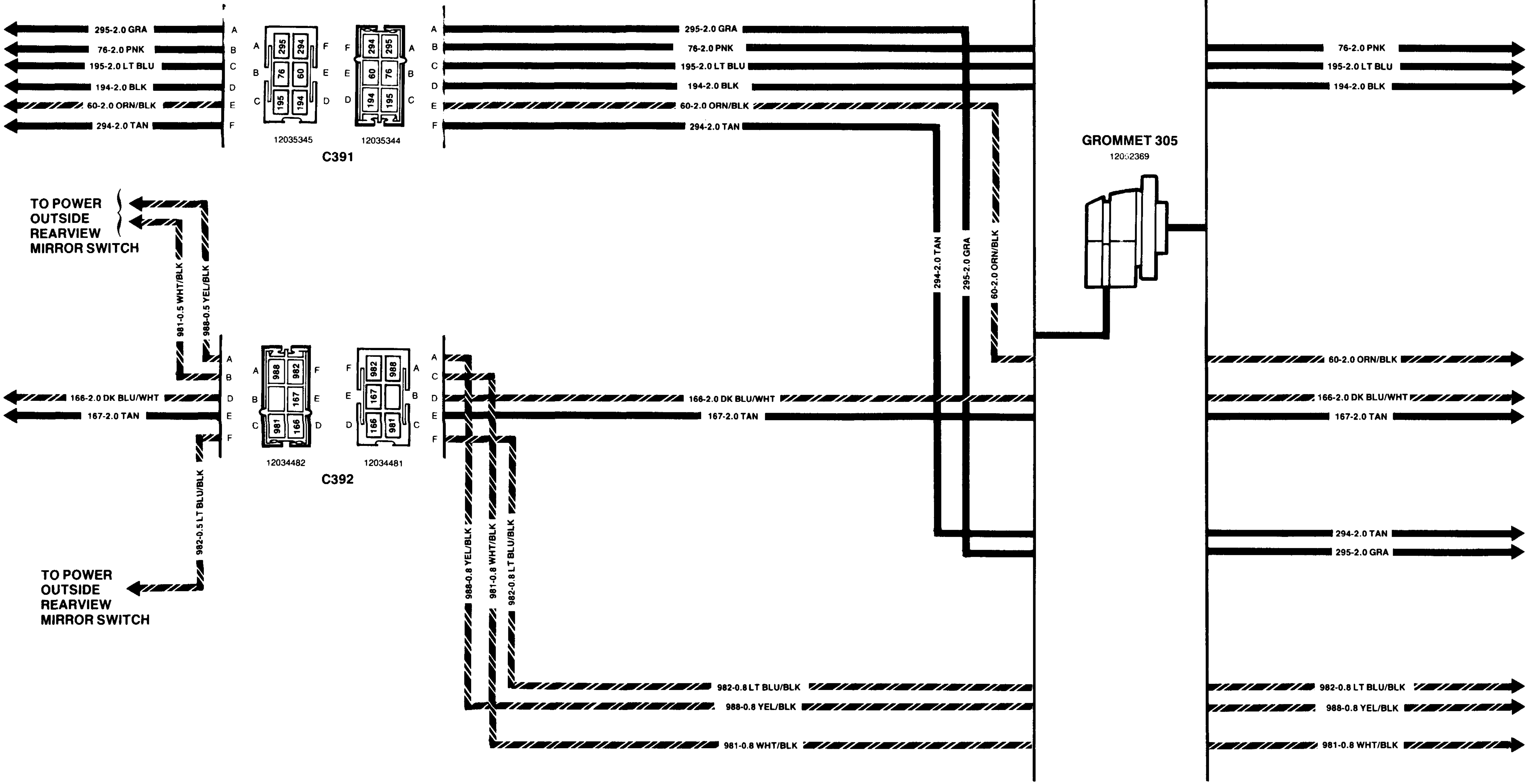
54 INSTRUMENT CLUSTER WIRING HARNESS (SONOMA GT)


RH WINDOW
LH WINDOW
UP
DN
150
76
164
165
167
166
12010121
C500
LH POWER WINDOW SWITCH
A
B
C
D
E
F
150-2.0 BLK
S500
150-3.0 BLK
167-2.0 TAN
166-2.0 DK BLU/WHT
76-2.0 PNK
60-2.0 ORN/BLK
82-0.8 LT BLU
164-2.0 DK BLU
165-2.0 BRN
150-3.0 BLK
167-2.0 TAN
166-2.0 DK BLU/WHT
76-2.0 PNK
60-2.0 ORN/BLK
82-0.8 LT BLU
LH POWER WINDOW MOTOR
M
Circuit Breaker
164
165
12004140
C501
12084979
GROMMET 500
LH POWER DOOR LOCK SWITCH
UNLOCK
LOCK
194
195
60
E C A
D B
12033945
C502
60-2.0 ORN/BLK
194-2.0 BLK
195-2.0 LT BLU
194-2.0 BLK
195-2.0 LT BLU
194-2.0 BLK
195-2.0 LT BLU
LH POWER DOOR LOCK MOTOR
M
Circuit Breaker
294
295
12004140
C503
294-2.0 TAN
295-2.0 GRA
294-2.0 TAN
295-2.0 GRA
294-2.0 TAN
295-2.0 GRA
LH POWER MIRROR MOTOR
M
L/R
UP/DN
82
81
89
88
12066498
C523
82-0.8 LT BLU
S501
88-0.8 YEL
89-0.8 LT GRN
81-0.8 WHT
88-0.8 YEL
81-0.8 WHT
88-0.8 YEL
81-0.8 WHT

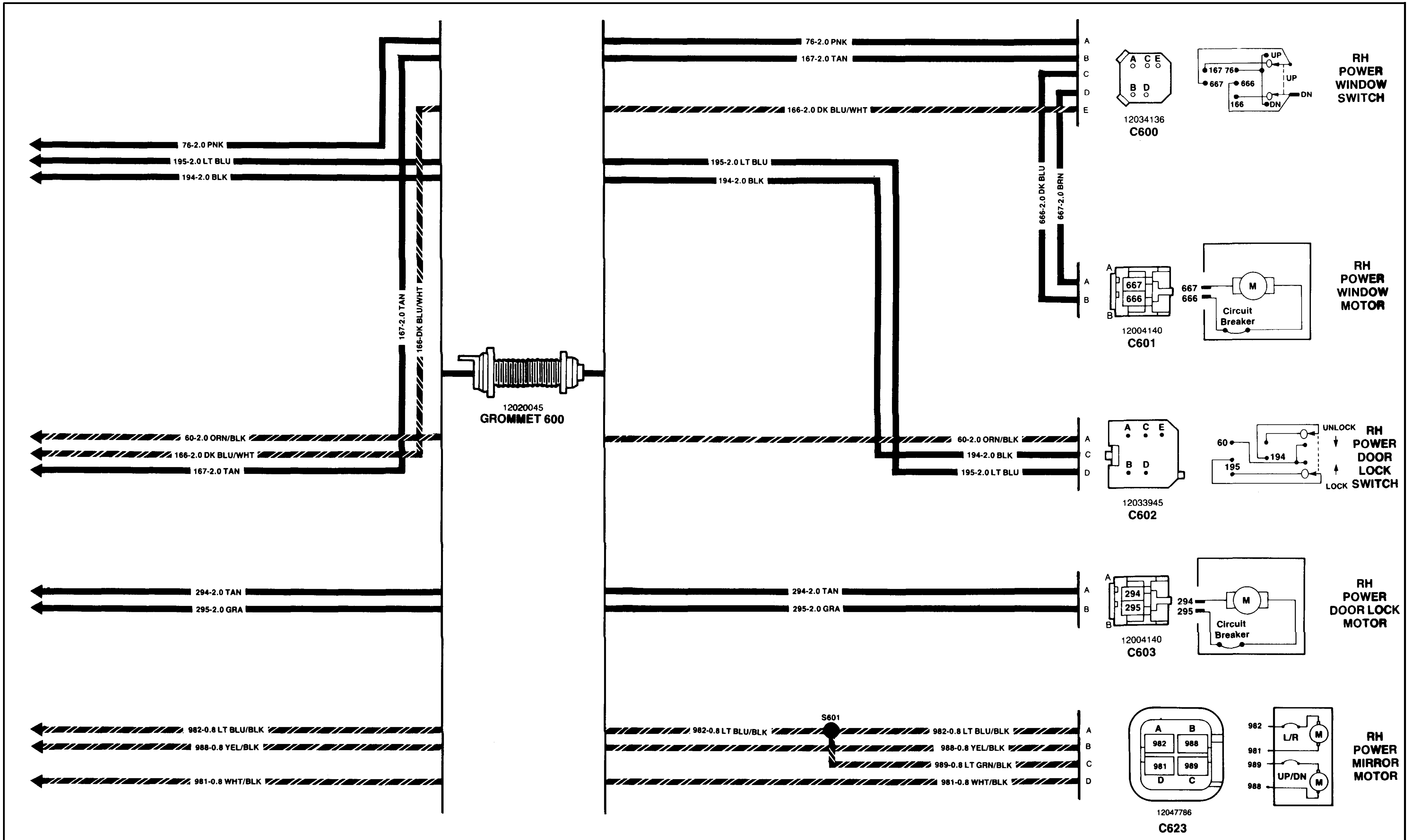


56 LEFT DOOR HARNESS/CROSS-BODY HARNESS (TYPHOON)

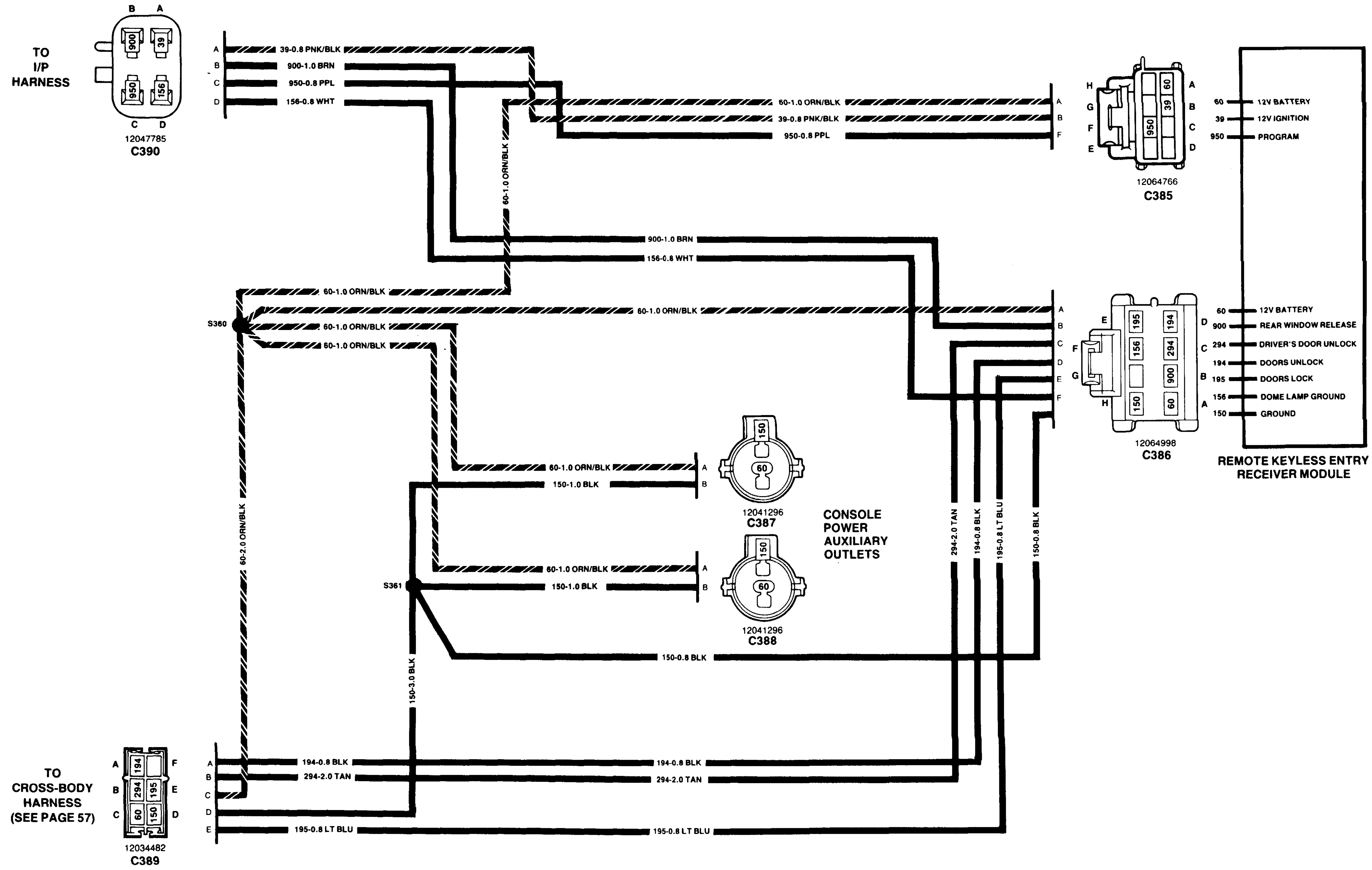

150-3.0 BLK
TO BUS BAR GROUND
150-0.5 BLK
FROM POWER OUTSIDE REARVIEW MIRROR SWITCH
S340
150-3.0 BLK
150-3.0 BLK
166-2.0 DK BLU/WHT
60-2.0 ORN/BLK
76-2.0 PNK
150-3.0 BLK
167-2.0 TAN
S345
295-2.0 GRA
76-2.0 PNK
195-2.0 LT BLU
194-2.0 BLK
60-2.0 ORN/BLK
294-2.0 TAN
TO FUSE BLOCK
76-2.0 PNK
60-2.0 ORN/BLK
S353
60-2.0 ORN/ BLK
60-2.0 ORN/BLK
150-3.0 BLK
294-2.0 TAN
167-2.0 TAN
166-2.0 DK BLU/WHT
194-2.0 BLK
295-2.0 GRA
195-2.0 LT BLU
195-2.0 LT BLU
194-2.0 BLK
166-2.0 DK BLU/WHT
167-2.0 TAN
60-2.0 ORN/BLK
150-3.0 BLK
60-2.0 ORN/BLK
195-2.0 LT BLU
S350
294-2.0 TAN
295 -2.0 GRA
S352
295-2.0 GRA
S351
194-2.0 BLK
194-2.0 BLK
194-0.8 BLK
294-2.0 TAN
194-2.0 BLK
195-2.0 LT BLU
295-2.0 GRA
150-3.0 BLK
294-2.0 TAN
TO REMOTE KEYLESS ENTRY HARNESS (SEE PAGE 60)
F
E
D
A
B
C
194
195
294
150
60
12034481
C389
A
B
C
D
E
60-2.0 ORN/BLK
150-3.0 BLK
195-0.8 LT BLU
194-0.8 BLK
60-2.0 ORN/BLK
150-3.0 BLK
295-2.0 GRA
195-0.8 LT BLU
A
B
C
D
E
F
A
B
C
D
E
F
194
294
60
150
295
195
194
60
294
195
295
150
UNLOCK
LOCK
DOOR LOCK RELAY



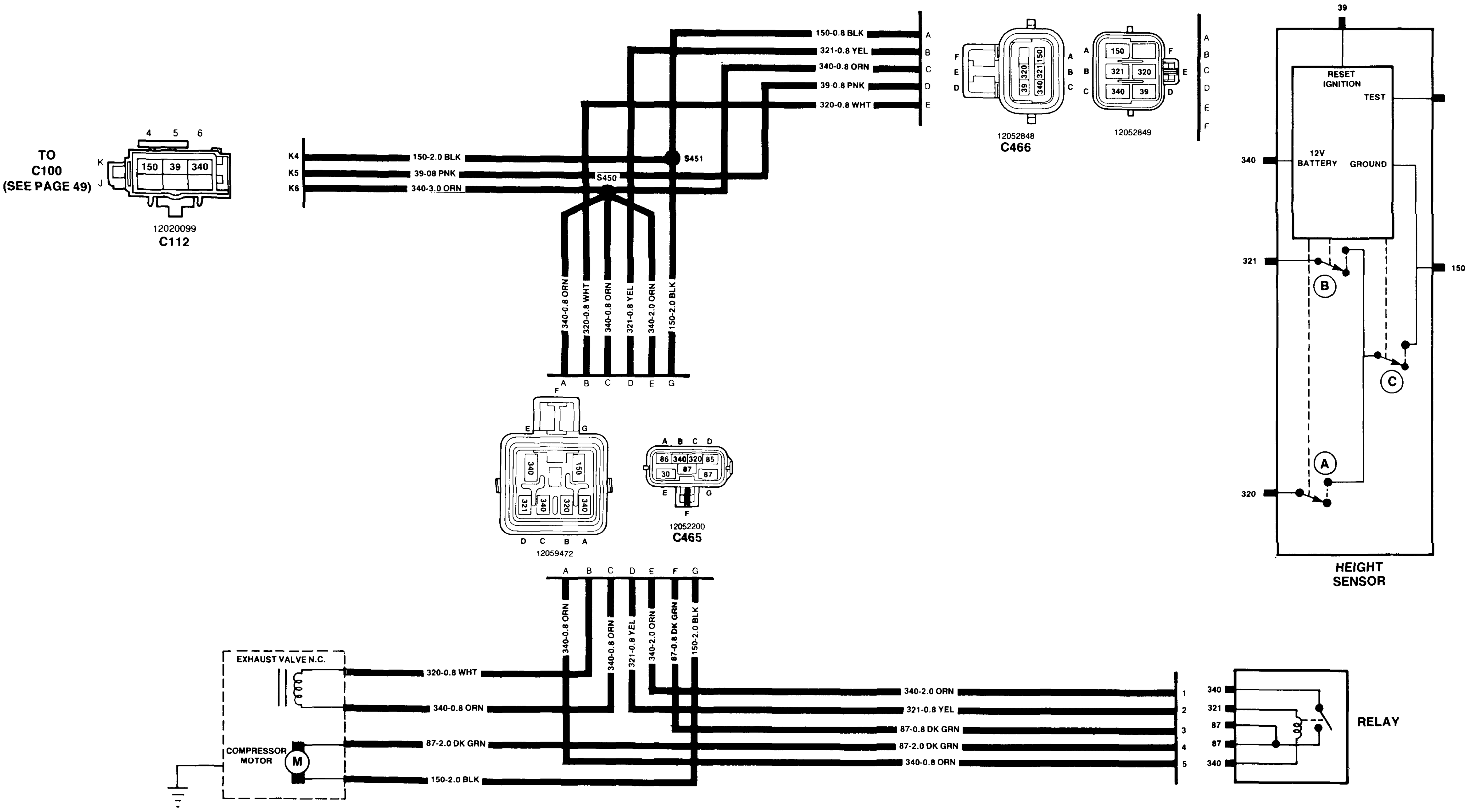
58 CROSS-BODY HARNESS/RIGHT DOOR HARNESS (TYPHOON)

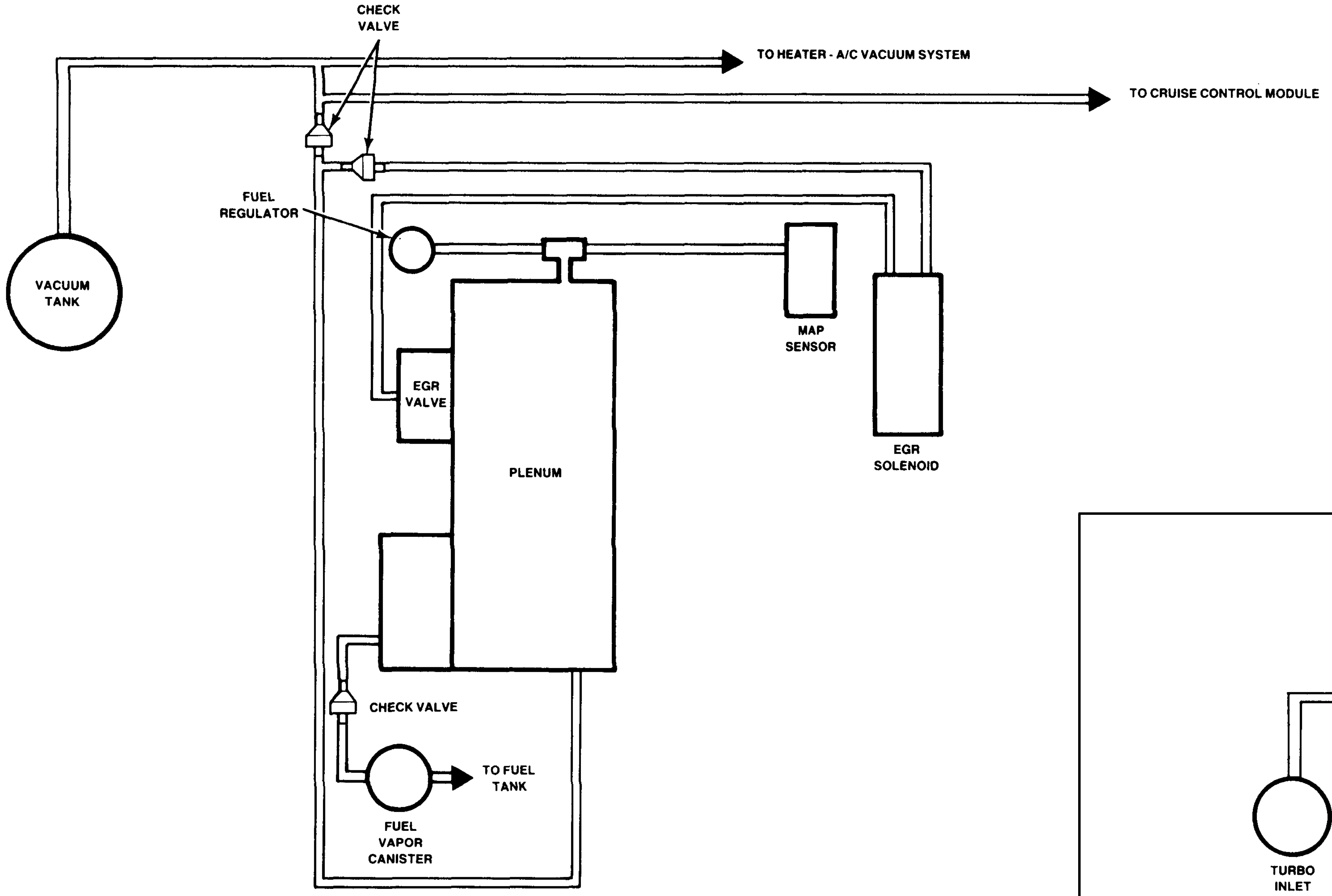


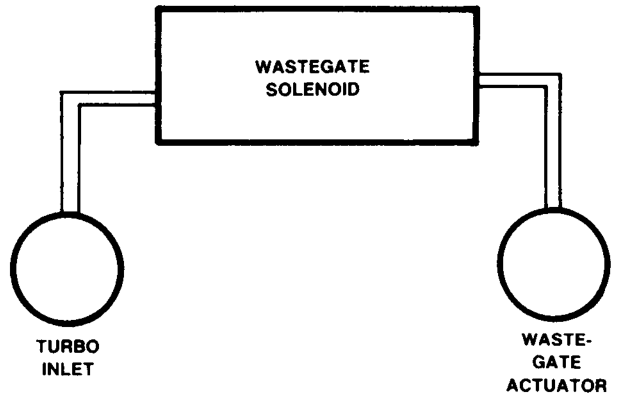
RIGHT DOOR HARNESS (TYPHOON) 59



60 REMOTE KEYLESS ENTRY HARNESS (TYPHOON)


TO
C100
(SEE PAGE 49)
4 5 6
K
J
150 39 340
12020099
C112
K4
K5
K6
150-2.0 BLK
39-08 PNK
340-3.0 ORN
S451
S450
150-0.8 BLK
321-0.8 YEL
340-0.8 ORN
39-0.8 PNK
320-0.8 WHT
A
B
C
D
E
F
E
D
39
320
340
321
150
A
B
C
12052848
C466
A
B
C
150
321
320
340
39
F
E
D
12052849
A
B
C
D
E
F
340-0.8 ORN
320-0.8 WHT
340-0.8 ORN
321-0.8 YEL
340-2.0 ORN
150-2.0 BLK
A B C D E G
F
E
G
340
150
321
340
320
340
D C B A
12059472
A B C D
86
340
320
85
87
30
87
E
G
F
12052200
C465
A B C D E F G
340-0.8 ORN
340-0.8 ORN
321-0.8 YEL
340-2.0 ORN
87-0.8 DK GRN
150-2.0 BLK
EXHAUST VALVE N.C.
COMPRESSOR
MOTOR
M
320-0.8 WHT
340-0.8 ORN
87-2.0 DK GRN
150-2.0 BLK
340-2.0 ORN
321-0.8 YEL
87-0.8 DK GRN
87-2.0 DK GRN
340-0.8 ORN
1
2
3
4
5
340
321
87
87
340
RELAY
39
RESET
IGNITION
TEST
340
12V
BATTERY
GROUND
321
150
B
C
A
320
HEIGHT
SENSOR





WASTEGATE SOLENOID

62 ENGINE VACUUM HARNESS (SYCLONE/TYPHOON)

X-9276

GMC TRUCK

GM